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The extension of the scope of the National Museum during recent years and the activity of the collectors employed in its interest have caused a great increase in the amount of material in its possession. Many of the objects gathered are of a novel and important character, and serve to throw a new light upon the study of nature and of man.

The importance to science of prompt publication of descriptions of this material led to the establishment, in 1878, of the present series of publications, entitled "Proceedings of the United States National Museum," the distinguishing peculiarity of which is that the articles are published in pamphlet form as fast as completed and in advance of the bound volume. The present volume constitutes the twentieth of the series.

The articles in this series consist: First, of papers prepared by the scientific corps of the National Museum; secondly, of papers by others, founded upon the collections in the National Museum; and, finally, of facts and memoranda from the correspondence of the Smithsonian Institution.

The Bulletin of the National Museum, the publication of which was commenced in 1875, consists of elaborate papers based upon the collections of the Museum, reports of expeditions, etc., while the Proceedings facilitate the prompt publication of freshly acquired facts relating to biology, anthropology, and geology, descriptions of restricted groups of animals and plants, the discussion of particular questions relative to the synonymy of species, and the diaries of minor expeditions.

Other papers of more general popular interest are printed in the Appendix to the Annual Report.

Papers intended for publication in the Proceedings and Bulletin of the National Museum are referred to the Advisory Committee on Publications, composed as follows: Frederick W. True (chairman), Marcus Benjamin (editor), James E. Benedict, Otis T. Mason, Leonhard Stejneger, and Lester F. Ward.

S. P. LANGLEY,
Secretary of the Smithsonian Institution.

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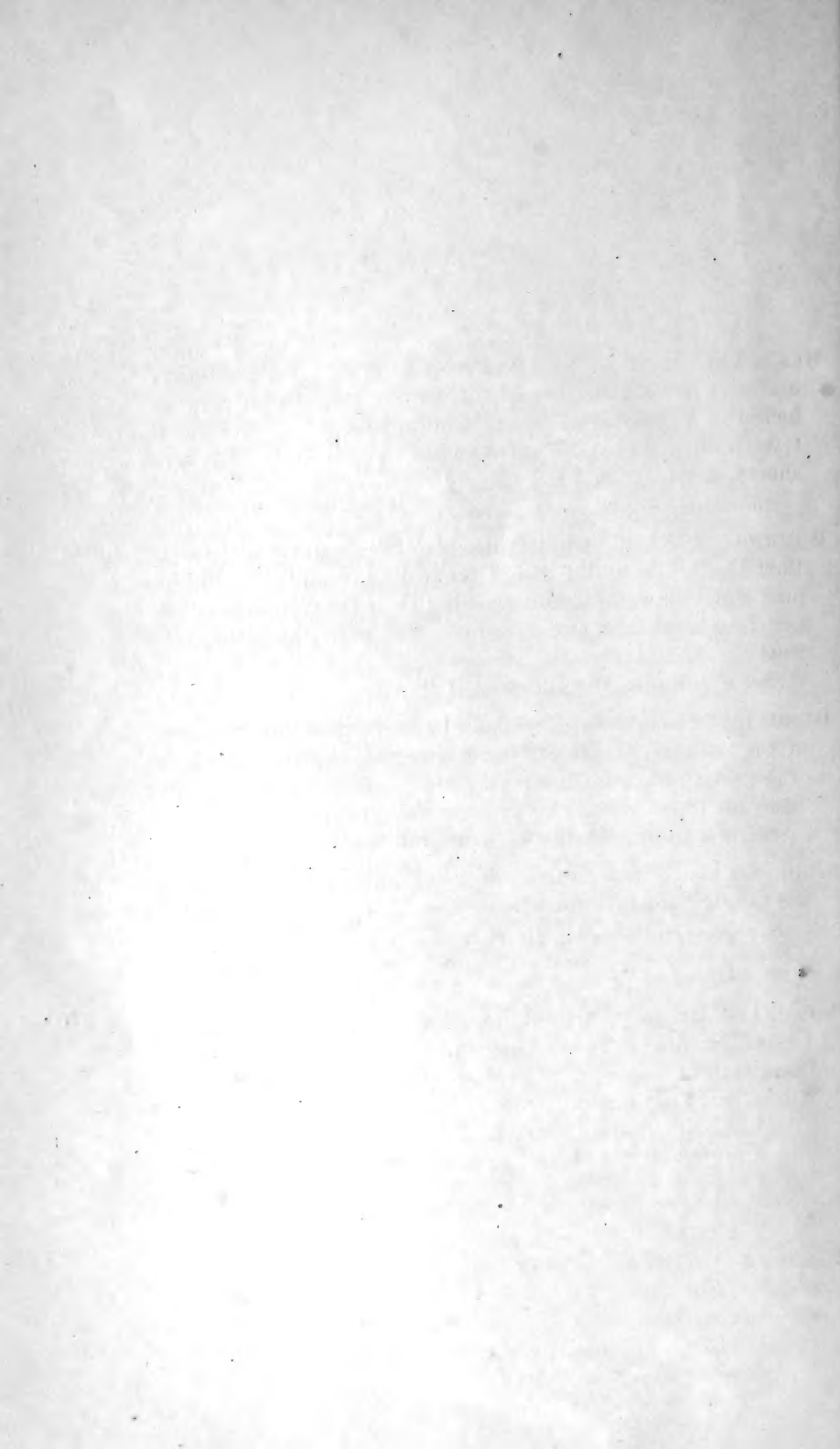


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ERRATA.

THE INTRODUCTORY PARAGRAPH UNDER EXPLANATION OF PLATES. ON PAGE 888, SHOULD READ AS FOLLOWS:

The figures on Plate LXXIV, fig. 2, Plate LXXVI, figs. 1, 2, Plate LXXVII, fig. 9, Plate XCI, figs. 1, 2, and Plate XCV, fig. 8, were drawn by Mr. J. H. Blake. Plate LXXXV, figs. 9, 10, 11, were drawn by Mr. J. H. Emerton. The other figures are all camera-lucida drawings by Mr. A. H. Verrill.

REVISION OF THE ORTHOPTERAN GROUP MELANOPLI
(ACRIDIIDAE), WITH SPECIAL REFERENCE TO NORTH
AMERICAN FORMS.

By SAMUEL HUBBARD SCUDDER.

INTRODUCTION.

THE PRESENT ESSAY describes in detail and discusses the classification of a group of grasshoppers which forms the prevailing type of orthopteran life throughout North America—the common short-horned grasshoppers one sees every summer day. Its best known representative to the world at large is the destructive migratory locust of the West, the so-called “Rocky Mountain Locust.” The outbreak of this insect has been at times extremely disastrous; so much so that a Government commission was for several years in existence, which published nearly twenty years ago two voluminous reports in which it and one or two of its immediate allies were studied with a minuteness and thoroughness, and illustrated with a fullness very rarely given to any such insignificant looking creature.

This destructive insect has numerous closely related allies in all parts of the United States, many of which often abound to such an extent as to do serious damage to crops, and a few of them have been known to migrate in similar fashion (though over a far more restricted area), so that they have sometimes been mistaken by the uninstructed for that destructive pest.

The group is almost confined to North America, and a great many species have been described by various writers in a more or less desultory manner. It is the aim of the present paper to enlarge and systematize our knowledge of this important group as a basis for future studies. No group of North American Orthoptera has been in greater need of revision.

Characteristics and limitations.—Stated as briefly as possible, the Melanopli are Acridians in which the antennae are longer than the fore femora, which have no foveolae on the vertex, the fastigium more or less deflexed, passing insensibly into the frontal costa, the prosternum mucronate, no sharp and distinct lateral carinae (or they are rarely present), an arolium on all the tarsi, the hind tibiae with smooth margins, provided with 9-14 (by rare exception 8) spines regularly disposed in the outer series, which lacks an apical representative, and the second hind tarsal joint only half as long as the first.

To state their characters more in detail, the Melanopli may be described as Acridians, generally of small or medium size, never very large, in which the head is not greatly exserted and the face is moderately oblique or subvertical; the antennae are linear, longer than the fore femora; the eyes are of moderate size, not very strongly prominent, never twice as long as the infraocular portion of the genae, the interspace between them very rarely broad, generally narrow; the fastigium is more or less declivent, never greatly produced in the axis of the body, apically entire and with no transverse ruga, passing insensibly and with obtuse arcuation into the frontal costa; the latter is hardly rounded as seen from the side, percurrent or subpercurrent, generally sulcate, the sulcation ordinarily confined to the lower portion; without foveolae, the tempora small, obliquely declivent, confused with the front; the superior ocelli more distant than the antennal scrobes; the lateral carinae of the face nearly equidistant from the lateral margins of the frontal costa, but slightly divergent inferiorly. The dorsum of the pronotum is nearly plane and without a crest, generally with no distinct lateral carinae, but at most with rounded shoulders or feeble rugae to represent them, but often passing insensibly into the lateral lobes; the principal sulcus is continuous; the prozona is generally smooth or obsoletely punctate, never tuberculate, its sulci generally feebly impressed, often mesially interrupted or subinterrupted, the posterior sulcus often distinctly divergent laterally from the principal sulcus; the metazona is generally shorter than the prozona and lies in the same or nearly the same plane with it, almost always densely punctate; the lateral lobes are truncate or subtruncate posteriorly, with no humeral sinus or only a feeble one, the posterior lower angle distinctly obtuse. The prosternum is armed with a spine which is usually rather prominent and conical, sometimes truncate, never sinuate, generally vertical on the posterior face, nearly or quite as high as the anterior coxae, the posterior portion of the prosternum not or but slightly tumescent; the mesosternal lobes are quadrate or transverse, separated more or less widely, the apical inner angle rectangulate or obtusangulate, generally rounded (often obtusely), the inner margins generally rounded, often posteriorly divergent; the metasternal lobes are contiguous or not very distant excepting sometimes in the female and then rarely as distant or even nearly as distant as

the mesosternal lobes. The tegmina are frequently abbreviate or even wanting; when fully developed, they taper gently almost throughout and are rather remotely reticulate at least in their apical half, the cells of the postradial area wholly or partially biseriata in arrangement on either side of an intercalary vein; the wings are almost always clear and uniform, never definitely pictured, the veins never scalariform, the areolae quadrate or longer than broad. All the tarsi are furnished with an arolium, the front legs are less distantly separated than the hind pair, the fore tarsi are of moderate length, the first joint short or rather short; the hind femora are distinctly incrassate basally, generally surpass the abdomen, the upper face generally smooth, the dorsal carina entire, unarmed, not profoundly excised before the geniculation; the hind tibiae have smooth lateral margins, the spines of the outer and inner series are equal or subequal in length, those of the outer series typically nine¹ or more in number, rarely exceeding fourteen, placed at subequal distances apart and lacking an apical spine next the calcaria; the hind tibiae have the first joint not compressed, equal to or slightly longer than the third, the second much shorter, generally a half shorter, than the first as seen from above. The second dorsal segment of the abdomen is neither granulate nor dentate at the anterior angles, the extremity of the abdomen in the male generally more or less clavate and recurved, the supraanal plate not tuberculate, with a basal median sulcus, a furcula usually present, the cerci very variable, rarely longer than the supraanal plate, straight or gently curved, never abruptly recurved basally, generally compressed at least in part, often laminate, but with no indirected median spine.

The foundation for our present knowledge of the structural features of the Melanopli was laid by Stål² and enlarged in his *Systema Acrideoideorum* (1878) and his *Observations Orthoptérologiques*, III (1878). In its present form the group was first defined and named by Brunner von Wattenwyl,³ who applied to it the term PEZOTETTIGES. I have here limited it strictly in the same manner, but it will appear that it contains a very much larger number of generic types than were credited to it by Brunner and a vast multitude of species. I shall moreover show below, when treating the genus *Podisma*,⁴ that the generic term *Pezotettix*, from which Brunner derived the name of the group, has been misapplied of recent years, and should be referred to the group called *Platyphymata* in Brunner's *Révision*. I have accordingly here named the present group MELANOPLI after its predominant genus *Melanoplus*, the species of which far outnumber all the others combined. Giglio-Tos in recent papers has described several new genera and

¹ By exception, in one sex or on one side of the body, there may be only eight.

² *Reconsio Orthopterorum*, I (1873).

³ *Révision du Système des Orthoptères* (1893).

⁴ See also *Psyche*, VII, pp. 195-196.

species from South America; but in the present paper full consideration will be given only to the North American species; a table will, however, be added for the determination of the Old World species in their place, and the South American forms will be merely tabulated at the close.

Geographical distribution.—The Melanopli are an almost exclusively American group; a single genus, *Podisma*, is represented in the Old World (and more abundantly than in the New) north of 35° north latitude. With that exception almost all the genera and species are confined to North America. South America possesses four genera (not included in the present paper)—*Dichroplus*, *Scotussa*, *Scopas*, and *Atrachelaeris*, with about twenty known species mostly referred to *Dichroplus*, besides *Paradichroplus*, with four species in Paraguay. The remaining genera are exclusively North American, but eleven of them—*Netrosoma*, *Phaedrotettix*, *Conalcaea*, *Barytettix*, *Phaulotettix*, *Cephalotettix*, *Rhabdotettix*, *Cyclocercus*, *Sinaloa*, *Aidemona*, and *Philocleon*, with nineteen species, besides two species of the South American genus *Paradichroplus*, are found exclusively in Central America and Mexico, or only pass the borders of the United States narrowly.

All of these Central and South American genera (with the single exception of *Philocleon*) belong to the division of Melanopli in which the lateral margins of the subgenital plate of the male are not at all ampliate at the base; and they comprise all but three of the genera belonging to that section, these three being *Gymnoscirtetes* with one species in Florida, *Hypochlora* with one species from the Canadian border to Kansas and Colorado, and *Campylacantha* with four species, three ranging from Nebraska to Texas and one found in Mexico. The great bulk of the species and most of the genera (including all but one—*Philocleon*—of those belonging in the section with ampliate basal margins to the subgenital plate) are confined to the United States and Canada, where they form one of the dominant types of Acridiidae.

This division, that with ampliate basal margins, is represented (apart from *Philocleon* with its single species) by fourteen genera and one hundred and seventy-nine species, of which only four genera occur south of our border, with thirteen species confined to Mexico, and twelve others found both in Mexico and the United States; leaving ten genera wholly, and four others almost wholly, belonging to the more northern region, with one hundred and sixty-six species. No species of either division are found in the Antilles.

With trifling exceptions, then, the division with nonampliate basal margins to the subgenital plate is characteristic of Central and South America—or subtropical and tropical America—while the other division, vastly more important, is characteristically temperate North American, with one outlier in temperate Europe-Asia.

The dominant genus is *Melanoplus* with one hundred and thirty-one species described in the present paper; a number more are known to

me, but insufficiently. *Podisma* follows, with about twenty-four species, of which only eight are found in America, then *Aeoloplus* with ten, *Hesperotettix* with eight, and *Bradynotes* with seven. The remaining genera have at the most only three or four species each, and fourteen of them are monotypic.

The genera with widest latitudinal range (over twenty degrees) are, primarily, *Melanoplus*, and then *Hesperotettix* (eight species), *Phoetaliotes* (one species), *Oedaleonotus* (one species), *Campylacantha* (four species), and probably *Podisma* (eight species). *Aeoloplus* (ten species) follows hard after. The genera characteristic of the United States, with narrowest known limits, are *Gymnoscirtetes* and *Eotettix*, both known only from Florida. These last two, with *Paroxya* and *Aptenopedes*, are the only genera (with eight species between them) confined to the eastern United States, if Texas may be included in that term, for they do not extend west of that. Most of the genera are western, using that term in a broad sense, though *Hypochlora*, *Campylacantha*, *Dendrotettix*, *Paratytiotropidia*, and *Phoetaliotes*—all but *Campylacantha* monotypic genera—are peculiar to the Mississippi Valley, though principally to its western half. The only genera found across or almost across the continent, or at all events on opposite sides of the continent, are *Melanoplus*, *Hesperotettix*, and *Podisma*. *Aeoloplus* (ten species), *Bradynotes* (seven species), *Poecilotettix* (three species), *Oedaleonotus* (one species), and *Asemoplus* (one species) are characteristic of the extreme West. Finally, *Hypochlora* (one species), *Bradynotes* (seven species), *Podisma* (eight species), and *Asemoplus* (one species) are confined or nearly confined to the region north of latitude 35°. *Podisma* has also the same limitations in the Old World. Regarding the distribution of *Melanoplus*, with its great preponderance of forms, further details will be given under that genus.

There are but few species which range across the continent, yet not a few have a very wide distribution. The examples of the former are wholly confined to *Melanoplus*: *M. atlansis*, *fasciatus*, *femur-rubrum*, *extremus*, *minor*, and *femoratus*, *M. extremus* only in the high north. As illustrations of the latter may be mentioned *Hesperotettix pratensis*, *Phoetaliotes nebrascensis*, *Paroxya floridana*, *Oedaleonotus enigma*, and the following species of *Melanoplus*: *flabellifer*, *spretus*, *scudderii*, *darsoni*, *cinereus*, *packardii*, *luridus*, *differentialis*, *bivittatus*, and *punctulatus*. Most of these range more widely from north to south than from east to west. About three fourths of all the species are known from west of the Mississippi River only.

Dimorphism in length of tegmina.—We find in the Melanopli every variation possible in the length of the tegmina, but the species are in general tolerably well fixed in this respect. The same is the case with most of the genera, the species of which are in each case generally apterous, provided with lateral pads, abbreviated tegmina, or fully

developed tegmina, as the case may be; but all the larger genera (excepting *Bradynotes*) and some of the smaller show considerable diversity in this respect; the greatest difference between different members of the same genus obtains in the two largest genera: *Melanoplus*, where the species may range from those with merely lateral pads to those with tegmina far surpassing the hind femora; and *Podisma*, where they range from apterous species to those with tegmina half as long as the abdomen. But this range is not confined to the larger genera, for several monotypic genera (*Dendrotettix*, *Phoetaliotes*, and *Oedaleonotus*) display a wide difference between different forms of the single species they possess, in the length of the tegmina, a difference which is also paralleled or almost paralleled among certain species of the genera *Hesperotettix*, *Podisma*, *Melanoplus*, and *Paroxya*, and particularly of the genus *Melanoplus*.

This last genus is of particular interest in this connection, for it is subequally divided between distinctly short-winged and distinctly long-winged forms, which only rarely appear to be closely allied; yet in four of the species, *M. dawsoni*, *M. marginatus*, *M. fasciatus*, and *M. extremus*—species in no way closely related—there is a marked dimorphism in respect of the length of the tegmina, the first two being normally possessed of tegmina only slightly longer than the pronotum, the last two of tegmina hardly as long, if as long, as the abdomen, but all occasionally equipped with tegmina distinctly surpassing the hind femora. When, however, we compare these fully developed tegmina (Plate I, figs. *a*, *c*, *f*, *i*) either with the abbreviated tegmina of the same species, as in *M. extremus* (Plate I, fig. *g*), or with those of their nearest macropterous allies, *M. gladstoni* (Plate I, fig. *b*), *M. paroxyoides* (Plate I, fig. *k*), and *M. borealis* (Plate I, fig. *d*), as in the other species, we can not fail to be struck by the common differences which separate these abnormal macropterous tegmina from the normal tegmina of the genus. (See further the tegmina of the type of the genus, *M. femur-rubrum*, Plate I, fig. *h*). Instead of the regularly tapering form normal to the genus, the added portion, which is largely the extension of the region beyond the post-radial intercalary area, is nearly equal, giving the tegmina a considerably greater apical breadth and a consequent openness of neuration, besides a less tapering form. What is further to be noticed is that this apical breadth and openness of neuration is also the characteristic of several cases in other genera where there is similar dimorphism in length of tegmina, as in *Dendrotettix quercus*, *Podisma alpina*, and *Phoetaliotes nebrascensis* (Plate I, fig. *e*). In *Podisma* the most abbreviated form of wing is plainly normal, and I am therefore inclined from these examples to regard the abbreviated as the normal form in *Dendrotettix*, *Phoetaliotes*, and the species of *Melanoplus* (except, of course, *M. femur-rubrum*) here illustrated. The same, however, is not the case in *Oedaleonotus*, where dimorphism of similar degree is found, and it is therefore prob-

able that the fully equipped form is here the normal, although, so far as we now know, it is much less commonly found than the brachypterous forms. Other instances where there is considerable but not so marked nor perhaps so uniform a difference in wing-length is in *Paroxya floridana* and perhaps *Hesperotettix viridis*, in both which genera the length of the tegmina is variable. In these two species the tegmina are not apically broad in the macropterous forms, and differ only in length from the brachypterous forms.

Materials, etc.—The specimens forming the basis of the present study are in my own cabinet, which contains, often in large series, the greater portion of the species, collected in large part by myself in different sections of the country, but supplemented by specimens secured from the Texan collections of Boll and Belfrage, a large series from Iowa and Illinois obtained by Doctor J. A. Allen, and others from the South-western States and Mexico by Edward Palmer; besides the entire collection of Mr. P. R. Uhler, who many years ago generously turned over to me his own private collection, containing among other things many specimens obtained from the early explorers of the West.

Through the favor of the Assistant Secretary of the Smithsonian Institution, in charge of the United States National Museum, Doctor G. Brown Goode, and the Honorary Curator of Insects in the same institution, Doctor C. V. Riley, I have had the Museum's entire collection of Melanopli in my hands during this study. The collections of the Museum of Comparative Zoology in Cambridge, Massachusetts, have also been open to me. My neighbors and colleagues, Mr. Samuel Henshaw and Mr. A. P. Morse, have also placed all their Melanopli in my hands; and from Professor Lawrence Bruner, of Lincoln, Nebraska, I have received a complete series of all the forms known to him, which has been on the whole the most important aid I have received. Professor Jerome McNeill, who had begun a study of the Melanopli, mainly of the National Museum, not only generously transferred the work to my hands, but gave me free use of his notes and sent me several species otherwise unknown to me. The University of Kansas sent me a series of interesting western forms in its museum, Mr. W. S. Blatchley a series of the Indiana species known to him, Professor C. P. Gillette interesting forms from Colorado, and Professor H. E. Weed a few from Mississippi. All of these gentlemen have freely answered many inquiries made of them, and any failing in the present paper must be laid at my door. In this way I have seen the types of nearly all the species described from North America, and while in England Mr. Samuel Henshaw kindly examined for me several of Walker's types at the British Museum. I have been further aided for the European species by Hofrath Brunner von Wattenwyl, Doctor Chr. Aurivillius, and Mons. A. de Bormans.

In all, I have examined for the purposes of this paper nearly eight thousand specimens, of which about seven thousand belong to the

single genus *Melanoplus*. The sexes are nearly equally divided, the males forming about forty-six per cent of the whole. Thirty genera (eighteen new) and two hundred and seven species (one hundred and fifteen new) are described in the present paper.

Finally, by the aid of a grant from the ELIZABETH THOMPSON SCIENCE FUND I have been able to procure illustrations of the abdominal appendages of every available species.

A few words should be added regarding certain details of presentation: Instead of giving the range of variation in the measurements of each species, I have selected as far as possible typical average specimens, male and female, for the purpose, taking the measurements of all parts from the same individuals. The number of individuals of each species seen is given, and the localities from which they came immediately added, with the name of the collector (when not myself), and when not from my own collection, the source from which I have received them stated (in parentheses); occasionally my own name is there added, when specimens from the same source are also found in my collection; where no parenthesis follows the locality, the specimens referred to are in my collection.

In describing the abdominal appendages of the males, I have found it convenient to introduce a few new terms. These are: *Furcula* for the pair of backward-directed apophyses of the last dorsal segment, which overlie, generally in a more or less forked position, the base of the supraanal plate; *infracercal plates* for the variously developed but generally inconspicuous paired plates, which underlie in part the cerci, in part the lateral portions of the supraanal plate; and *pallium* for the sometimes erectile, membranous pellicle partially closing the open cavity formed of the walls of the subgenital plate, and variously developed in the different genera.

December 20, 1895.

NOTE.—The exclamation point employed in the synonymy of the species has its usual significance—that the reference is authoritative from an examination of the original types of the author in the passage referred to, with the present paper in view.

ANALYTICAL KEY TO THE GENERA OF NORTH AMERICAN MELANOPLI
(INCLUDING THE OLD WORLD FORMS).¹

A¹. Lateral margins of subgenital plate (last ventral segment) of male, as seen laterally, straight throughout, or very slightly convex, never at all abruptly amplified at the base.

b¹. Body exceptionally slender; mesosternal lobes subattinent in both sexes; prozona three times as long as metazona..... 1. *Gymnoscirtetes* (p. 14).

b². Body not exceptionally slender; mesosternal lobes in both sexes so widely separated that the interspace between them is at most twice as long as broad; prozona not more than twice as long as metazona.

c¹. Interspace between mesosternal lobes of female decidedly transverse, sometimes twice as broad as long; of male sometimes transverse, sometimes quadrate or subquadrate; tegmina lobiform, linear, or wanting.

d¹. Interspace between mesothoracic lobes of male decidedly transverse, as broad as or broader than the lobes; the pronotum without lateral carinae; tegmina ovate or wanting..... 2. *Netrosoma* (p. 16).

d². Interspace between mesothoracic lobes of male quadrate or subquadrate, or, if feebly transverse (as in *Paradichroplus*), not so broad as the lobes, and then the pronotum furnished with lateral carinae; tegmina ovate or linear.

e¹. Subgenital plate of male pyramidal, pointed, a slight tubercle extending beyond its posterior margin, but the margin extending well beyond the apex of the supraanal plate..... 3. *Paradichroplus* (p. 18).

e². Subgenital plate of male more or less conically protuberant apically, but its interior apical margin not surpassing or barely surpassing the apex of the supraanal plate.

f¹. Apical tubercle of subgenital plate small, extending but a short distance beyond the supraanal plate; cerci of male abruptly narrowed before the middle by excision of the inferior margin, the apical half narrow; lateral carinae of pronotum wholly wanting..... 4. *Phaedrotettix* (p. 22).

f². Nearly the whole subgenital plate forming a blunt conical tubercle projecting some distance beyond the supraanal plate; cerci of male forming broad, apically deurved, subfalcate laminae; lateral carinae of pronotum more or less distinct..... 5. *Conalcaea* (p. 23.)

c². Interspace between mesosternal lobes of female generally longer than broad, sometimes quadrate rarely feebly transverse²; of male never at all transverse (except feebly in *Sinaloa* and *Cephalotettix*); tegmina variable.

d². Tegmina never fully developed, rarely as long as the pronotum, lateral and ovate, or linear, or wholly wanting; hind margin of pronotum distinctly truncate; fore and middle femora of male (except in *Phaulotettix*) distinctly more gibbous than in the female.

e³. Furcula of male wanting or forming a pair of brief lobes at most no longer than broad.

¹ By permission of the Assistant Secretary this key has been issued in advance in the Proceedings of the American Academy, XXXII, No. 9.

² *Cephalotettix*, in which the female is unknown, is placed in this division.

- f*¹. Last dorsal segment of male furnished mesially with a pair of slightly protuberant rounded lobes; cerci of male compressed laminate, beyond the slightly narrowing basal portion equal or subequal, the tip curved downward or inferiorly angulate at apex.
- g*¹. Prosternal spine erect; interspace between mesothoracic lobes of male nearly twice as long as broad; fore and middle femora of male noticeably gibbous; subgenital plate of male terminating in a large conical tubercle..... 6. *Barytettix* (p. 27).
- g*². Prosternal spine retrorse; interspace between mesothoracic lobes of male only a little longer than broad; fore and middle femora of male only slightly gibbous; subgenital plate of male with no apical tubercle.
7. *Phaulotettix* (p. 29).
- f*². Last dorsal segment of male entirely without projecting lobes or furcula in any form, unless as exceptionally broad and short sessile plates; cerci of male (except in *Cephalotettix*) apically acuminate or curved upward.
- g*¹. Head large and eyes, at least in male, large and very prominent, the breadth of the head distinctly exceeding the greatest width of the pronotum; interspace between mesothoracic lobes of male slightly transverse 8. *Cephalotettix* (p. 30).
- g*². Head normal and eyes not very prominent even in the male, so that the breadth of the head does not exceed the greatest width of the pronotum; interspace between mesothoracic lobes of male distinctly longer than broad.
- h*¹. Tegmina lobiform; subgenital plate of male protruding beyond the tip of the supraanal plate by less than half the length of the latter; cerci of male compressed, subequal, the tip broad.
9. *Rhabdotettix* (p. 32).
- h*². Tegmina linear; subgenital plate of male protruding beyond the tip of the supraanal plate by much more than half the length of the latter; cerci of male tapering from the base, the tip acuminate.
10. *Cyclocercus* (p. 36).
- e*². Furcula of male consisting of a pair of parallel, attingent, cylindrical prominences, generally at least twice as long as broad.
- f*¹. Tegmina lobiform; interspace between mesosternal lobes of male slightly transverse; cerci of male forming compressed, subequal laminae.
11. *Sinaloa* (p. 40).
- f*². Tegmina wanting; interspace between mesosternal lobes of male longer than broad; cerci of male styliform, conical 12. *Paraidemona* (p. 41).
- d*². Tegmina fully developed or abbreviate, never much if any shorter than the pronotum; hind margin of pronotum distinctly angulate; fore and middle femora scarcely more gibbous in the male than in the female (except in some species of *Campylacantha*).
- e*¹. Tegmina fully developed; disk of pronotum nearly flat, the lateral lobes nearly at right angles to it, the posterior margin rectangulate or subrectangulate; prosternal spine quadrate, appressed, broadly truncate.
13. *Aidemona* (p. 44).
- e*². Tegmina abbreviate; disk of pronotum tectiform, the posterior margin obtusangulate; prosternal spine more or less conical and acuminate.
- f*¹. Head not prominent, the summit very slightly arched longitudinally; prosternal spine erect; furcula of male composed of projecting cylindrical fingers; surface of the body very feebly pilose.... 14. *Hypochlora* (p. 46).
- f*². Head prominent, the summit strongly arched longitudinally; prosternal spine more or less retrorse; furcula of male reduced to slight, scarcely projecting lobes; surface of body rather densely pilose.
15. *Campylacantha* (p. 48).

A². Lateral margins of subgenital plate of male suddenly amplify to a considerable degree at the base; or if not to a considerable degree, then the entire margin rather strongly convex or sinuate.

b¹. Subgenital plate of male furnished with a distinct subapical tubercle (i. e., one in which the apical margin does not pass through and form a part of the summit of the tubercle, but where it is distinctly separated from that summit), but not otherwise tumescent.¹

c¹. Median carina of pronotum well developed and equally developed throughout, accompanied on the front of the prozona by distinct lateral carinae; prosternal spine sharply acuminate; tubercle of subgenital plate directed wholly backward, occupying the middle of the terminal portion of the plate; furcula distinctly developed. 16. *Eolettix* (p. 53).

c². Median carina of pronotum feebly developed and generally much more feebly on the prozona than on the metazona, accompanied by no lateral carinae whatever; prosternal spine bluntly acuminate; tubercle of subgenital plate directed upward or upward and backward, occupying the upper extremity of the terminal portion of the plate.

d¹. Body relatively slender and compressed, not much enlarged at the metathorax, particularly in the male; disk of the pronotum tectiform,² the prozona not distinguished from the metazona either by its plane or by any lack of a median carina, which latter is generally marked in color; pronotum fully half as long again as broad; hind femora long and slender; apical tubercle of male abdomen prominent; furcula present as distinctly projecting lobes; terminal segments of female abdomen not abbreviated, the ovipositor fully exerted.

17. *Hesperotettix* (p. 55).

d². Body relatively short and stout, considerably enlarged at the metathorax even in the male; disk of pronotum gently convex transversely, the prozona slightly and independently tumid with no median carina, thus distinguishing it from the metazona;³ hind femora relatively short and stout; apical tubercle of male abdomen not very prominent; furcula scarcely or not apparent; terminal segments of female abdomen abbreviated, the ovipositor only partially exerted 18. *Aeoloplus* (p. 68).

b². Subgenital plate of male with no distinct subapical tubercle, but often apically prolonged or tumescent.⁴

c¹. Meso- and metastethia together, in both sexes, no longer or scarcely longer than broad; metastethium narrowing but little posteriorly, so that the portion behind the metasternal lobes is but little narrower than the rest, rarely (in the male) less than three-fourths its width; cerci of male very simple, subconical, straight; ovipositor half concealed. 19. *Brahynotes* (p. 80).

c². Meso- and metastethia together, at least in the male and nearly always in both sexes, distinctly longer than the width of the metastethium; the latter rapidly narrowing posteriorly, so that the portion behind the metasternal lobes is not, or is hardly more than, one-half the greatest width of the metastethium; cerci of male variable; ovipositor generally fully exerted.

d¹. Interspace between mesosternal lobes of male distinctly transverse,⁵ as

¹ See note under alternate category.

² This feature is not so apparent in the first three species of *Hesperotettix* as in the others.

³ This feature is less marked in *Ae. tenuipennis* and *Ae. elegans* than in the others.

⁴ There is a minute subapical tubercle in some species of the flabellifer series of *Melanoplus*, but in these the male cerci are exceptionally broad and flabellate, while in the species of the alternate category (*A² b¹*) the cerci are very slender and tapering.

⁵ In many cases the interspace is truncato-cuneiform or broadly clepsydral, in which cases the breadth is to be measured in the middle. In a single species of *Podisma*, *P. davisama*, the interspace is slightly longitudinal.

broad as, or nearly as broad as, the lobes themselves; of the female distinctly or strongly transverse, fully as broad as or (and generally) broader than the lobes; metasternal lobes of male generally distinctly distant, occasionally approximate; of the female generally more distant, the interspace in the latter generally as wide as or wider than the frontal costa; tegmina typically abbreviate.

*e*¹. Face almost vertical; eyes small, but prominent and widely distant; pronotum constricted in the middle, with deeply impressed transverse sulci, and the lateral lobes not obliquely truncate apically in front; distinct lateral carinae 20. *Dendrotettix* (p. 91).

*e*². Face a little oblique; eyes rather large, not very prominent, and not greatly distant; pronotum not, or but feebly, constricted in the middle, with generally feebly impressed transverse sulci and the lateral lobes obliquely truncate apically on the anterior section. 21. *Podisma* (p. 94).

[*f*¹. Pronotum of subequal width, the sides nearly parallel; subgenital plate of male normal *Podisma*, s.s.

*f*². Pronotum enlarging posteriorly, conspicuously in the female; subgenital plate of male exceptionally expanded, laterally tumid and elevated premarginally *Eupodisma*.]

*d*². Interspace between mesosternal lobes generally longer or much longer than broad in the male, almost never (see *Melanoplus montanus* and *M. borealis*) in the least broader than long even when the sides of the interspace are posteriorly divergent; generally quadrate in the female but more variable than in the other sex, sometimes as narrow as there, more often subtransverse, occasionally in some short-winged forms (as in *Melanoplus artemisiae*, *M. militaris*, *M. altitudinum* and *Asemoplus montanus*) distinctly transverse; in both sexes always distinctly, generally much, narrower than the lobes (except in the females of the cases just cited, where they are barely narrower); metasternal lobes of male generally attingent or subattingent, rarely only approximate; of the female less distant than in the alternate category (*A*² *b*² *c*¹ *d*¹), generally approximate or subapproximate, the interspace generally narrower than the frontal costa; typically the tegmina are completely developed.

*e*¹. Face almost vertical or a little oblique, its angle with the fastigium rarely less than 75°; eyes rounded oval, never more, generally less, than half as long again as broad; portion of metasternum lying behind the lobes transverse, more than twice as broad as long; tegmina normally present.

*f*¹. Tegmina always present; sides of first abdominal segment with a distinct tympanum.

*g*¹. Fastigium of vertex plane or convex; eyes separated widely, the space between them twice as broad as the frontal costa; pronotum furnished with distinct percurrent lateral carinae; tegmina abbreviate; cerci apically acuminate 22. *Paratylotropidia* (p. 117).

*g*². Fastigium of vertex more or less depressed or with elevated lateral margins; eyes separated narrowly, at most but little further apart than the width of the frontal costa; pronotum with indistinct¹ or no lateral carinae; tegmina fully developed or abbreviate; cerci variable, rarely acuminate apically.

*h*¹. Inferior genicular lobe of hind femora with at least a darker basal spot or transverse band; cerci of male variable, often enlarging apically.

*i*¹. Dorsum of pronotum rarely or never twice as long as the average breadth, generally only half as long again even in the male, generally constricted more or less in the middle; antennae even when longest (as in *Melanoplus nitidus* and *M. packardii*, for instance) no

¹ In a few species they are tolerably distinct.

longer than the hind femora and only twice as long as the pronotum alone; face rarely as declivent as in *Paroxya*; prozona usually a half longer than the metazona.

*j*¹. Head not large in proportion to pronotum, nor prominent, but little longer than the prozona, unless (as in *Melanoplus spretus*) the latter is distinctly transverse; pronotum in no way subsellate, nor flaring in front; tegmina, when fully developed, narrow, rarely (*Melanoplus dawsoni*,¹ *M. extremus*, *M. marginatus*, etc.) rather broad, but then very distinctly tapering, more or less tapering in distal half, at a distance from the apex equal to the breadth of the tegmina distinctly narrower than the metazona, the intercalaries and cross-veins of the discoidal area (except in *M. dawsoni completus* and *M. marginatus amplius*) relatively numerous, at least in the apical fourth and usually throughout, the venation in general sharp and clearly defined, the area intercalata generally distinctly defined by the adjustment of the veins at its distal extremity, the humeral vein straight and apically arcuate, nearly always terminating either on the apical margin or but a short distance before it, running for some distance almost exactly parallel to the costal margin or merging insensibly into it; cerci of male very variable, very rarely (*Melanoplus flabellatus*, *M. puer*) substyliiform, and then the subgenital plate is either exceptionally broad, or only moderately narrow and the apical margin elevated..... 23. *Melanoplus* (p. 120).

*j*². Head large in proportion to pronotum, especially above, and prominent, nearly half as long again as the long prozona; pronotum faintly subsellate, feebly flaring in front to receive the head; tegmina, when fully developed, broad and subequal, hardly tapering in the distal half, at a distance from the apex equal to the breadth of the tegmina as broad as the metazona, the intercalaries and cross-veins of the discoidal area everywhere few, the venation in general loose and ill defined, the area intercalata not distinctly marked by the adjustment of veins at its distal extremity, the humeral vein (the upper of the pair of stout veins from the upper attachment) broadly sinuous, terminating on the costal margin at least as far before the apex as the breadth of the tegmina, nowhere running closely parallel to that margin nor merging into it; cerci of male styliiform, the subgenital plate very narrow, the margin not apically elevated..... 24. *Phoetaliotes* (p. 376)

*i*². Dorsum of pronotum twice as long as average breadth, at least in the male, with no median constriction; antennae, at least in the male, generally longer than the hind femora and much more than twice as long as the pronotum, generally twice as long as head and pronotum together; face more declivent than in *Melanoplus*; prozona only about a third longer than the metazona.

25. *Paroxya* (p. 380).

*h*². Inferior genicular lobe of hind femora wholly pallid, with no dark basal spot or transverse band; cerci of male conical or subconical or basally bullate, always apically pointed.

*i*¹. Subgenital plate of male terminating in a pronounced tubercle; prosternal spine slender..... 26. *Poecilotettix* (p. 385).

*i*². Subgenital plate of male, even when apically angulate, not furnished with an apical tubercle; prosternal spine stout.

*j*¹. Relatively heavy-bodied; dorsal disk of prozona tumid independently of the metazona; pronotum distinctly angulate or con-

¹ In form of tegmina and sparseness of neuration this species is the *Melanoplus* most nearly allied to *Phoetaliotes*, and like it it is dimorphic as to tegmina.

- vex behind; the portion of the metasternum lying behind the lobes laterally extended, reaching to the coxae; tegmina fully developed or abbreviate, but overlapping, with many longitudinal veins; cerci of male very stout and bullate on basal half or more; abdomen of female bluntly rounded apically, the posterior segments much abbreviated; ovipositor but slightly exerted. . . . 27. *Oedaleonotus* (p. 390).
- f*². Relatively slender-bodied; dorsal disk of prozona not tumid independently of the metazona; pronotum truncate posteriorly; portion of metasternum lying behind the lobes laterally abbreviated, much narrower than the width between coxae; tegmina linear, lateral, distant, with only a few longitudinal veins; abdomen of female tapering regularly to a pointed tip; ovipositor normally exerted. 28. *Asemoplus* (p. 394).
- f*². Tegmina wanting; sides of first abdominal segment with no tympanum 29. *Philocleon* (p. 396).
- e*². Face rather strongly oblique, the angle it makes with the fastigium varying about from 55° to 67°; eyes elongate, almost or quite twice as long as broad; portion of metasternum lying behind the lobes subtriangular, not greatly broader than long; tegmina linear and lateral or absent. 30. *Aptenopedes* (p. 398).

1. GYMNOSCIRTETES, new genus.

(*γυμνρός*, naked (in allusion to its apterous condition); *σκυρᾶω*, to leap.)

Gymnoscirtetes BRUNER, MS.

Body exceptionally long and slender, subcylindrical, a little compressed. Head excepting eyes scarcely enlarged, the face considerably declivent; vertex scarcely (male) or somewhat (female) tumid, triangular, the eyes approximate, especially in the male where the slender fastigium between them is narrowly sulcate; fastigium declivent, expanding greatly in front and broadly hollowed; frontal costa of moderate width but distinctly broader than the interspace between the eyes, subequal but constricted just below the ocellus, percurrent, sulcate; eyes large, prominent, particularly in the male where they are subrotund, while in the female they are nearly half as long again as broad, in both sexes but particularly in the male about twice as long as the anterior infraocular portion of the genae; antennae rather slender, cylindrical, much longer than the head and pronotum together. Pronotum compressed cylindrical, truncate at each extremity, with completely parallel sides and with a slight uniform median carina, the prozona quadrate above and fully three times as long as the metazona, its two median sulci slightly impressed, subapproximate, and distant from either margin; lateral carinae wholly absent, the lateral lobes very short, their lower margin obtusely angulate, the posterior angle distinct but obtuse. Prosternal spine rather slight and moderately slender, conical, erect; mesosternal lobes subattinent in both sexes or even attinent in the male; metasternal lobes attinent in both sexes. Apterous. Fore and middle femora scarcely more gibbous in the male than in the female; hind femora very slender, unarmed; hind tibiae with short spines, similar in length on either side, 8-9 in number in the

outer series. Lateral margin of the subgenital plate of the male straight from base outward, at the tip slightly elevated into a minute erect tubercle; cerci simple, conical.

This genus is very distinct from anything known to me, and I have been in some doubt as to whether it should be placed in *Melanopli*, especially as in the only male I have seen there were but eight spines on the outer side of the hind tibiae; but Professor L. Bruner informs me that he has an immature male with nine spines, which agrees with what I find in the female, so that this feature must be looked on as variable, as it is in some other genera of *Melanopli*.

Although I have placed it at an extreme distance from *Aptenopedes*, from which it is clearly widely separated in the lack of any basal ampliation of the subgenital plate of the male, it recalls that genus in its general appearance and especially in the triangular vertex of the head; it differs, however, much from it in its subcylindrical slender body and the close approximation of the sternal lobes.

It is represented by a single species occurring in Florida.

GYMNOSCIRTETES PUSILLUS, new species.

(Plate II, fig. 1.)

Gymnoscirtetes pusillus BRUNER!, MS.

Head above and in front between the lateral carinae of the face lighter or darker chestnut brown; lower part of the genae of a similar color but in a lighter tint, while the upper part of the genae is lemon yellow in continuation of the body stripe of that color; vertex with a mediodorsal, greatly widening, blackish fuscous stripe including a yellowish thread; basal joint of antennae yellow, the remainder dark testaceous. Pronotum luteo-testaceous, above the median carina fuscous; upper half of lateral lobes piceous, forming a broad longitudinal band which extends forward to the eyes (where it is margined above with dull yellow) and behind over the abdomen, becoming there somewhat narrowed posteriorly and broken beneath, fading out on the terminal segments; lower half of lateral lobes of pronotum lemon yellow, forming a band which extends forward over the head and backward over the meso- and metathorax, and on the abdomen (growing duller) becomes a part of the general color of the under surface. Metazona and extreme anterior part of prozona feebly and rather sparsely punctulate; upper surface of meso- and metanota and of abdomen like the pronotum, but more or less infuscated. Hind femora yellow luteous, the upper half or less of the outer face more or less plumbeous; hind tibiae pale dull green, the spines black, pallid at base. Supra-anal plate of male large, triangular, the apex acuminate, a little blunt, the whole central basal portion elevated to form another similar triangle in which lies a pronounced demi-lanceolate, basal sulcus, with sharp walls, considerably less than half as long as the plate; furcula consist-

ing of a pair of scarcely projecting rather distant rounded lobes; cerci styliform, slender, gently tapering to a rather blunt point, conical, straight or feebly incurved apically, fully as long as the plate; infracercal plate slightly developed, concealed when the cerci are appressed.

Length of body, male, 13 mm., female, 19.75 mm.; antennae, male, 5.75 mm., female, 6.5+ mm.; hind femora, male, 7 mm., female, 9.5 mm.

One male, one female. Jacksonville, Duval County, Florida, Ashmead (L. Bruner; U.S.N.M. [No. 701]).

2. NETROSOMA, new genus.

(*νητρον*, a spindle; *σωμα*, body.)

Body subfusiform, especially in the female, compressed cylindrical, glabrous but very sparsely pilose. Head not prominent, the genae tumescent, the vertex considerably arched, slightly elevated above the level of the pronotum, the fastigium very narrow in the male, rather narrow in the female, gently descending, deeply sulcate, the face retreating somewhat, particularly in the male; eyes rather prominent, broad oval, half as long again as the infraocular portion of the genae, at least in the male; frontal costa rather prominent and narrowed above, below moderately broad, at least as broad as (female) or distinctly broader than (male) the interspace between the eyes, with the face feebly punctate; antennae with the apical joints depressed, fully half (male) or a little less than half (female) as long as the body. Pronotum enlarging considerably and regularly backward, compressed cylindrical, the dorsum well arched transversely, passing quite insensibly into the vertical lateral lobes, with the feeblest possible signs of a median carina, both front and hind margins truncate, the sparsely but distinctly and finely punctate prozona about twice as long as the similarly but more densely punctate metazona, the transverse sulci obliterated on the dorsum. Prosternal spine erect, conical, in the female appressed; interval between mesosternal lobes transverse, as broad as or broader than the lobes in both sexes, the metasternal lobes subattendant (male) or approximate (female). Tegmina lateral and linear, shorter than the pronotum, or wanting. Fore and middle femora of male not at all tumid; hind femora short but not very stout, the hind tibiae with eight spines in the outer series. Extremity of male abdomen feebly clavate and a little upturned, the subgenital plate with lateral margins straight from the very base, with a slight tubercle at tip which scarcely surpasses the supraanal plate; cerci laminate, of moderate breadth, inferiorly acuminate and turned downward at tip; furcula wanting.

Two species are known, both from Mexico.

N. fusiformis may be regarded as the type.

ANALYTICAL KEY TO THE SPECIES OF NETROSOMA.

Tegmina present in both sexes; interspace between the mesosternal lobes of male no broader than the lobes themselves; hind tibiae red on proximal half only.

1. *fusiformis* (p. 17).

Tegmina absent, at least in the male; interspace between the mesosternal lobes of male broader than the lobes themselves; hind tibiae red on distal half only.

2. *nigropleura* (p. 18).

I. NETROSOMA FUSIFORMIS, new species.

(Plate II, fig. 2.)

Body fulvo-luteous with piceous or chocolate black markings. Head with the face and posterior part of the genae fulvo-luteous, the region of and about the frontal costa generally infuscated, the front half of the genae below the eyes, a broad band behind the eyes, a slender medio-dorsal line reaching the posterior part of the fastigium, and the lateral walls of the frontal costa above the antennae, black; antennae fuscous, lighter at base. Upper surface of body behind the head with a median stripe, generally of uniform though in different individuals of varying breadth, generally as broad as the interspace between the eyes, of fulvo-luteous, separating a pair of piceous or chocolate black very broad stripes, which in passing backward broaden on the pronotum and narrow and finally disappear on the abdomen, the metathoracic episterna fulvous. The meso- and metanota and some of the basal abdominal segments are sparsely punctate; posterior margin of the pronotum feebly emarginate, including in the emargination the whole dorsal breadth; interspace between the mesosternal lobes of male of the same breadth as the lobes themselves. Tegmina blackish, the veins occasionally lighter, a little longer than the prozona, enlarging slightly beyond the base in the male. Fore and middle femora fuscous; hind femora with the outer face luteo-fufvous or pallid luteous, crossed with a variable obliquity by a pair of broad subtransverse bands of ferrugineo-fuscous or black, often confluent along the lower margin and with a basal spot of the same, the bands repeated on the inner side; upper face and geniculation ferruginous; hind tibiae glauco-plumbeous on the distal, coralline on the proximal half, the transition gradual, the spines pallid with black tips. Supraanal plate of male long triangular with gently convex sides, the tip acutangulate, with a rather deep median sulcus interrupted in the middle, bounded at base by high and coarse rounded walls, at tip by slight walls; furcula wholly wanting; cerci moderately broad, equal from the base or with the slightest possible median constriction, lamellate, as long as the supraanal plate, the apical portion suddenly bent slightly inward, turned strongly downward and sharply acuminate.

Length of body, male, 14 mm., female, 21.5 mm.; antennae, male, 7 mm., female, 8 mm.; tegmina, male, 3 mm., female, 3.25 mm.; hind femora, male, 8.5 mm., female, 12.25 mm.

Three males, 14 females. Montelovez, Chihuahua, Mexico, September 20, E. Palmer. [U.S.N.M. No. 702, female.]

2. NETROSOMA NIGROPLEURA, new species.

(Plate II, fig. 3).

Pezotettix nigropleura BRUNER!, MS.

Body luteo-testaceous, heavily marked with black. Head uniform luteo-testaceous, sometimes feebly infuscated, with a broad black band behind the eyes, and the lateral faces of the frontal costa above the antennae marked with black; antennae blackish fuscous. Pronotum and body behind it with a broad equal mesial band of luteo-testaceous, separating two very broad black bands precisely as in *N. fusiformis*, only the lower third of the lateral lobes, the mesothoracic episterna and the lower half of the metathoracic episterna luteous. Meso- and meta-nota with scarcely perceptible very sparse punctuation; posterior margin of the pronotum feebly emarginate, including the whole dorsal breadth; interspace between mesosternal lobes of male a little broader than the lobes themselves. Tegmina wholly wanting in the male (female unknown). Hind femora luteo-testaceous with very feeble cloudy signs of bifasciate markings similar to those of *N. fusiformis*; hind tibiae dull luteous at base passing on apical half into coral red, the spines pallid with black tips. Supraanal plate of male triangular with straight sides, the extremity abruptly truncate and with a small mesial triangular appendix, the basal half with a raised rounded longitudinal ridge, having a tolerably deep mesial furrow on its summit; furcula wholly wanting; cerci moderately broad, lamellate, tapering gently and straight on basal third or more, beyond arcuate subfalcate and gently incurved, terminating in an acute but rounded angle below. Length of body, male, 13 mm.; antennae, 8.5 mm.; hind femora, 8.25 mm.

Two males. Lerdo, Durango, Mexico (L. Bruner).

Besides the differences from *N. fusiformis* mentioned in the table, the present species has relatively longer antennae.

3. PARADICHOPLUS.

(παρά, beside; Dichroplus, a genus of Melanopli.)

Pezotettix (Div. II) STÅL, Bih. K. Sv. Vet. Akad.-Handl., V. No. 9 (1878), pp. 4, 8. *Paradichroplus* BRUNNER, Rév. Syst. Orth. (1893), p. 145.

Body rather elongate, compressed, sparsely pilose. Head not prominent, nor broader than the thorax, the vertex gently convex, scarcely or not elevated above the level of the pronotum, the fastigium rounded, descending moderately, the face retreating considerably, especially below; interspace between the eyes not very narrow even in the male, as broad as the broadest part of the frontal costa, which is at the ocellus, the costa narrowing considerably above, slightly sulcate below and failing to reach the clypeus; antennae short and stout, scarcely if at

all exceeding in length the pronotum. Pronotum enlarging regularly and slightly (male) or considerably (female) from in front backward, the disk nearly plane, separated by percurrent lateral carinae (as distinct as the percurrent median carina) from the subvertical lateral lobes, the front and hind border truncate or subtruncate, the nearly smooth prozona less than twice as long as the rather feebly punctate metazona, rather longer than broad, divided in the middle by a feeble transverse sulcus, followed at less than half the distance to the metazona by a doubly arcuate sulcus at least as distinct. Prosternal spine erect, variable; mesosternal lobes separated by an interval which is subquadrate but a little transverse and nearly as broad as the lobes in the male, strongly transverse and broader than the lobes in the female, the metasternal lobes subapproximate in both sexes. Tegmina elliptical, not wholly lateral, shorter than the pronotum. Fore and middle femora tumid in the male, the hind femora moderate, compressed, the hind tibiae with 9-11 spines in the outer series. Extremity of the male abdomen upturned and slightly enlarged, the subgenital plate strongly produced and elongate, its lateral margins feebly convex, meeting apically at an acute angle which is provided with a slight tubercle and is removed at a long distance from the tip of the supraanal plate; furcula developed slightly or moderately; cerci very long and very slender, laminate, directed inward apically.

Two species are known, coming from Mexico, Central America, and northern South America.

ANALYTICAL KEY TO THE SPECIES OF PARADICHIROPLUS.

- Prosternal spine quadrate, appressed, truncate; posterior margin of pronotum feebly emarginate; inner edges of tegmina separated by half the width of the pronotum; furcula well developed. 1. *mexicanus* (p. 19).
 Prosternal spine conical; posterior margin of pronotum entire; inner edges of tegmina subattingent; furcula very slight 2. *varicolor* (p. 21).

I. PARADICHIROPLUS MEXICANUS.

(Plate II, figs. 4, 5.)

Platyphyma mexicanum BRUNNER, Verhandl. Zool.-Bot. Gesellsch. Wien, 1861 (1861), p. 224; Orth. Stud. (1861), p. 4.—WALKER, Cat. Derm. Salt. Brit. Mus., Suppl., V (1871), p. 71.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 224.

Caloptenus mexicanus WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), pp. 682-683.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 227.

Paradichiroplus mexicanus BRUNNER, Rév. Syst. Orth. (1893), p. 115.

Blackish fuscous above with a strong ferruginous tinge, dull flavous below. Head with tumescent genae plumbeous or livid, more or less heavily mottled with ferrugineo-fuscous, the summit wholly blackish fuscous, separated from a broad blackish fuscous band behind the eyes by a lighter but obscure stripe behind the upper part of the eyes; frontal costa rather prominent above, especially in the male, punctate,

narrowed a little above the ocellus and slightly sulcate below it, the fastigium shallowly sulcate; antennae ferruginous. Pronotum with the hind margin feebly emarginate, the disk nearly uniform in color, but with the lateral lobes sometimes lighter and the metazona sometimes longitudinally combed with obscure luteous, the lateral lobes mostly of the color of the disk or darker, but their lower portion, both on prozona and metazona, with quadrate patches of dull luteous or flavous, forming a broken band slightly separate from the lower margin. Prosternal spine quadrate, brief, appressed; broadly truncate. Tegmina ovate, less than twice as broad as long, their inner edges separated by half the width of the pronotum, of the color of the upper surface. Fore and middle legs dull ferruginous; hind femora ferruginous, the carinae, lower margin of the outer face, and lower face flavous, on the last often strongly tinged with red; hind tibiae pale red, the spines, except at base, black. Supraanal plate of male triangular, acutely angled at tip, the lateral margins a little elevated, within them the surface tectate, bearing at the summit of the ridge a deep slender sulcus fully two-thirds the length of the plate, the ridge fading beyond; furcula consisting of a pair of basally approximate, short, triangular, pointed teeth, diverging at nearly right angles; cerci long and very slender, tapering in the basal third, beyond lamellate, equal nearly to the tip, incurved gently and downcurved as gently, feebly twisted, the apex acutangulate below by the slope of the upper margin, somewhat longer than the supraanal plate, pilose; infracercal plates moderately broad, laterally arcuate, about as long as the supraanal plate.

Length of body, male, 18 mm., female, 23.5 mm.; antennae, male, 5.5 mm., female, 6 mm.; tegmina, male, 3.25 mm., female, 4 mm.; hind femora, male, 10.5 mm., female, 12.75 mm.

Three males, 2 females. Mount Orizaba, Mexico, W. S. Blatchley; the same, 11,500 feet, March (L. Bruner). Originally described from the same mountain as collected by M. Aug. Sallé "au pied de la neige." Mr. Blatchley informs me that at the time of his visit the snow line was at 15,000 feet, and adds that he took a single specimen of the species at 13,500 feet, "a very few individuals may have been taken as low as 9,000 feet, but the species was common only between 10,000 feet and 12,000 feet; above 12,000 feet scarce."

According to statements in the daily press,¹ Orizaba, which is of volcanic origin, showed signs of a renewal of activity early in March, 1895, when hot ashes were ejected, the snow disappeared from the summit and the vegetation of the upper part of the mountain was burned. Possibly this means the extinction of *Paradichroplus mexicanus*.

The following description of the living insect, made upon the spot, has been kindly sent me by Mr. Blatchley: Pronotum of male ash gray tinged with yellow, especially along the median line; sides of pronotum with a brownish stripe on upper half, bordered below with

¹ See especially the Examiner of San Francisco, March 12, 1895.

one of yellowish white; face grayish; abdomen with a yellow line along the back, the sides brown, the sternites yellow; sternites of thorax bluish gray; a whitish bar extends from base of tegmina diagonally to hind coxae; sides of hind femora brown with two yellowish stripes on upper margin, below light orange; tibiae deep orange; tarsi flesh color. Female tinged with greenish yellow where there is clear yellow in the male; cheeks, whole sternum and lower sides of abdomen blue, especially the sternites of thorax; lower sides of hind femora and tibiae deep orange.

Mr. Samuel Henshaw, while recently in London, procured for me at the British Museum a drawing of the genitalia of Walker's *Caloptenus mexicanus*, described by him as new, showing that it was unquestionably the present species. (See Plate II, fig. 4.)

2. PARADICHROPLUS VARICOLOR.

(Plate II, fig. 6.)

Pezotettix varicolor STÅL, Bih. K. Sv. Vet.-Akad. Handl., V (1878), No. 9, pp. 9-10.

Paradichroplus varicolor BRUNNER, Rév. Syst. Orth. (1893), p. 145.—GIGLIO-TOS, Zool. Jahrb., Abth. Syst., VIII (1895), p. 813.

Dark ferrugineo-testaceous, lutescent beneath, with a black lateral stripe. Head with the genae not in the least tumescent as seen from above, the summit blackish fuscous, and behind the eyes a broad piceous band; raised portions more or less obscured with blackish fuscous; frontal costa much narrowed above, punctate, plane; fastigium feebly sulcate anteriorly. Pronotum with the hind margin entire, the lateral carinae feeble on the metazona, the upper portion of the lateral lobes with a broad piceous band, the continuation of that behind the eye, somewhat tinged with chocolate, accompanied on the prozona by a slender black stripe between the front and middle sulcus, halfway between the black band and the lower margin. Prosternal spine conical. Tegmina half as long again as broad, apically acuminate, their inner edges subattingent, testaceous, the costal half, in continuation of the pronotal stripe, infuscated. Fore and middle legs ferruginous above, luteous below; hind femora with the upper half of the outer and upper third of the inner face blackish, the upper face ferruginous, the remainder flavous, the hind tibiae dull pale red, the spines black on apical, pallid on basal half. Supraanal plate of male broadly triangular, apically rectangulate, the angle rounded, the surface nearly flat, with a percurrent rather sharply defined median sulcus; furcula consisting of a pair of subattingent, very feeble, rounded lobes; cerci very slender, tapering very gradually on basal half, then laminate and subequal, bent abruptly inward and backward and feebly twisted, terminating in a blunt point.

Length of body, male, 11.75 mm.; tegmina 2.75 mm.; hind femora 8 mm.

One male, Columbia. Originally described from Colombia and Mex-

ico. Having only a male from Columbia, received from Hofrath Brunner von Wattenwyl, I am compelled to base my description and figure upon that alone. Giglio-Tos reports it from Paraguay.

4. PHAEDROTETTIX, new genus.

(φαιδρότος, bright; τέττιξ, grasshopper.)

Body small, compact, distinctly largest at the metathorax, sparsely pilose. Head a little prominent and, with the eyes, nearly as broad as the posterior portion of the pronotum, at least in the male, the vertex moderately convex, slightly elevated above the pronotum, the fastigium descending rapidly and the face retreating somewhat; eyes moderately large, moderately prominent, more prominent in the male than in the female, broad oval, half (female) or less than half (male) as long again as broad, scarcely longer than the infraocular portion of the genae; interspace between the eyes almost equally narrow in both sexes, considerably narrower than the frontal costa, which is not very narrow, subequal, percurrent, sulcate; antennae slender, of similar length in the two sexes, but very little longer than head and pronotum together. Pronotum very feebly flaring in front to receive the head, the metazona flaring considerably throughout, otherwise parallel-sided, compressed, the dorsal surface transversely convex, passing insensibly into the vertical lateral lobes with no lateral carinae, both front and hind margins truncate, the latter feebly and roundly emarginate, a percurrent median carina; prozona sparsely punctate, less than twice as long as the closely punctate metazona, at least in the male, its middle transverse sulcus angulate, being bent forward laterally, its posterior sulcus similarly bent or sinuate, its anterior sulcus rather remote from the front margin. Prosternal spine erect, conical, subappressed; interspace between mesosternal lobes of male subquadrate, slightly longer than broad, of female distinctly transverse, almost as broad as the lobes; metasternal lobes approximate in both sexes. Tegmina linear, lateral, about as long as the prozona. Fore and middle femora tumid in the male; hind femora rather long and slender, the hind tibiae with nine spines in the outer series. Extremity of the male abdomen subclavate, upturned, bluntly rounded, but with a slight apical tubercle formed partly by the compression of the subgenital plate, the lateral margins of which are straight throughout, and at apex do not surpass the tip of the supranal plate; cerci laminate, subfalcate; furcula subobsolete.

A single species is known, coming from Mexico and southern Texas.

PHAEDROTETTIX AUGUSTIPENNIS, new species.

(Plate II, fig. 7.)

Pezotettix angustipennis BRUNER!, MS.

Fuscous above, luteo-fuscous below. Head livid fuscous, flecked and more or less punctate with fuscous, the vertex (except a livid stripe following the upper edge of the eye and passing backward) and a broad

band behind the middle of the eye blackish fuscous; whole face and lower part of genae punctate; antennae fusco-ferruginous. Pronotum blackish fuscous on prozona, ferrugineo-fuscous on metazona, the upper portion of the lateral lobes with a broad blackish band, on the metazona curving slightly downward and fading out, sometimes edged above anteriorly by a feeble, dull luteous stripe, but beneath sharply defined from the dull luteous remainder of the lateral lobes, this band often subobsolete in the female, or scarcely distinguishable from the disk; metasternal epimera with an oblique luteous stripe. Tegmina dark fuscous. Fore and middle femora luteo-fuscous or fusco-luteous; hind femora with the outer face greenish plumbeous, the upper face ferruginous, the lower luteous, the inner luteous in the lower, fuscous in the upper half, the whole geniculation fuscous; the hind tibiae blue-green, fusco-ferruginous at extreme base and tip, the spines black-tipped. Supraanal plate of male subclypeate, tapering gradually, the broadly subtruncate tip very obtusely angulate, the sides feebly concave, with a median tectate ridge which divides in the basal third to include a narrow, triangular, rather deep sulcus; furcula consisting of a pair of inconspicuous rounded lobes, formed by the slight fullness of the interior angles of the divided halves of the last dorsal segment; cerci broad at base but at once narrowed by the abrupt excision of the lower margin, so as to be less than half the basal breadth, the apical portion subequal, subfalcate, the lower apical angle acute, the whole laminate, scarcely incurved.

Length of body, male, 13 mm., female, 17 mm.; antennae, male, 5.5 mm., female, 6 mm.; tegmina, male, 2 mm., female, 2.8 mm.; hind femora, male, 8 mm., female, 10 mm.

Six males, six females. Mount Alvarez, San Luis Potosi, Mexico, E. Palmer [U.S.N.M. No. 703, male and female]; Comancho, Durango, Mexico, November (L. Bruner); Corpus Christi Bay, Nueces County, Texas, December 11-20, E. Palmer.

3. CONALCAEA, new genus.

(κωνος, cone; ἄλκαία, tail.)

Body rather stout, somewhat compressed, slightly (male) or distinctly (female) largest at the metathorax, thinly pilose. Head moderate, slightly prominent in the male only, with the eyes about as broad, in the male, as the metazona; vertex gently convex, scarcely elevated above the level of the pronotum, the fastigium descending rapidly, the face retreating slightly; eyes large, not very prominent, little more so in the male than in the female, longer than (male) or not quite so long as (female) the posterior infraocular portion of the genae, broad oval, hardly more than half as long again as broad in either sex; interspace between the eyes rather narrow, similar in the two sexes, scarcely narrower than the frontal costa, which is subequal, more or less sulcate, and fails to reach the clypeus; antennae slender, rather long. Pro-

notum enlarging slightly (male) or considerably (female) in passing backward, with distinct pereurrent median carina and sometimes distinct, sometimes scarcely perceptible lateral carinae, the dorsum very broadly tectate in the first case, obscurely so in the second, the lateral lobes subvertical or vertical; both front and hind margins transverse, the latter emarginate; prozona sparsely punctate, as long as its posterior breadth, about twice as long as the densely punctate metazona, cut in the middle by a distinct, straight, transverse sulcus, and followed at less than half the distance to the metazona by a similarly impressed transverse sulcus of variable direction. Prosternal spine conical, erect, in the male rather long; interspace between mesosternal lobes subquadrate but much narrower than the lobes in the male, distinctly transverse and nearly or quite as broad as the lobes in the female, the metasternal lobes attingent or approximate in the male, moderately distant in the female. Tegmina rather long elliptical, fully as long as the prozona. Fore and middle femora tumid in the male; hind femora not very long and rather stout, but subcompressed, the hind tibiae with nine to ten spines in the outer series. Extremity of the male abdomen subclavate, but elongate by the posterior extension of the subgenital plate, as in *Barytettix*, as a blunt conical tubercle; lateral margins of this plate straight from the base, the apical margin well rounded, reaching beyond the tip of the supraanal plate by a brief distance; cerci and furcula as in *Barytettix*.

The type of this genus is *C. miguelitana*, the only one in which both sexes are known.

Three species are here described; they occur in Mexico and southwestern New Mexico.

ANALYTICAL KEY TO THE SPECIES OF CONALCAEA.

A¹. Lateral carinae of pronotum distinct; posterior margin of pronotum distinctly emarginate.

b¹. Tegmina well rounded at tip; hind tibiae red..... 1. *miguelitana* (p. 24).

b². Tegmina apically truncate; hind tibiae luteous or flavescens.

2. *truncatipennis* (p. 25).

A². Lateral carinae of pronotum obscure, the dorsum passing almost insensibly into the lateral lobes; posterior margin of pronotum only faintly emarginate; lobes of furcula of male much broader than long, scarcely projecting.

3. *neomexicana* (p. 26).

I. CONALCAEA MIGUELITANA, new species.

(Plate II, fig. 8.)

Fusco-testaceous, more or less lutescent beneath, very sparsely pilose. Head dull luteous (male) or olivaceo-testaceous, much infuscated (female), the vertex always more or less infuscated and especially marked with a pair of dark streaks divergent from the base of the fastigium; genae much mottled with fuscous, particularly in the female; fastigium sulcate between the eyes and feebly, in the male only, beyond; frontal costa barely reaching the clypeus, nearly plane but depressed at the ocellus in the female, feebly sulcate except at summit in the male, punctate

especially above, the punctation extending upon the sides of the fastigium; rest of face and lower part of genae sparsely punctate; antennae fuscous, apically ferruginous. Pronotum with the disk of the prozona more uniformly darker than the rest, the lower part of the lateral lobes of the prozona suffused with luteous; thoracic epimera black. Tegmina narrow at the base, enlarging rather rapidly to beyond the middle and then again diminishing to the well-rounded extremity, distinctly shorter than the pronotum but longer than the prozona, black in the interstices of the veins which are fusco-luteous, generally darker below than above. Hind femora variable in color but with the upper half or more of the outer face always dark fuscous, sometimes blackish, the rest of it more or less luteous, the adjoining carinae black, but the others yellowish, the outer portion of the lower surface dull olivaceous, the upper surface olivaceo-fuscous, the genicular arc black; hind tibiae red, feebly incurved, the spines black on their apical half, more or less pallid, especially on the inner side, on their basal half. Abdomen sparsely and coarsely punctate throughout with a pallid median carina, the hinder edges of the segments sometimes deeply infuscated. Supraanal plate of male rather long triangular, with a pair of approximate, rather sharp ridges, subparallel but nearly meeting in the middle, inclosing on basal half a tolerably deep sulcus, just before the extremity of which, outside the middle of either side of the plate, is a very short blunt ridge; furcula consisting of a pair of subattinent minute lobes, projecting by about their own width; cerci compressed, laminate, broad, subequal, tapering a very little at the base, subfalcate, the lower apical portion produced and very acutely angulate, not incurved; apical tubercle coarse and blunt, projecting beyond the apical margin of the subgenital plate but a short distance.

Length of body, male, 19 mm., female, 27 mm.; antennae, male, female, 9 mm.; tegmina, male, 4.1 mm., female, 5 mm.; hind femora, male, 12.5 mm., female, 15 mm.

Two males, 3 females. Sierra de San Miguelito, San Luis Potosi, Mexico, E. Palmer.

2. CONALCAEA TRUNCATIPENNIS, new species.

Fusco-testaceous, mottled with dull ferruginous, the abdomen dull testaceous. Head pale ferrugineo-testaceous, mottled with ferruginous on luteo-testaceous, the summit with two divergent ferruginous stripes and feeble signs of a postocular ferruginous stripe; fastigium feebly depressed between the eyes, punctate at tip; frontal costa punctate throughout, very shallowly sulcate; rest of face and lower part of genae sparsely punctate; antennae dark fuscous. Pronotum with feeble signs of a luteous stripe following the lateral carinae, the posterior margin of either side, including that of the lateral lobes, sinuate. Tegmina rapidly enlarging from the constricted base to the middle, beyond subequal, broadly truncate at the extremity, about as long as the prozona, testaceous. Hind femora ferrugineo-testaceous, dull olivaceous beneath,

the genicular arc black; hind tibiae luteo-testaceous or flavescent, the spines black-tipped. Abdomen sparsely and coarsely punctate.

Length of body, female, 22 mm.; antennae, 6.75 mm.; tegmina, 3.9 mm.; hind femora, 11.5 mm.

One female. Saltillo, Nuevo Leon, Mexico, March 21-28, E. Palmer.

This species differs from the preceding by its truncate tegmina, paler hind tibiae, more uniform and generally lighter coloring, and the wider interval between the mesosternal lobes of the female, which is here almost or quite as wide as the lobes themselves.

3. CONALCAEA NEOMEXICANA, new species.

(Plate II, fig. 9.)

Ferrugineo-testaceous above, heavily marked with black, testaceous beneath. Head testaceous, with a flavous tinge, flecked with fuscous on the sides, and heavily infuscated above with a narrow streak of luteo-testaceous behind the middle of the upper half of the eye, separating a fuscous patch above from a black patch below; fastigium shallowly and interruptedly sulcate, the frontal costa punctate, sulcate in its middle half, the rest of the face and genae almost equally punctate; antennae?. Pronotum scarcely widening posteriorly, with hardly any indication of lateral carinae, the hind border very feebly emarginate, the disk almost uniformly ferrugineo-testaceous, the upper half of the lateral lobes of the prozona piceous, cut in the anterior half by an oblique luteous streak, the lower half luteo-testaceous; thoracic epimera black. Tegmina enlarging gently from the rather narrow base to the middle of the distal half and then well rounded, fully as long as the prozona, black, with mostly luteous veins. Hind femora with the outer face livid, streaked with black above, the upper face ferruginous, the lower pale green, separated from the outer face by a dark-green carina, the genicular arc black; hind tibiae reddish luteous, the spines pallid, with black tips. Abdomen, at least in its basal half, together with the meso- and metanota, black or blackish ferruginous, with a narrow ferrugineo-testaceous median stripe, the black narrowing and finally disappearing posteriorly, coarsely punctate. Supraanal plate of male long triangular, tectate, with a slender and deep percurrent median sulcus, and the lateral margins gradually raised a little; furcula consisting of little more than the thickening of the adjoining edges of the parted halves of the last dorsal segment; cerci very much as in *C. miguelitana*, but more contracted in the middle, wider beyond, with the upper margin in consequence more strongly sinuate; terminal tubercle large and extending beyond the posterior margin of the subgenital plate by a greater distance than the latter is removed from the tip of the supraanal plate.

Length of body, male, 19 mm.; tegmina, 4 mm.; hind femora, 11.25 mm.

One male. Silver City, Grant County, New Mexico (L. Bruner).

6. BARYTETTIX, new genus.

(βαρὺς, heavy; τέριξ, grasshopper.)

Body heavy, moderately compressed, thinly pilose. Head large, moderately prominent, the vertex gently convex, not raised above the level of the pronotum, the fastigium descending with moderate rapidity and the face retreating slightly; eyes very large, moderately prominent, about equally so in the two sexes, broadly ovate in the male, elliptical in the female, much longer than the infraocular portion of the genae; interspace between the eyes narrow, especially in the male, the fastigium sulcate throughout, widening considerably beyond, the frontal costa relatively broad, considerably broader than the interspace between the eyes; antennae not very slender, long, half as long as the body in the male. Pronotum short, subequal, widening slightly at the metazona, the front margin truncate and laterally plicate, the hind margin truncate and emarginate, its dorsum gently convex, passing insensibly into the vertical lateral lobes, a feeble percurrent median carina; prozona transverse, especially in the female, sparsely punctate, slightly less than twice as long as the densely punctate metazona, crossed in the middle by a distinct transverse sulcus, followed at less than half the distance to the metazona by a similar angulato-arcuate sulcus. Prosternal spine bluntly conical, erect; interspace between mesosternal lobes twice as long as broad in the male, subquadrate and nearly as broad as the lobes in the female, the metasternal lobes rather distant in the male, approximate in the female. Tegmina elliptical, about as long as the prozona. Fore and middle femora very tumid in the male; hind femora short and moderately stout; hind tibiae with nine to ten spines in the outer series. Extremity of the male abdomen subclavate, but with the subgenital plate so produced posteriorly as to form an exceedingly coarse and blunt conical tubercle, the lateral margins straight from the very base, the apical margin removed from the tip of the supraanal plate by considerably more than half the length of the latter; cerci large, laminate, arcuate, the angulate tip directed downward; furcula composed of a pair of minute lobes.

B. crassus may be taken as the type of the genus.

Two species are known, both from Lower California.

ANALYTICAL KEY TO THE SPECIES OF BARYTETTIX.

- Tegmina unicolorous; hind margin of pronotum distinctly emarginate; frontal costa sulcate throughout (male) 1. *crassus* (p. 28).
 Tegmina longitudinally bicolored; hind margin of pronotum very feebly emarginate; frontal costa plane, or depressed only just below the ocellus (female).
 2. *peninsulae* (p. 28).

1. *BARYTETTIX CRASSUS*, new species.

(Plate II, fig. 10.)

Luteo-testaceous, probably flavescens in life, marked with fuscous and black. Head subluteous, a little infuscated on vertex and with a fuscous band behind the eye distinct only at its upper margin; borders of fastigium and frontal costa punctate; other parts of face very obscurely and sparsely punctate; frontal costa sulcate throughout; antennae luteo-testaceous, becoming infuscated on the apical half. Prozona luteo-testaceous above, luteous on the lower half of the lateral lobes, their upper half occupied by a broad piceous patch which narrows anteriorly by the excision of its lower margin; metazona fusco-testaceous; epimera black. Tegmina blackish fuscous with dull luteous veins. Fore and middle legs luteo-testaceous, the apical half of the claws black, the arolia much more than half as long as the last tarsal joint, narrowly edged with black (hind legs wanting). Abdomen with a narrow laterodorsal dark fuscous stripe on some of the basal segments, and most of the segments dorsally margined posteriorly with testaceous. Supraanal plate of male triangular with sinuous sides, either longitudinal half broadly and deeply sulcate, the rising margins between them inclosing a deep and rather narrow median sulcus, constricted at the middle; furcula consisting of a pair of approximate, very small, rounded lobes, scarcely projecting; cerci very broad and compressed, a little narrowed before the middle, the basal portion a little bullate, the apical produced by its inferior extension, the apex acutely angulate and curved downward, the whole very feebly incurved; upper margin of the subgenital plate straight throughout, well rounded apically, the tubercle very coarse and very blunt, nearly doubling the length of the plate.

Length of body, male, 21.75 mm.; antennae, 11 mm.; tegmina, 4 mm.

One male. San Jose del Cabo, Lower California, G. Eisen, collection California Academy of Sciences (L. Bruner).

2. *BARYTETTIX PENINSULAE*, new species.

Light testaceous with a luteous tinge, marked with black. Head testaceous with a faint ferruginous tinge, marked above with a median, more or less broken, black stripe which follows the sulcus of the fastigium and broadens considerably behind; also with a very broad black band behind the eyes; whole face and lower portion of the genae distinctly but sparsely punctate, the frontal costa feebly convex except for a slight depression below the ocellus; antennae light ferruginous on basal, ferruginous on apical half. Metazona testaceous with no luteous but a feeble olivaceous tinge, the prozona luteo-testaceous, marked on disk with a couple of narrow, parallel, subdorsal black lines on its posterior half, which cross also the metazona, but are there evanescent and slightly divergent; lateral lobes of the prozona marked

above by a broad, slightly oblique, fusco-piceous patch which fails to reach the anterior border; pleural incisures and metathoracic epimera marked in black. Tegmina black on more than the lower half, above pallid luteous. Fore and middle legs luteo-testaceous; hind femora pallid luteous, the entire geniculation except most of the lower lobe black; hind tibiae long pilose, brownish luteous excepting the under surface which is brownish fuscous, the spines black excepting their inner bases. Abdomen with a narrow mesial black stripe widening on each segment at its extremity and cut by the testaceous carina; sides of some of the apical segments partly blackish fuscous.

Length of body, female, 19 mm.; antennae, 7.5 mm.; tegmina, 3 mm.; hind femora, 12 mm.

One female. Lower California, G. Eisen, collection California Academy of Sciences (L. Bruner).

7. PHAULOTETTIX, new genus.

(*φᾶῦλος*, good-for-nothing; *τέτριξ*, grasshopper.)

Body compact, compressed, pilose. Head not prominent, not wider, including the eyes, than the broadest part of the thorax, the vertex gently arched, not elevated above the pronotum, the fastigium rapidly descending, the face retreating slightly; eyes large but not very prominent, more than half as long again as broad in the male and nearly twice as long as the anterior infraocular portion of the genae, separated above by a very narrow space; frontal costa narrow, but wider than the space between the eyes, equal, percurrent, sulcate; antennae only a little longer than head and pronotum together. Pronotum truncate at each extremity, barely broader behind than in front, transversely convex, the disk passing insensibly into the vertical lateral lobes, a slight median carina; prozona transverse, slightly less than twice as long as the metazona, divided in the middle by a distinct transverse sulcus, followed at a short distance behind by a less distinct sinuous sulcus, very feebly and sparsely punctate in distinction from the densely though not sharply punctate metazona. Prosternal spine short, blunt, conical, retrorse; interval between mesosternal lobes subquadrate, the metasternal lobes attingent over a short space. Tegmina present as minute pads scarcely extending beyond the pronotum, situated high upon the sides. Fore and middle femora scarcely tumescent; hind femora very short and moderately stout, the hind tibiae with 9 spines in the outer series. Abdomen strongly compressed, the tip scarcely enlarged as seen from above, upturned only by its inferior curve; margins of the subgenital plate not ampliate at the base, straight, well rounded and entire apically, extending beyond the tip of the supraanal plate by about half the length of the latter; furcula minute; cerci simple, compressed laminate, tapering, inferiorly angulate at apex.

As only the male is known to me, the description is necessarily based on that sex only.

A single species is known, from Mexico.

PHAULOTETTIX COMPRESSUS, new species.

(Plate II, fig. 11.)

Brownish testaceous above, olivaceo-testaceous below, marked on the sides with a feebly arcuate piceous stripe. Head dark brownish testaceous above, with a piceous band behind the eyes, below which the posterior parts of the genae are ferruginous, while the face and rest of the head are olivaceo-testaceous; frontal costa punctate above; fastigium very narrowly and slightly sulcate; antennae flavescens, growing fuscos apically. Pronotum dull olivaceo-testaceous on disk, with a large median, fusco-ferruginous, trapezoidal patch, the upper half of the lateral lobes blackish, the lower flavo-testaceous, excepting the dark lower part of the front half of the prozona; sides of the abdomen with a diminishing piceous band, broken by the pink incisures, the middle of the dorsum becoming gradually brownish testaceous. Tegmina testaceous. Fore and middle legs and hind femora green, the latter fuscoluteous above, blackish on the sides of the geniculation, and luteous within; hind tibiae red with a green base, the spines pallid, black-tipped. Supraanal plate long triangular, well rounded at apex, strongly tectate, with a moderately deep basal median sulcus, less than half as long as the plate; furcula consisting of a pair of minute, attingent, parallel fingers, hardly longer than broad; cerci slender, compressed, short, tapering on the basal half, beyond equal, the lower outer extremity acutangulate (hardly so represented in the figure).

Length of body, male, 15 mm.; antennae, 6.1 mm.; hind femora, 8.6 mm.

One male. Montelovez, Cohahuila, Mexico, September 20, E. Palmer.

8. CEPHALOTETTIX, new genus.

(κεφαλι), head; τέττιξ, grasshopper.)

Body subcylindrical with subparallel sides, slightly constricted in the middle of the abdomen. Head large, prominent, well exerted, together with the eyes considerably broader (at least in the male) than any part of the thorax; vertex well arched, elevated above the pronotum, the fastigium rapidly descending, and the face considerably retreating, these two at right angles; eyes very large and very prominent (in the male), very broadly ovate, and yet nearly twice as long as the infraocular portion of the genae; fastigium broadening considerably in front of the eyes, sulcate throughout, the frontal costa considerably broader than the interval between the eyes, yet not very broad, equal except for a slight contraction above, feebly depressed just above the ocellus; antennae slender, about half as long as the body. Pronotum parallel sided, scarcely widening at the metazona, the front and hind margin as in *Rhabdotettix*, compressed cylindrical, with neither median nor lateral carinae, the disk passing insensibly into the lateral lobes; prozona sparsely punctate, about twice as long as the densely punctate meta-

zona, divided in the middle by a feeble, straight, transverse sulcus, followed at scarcely less than halfway to the metazona by a similar sulcus. Prosternal spine erect, rather long, pyramidal, acuminate; interval between mesosternal lobes feebly transverse, almost as wide as the lobes themselves, the metasternal lobes subcontiguous. Tegmina elliptical, about as long as the prozona. Fore and middle femora tumescent in a slight degree; hind femora short and moderately stout, the hind tibiae with nine spines in the outer series. Extremity of the abdomen subclavate, well rounded, upturned, the margins of the subgenital plate of male with no basal ampliation, straight, the apex broadly rounded, protruding beyond the tip of the supraanal plate by less than half the length of the latter; furcula wanting; cerci compressed, slender, subequal and nearly straight.

The female being unknown, the description is based wholly upon the male.

The genus is represented by a single species found in Mexico.

CEPHALOTETTIX PARVULUS, new species.

(Plate III, fig. 1.)

Pezotettix parvulus McNEILL!, MS.

Pezotettix olivaceus BRUNER!, MS.

Blackish or fuscous bronze green above, olivaceous yellow below, rather sparsely and not briefly pilose. Head above and sides to the lower level of the eyes bronze green, becoming blackish above, with the feeblest sign of a light-colored stripe behind the upper margin of the eye; rest of head with face olivaceous yellow, feebly infuscated and sparsely punctate; antennae olivaceous at base, testaceous beyond and infuscated at tip. Pronotum wholly and almost uniformly dark bronze green, a little darker above than on the lateral lobes, and slightly darker on prozona than on metazona. Abdomen above fusco-olivaceous, more or less ferruginous at the ends of the segments. Tegmina testaceous. Fore and middle legs and hind femora olivaceous yellow, the upper surface of the latter becoming fuscous in the apical half, the whole geniculation blackish; hind tibiae green, the spines blackish brown except at base. Supraanal plate of male triangular, broadly tectiform except apically, the summit of the tectate portion with a rather deep, slightly narrowing, basal sulcus half as long as the plate; furcula absent; cerci slender, compressed but not laminate, tapering slightly at the base, beyond equal, straight, feebly incurved and bluntly rounded at the tip, angulate below.

Length of body, male, 13.25 mm.; antennae, 6.75 mm.; tegmina, 2.5 mm.; hind femora, 8.5 mm.

Two males. Otoyac, Vera Cruz, Mexico, 2,700 feet, December (L. Bruner); Orizaba, Mexico, 4,000 feet, W. S. Blatchley (J. McNeill).

I have preferred McNeill's name to Bruner's because the latter has and the former has not been employed in closely related genera.

9. RHABDOTETTIX, new genus.

(ῥάβδος, a stick; τέττιξ, grasshopper.)

Paraideмона (pars) BRUNNER, Rév. Syst. Orth. (1893), p. 145.

Body more or less pilose, of much the same shape as in *Paraideмона*, at least in the male; that of the female differs only in being a little shorter. Head not prominent, not wider including the eyes than the broadest part of the pronotum; vertex very feebly arched, scarcely elevated above the level of the pronotum and in the male not above that of the eyes, the fastigium rather rapidly declivent, narrow (female) or very narrow (male) between the eyes, broadening in front, sulcate between the eyes in the female, throughout in the male; frontal costa contracted only at the extreme summit, elsewhere equal, broader than the interspace between the eyes but not very broad, slightly sulcate; eyes moderately prominent in the male, much larger than (male) or about as large as (female) the whole infraocular portion of the genae; antennae rather slender, fully half as long as the body (male) or simply longer than head and pronotum together (female). Pronotum very slightly (male) or distinctly (female) enlarging from in front backward, the front margin not in the least flaring to receive the head, the hind margin biconvexly truncate, being slightly emarginate in the middle with very broadly convex halves, more distinct in the female than in the male; disk nearly plane, but very broadly convex transversely, with well rounded angles in passing into the vertical lateral lobes, and a very feeble, blunt, median carina; prozona about twice as long as the metazona, sparsely punctate especially in the female, the metazona densely punctate, the transverse sulci of the former much as in *Sinaloa*, but slightly more distant. Prosternal spine short, erect, conical; mesosternal lobes separated by an interval which is distinctly longer than broad in the male, subquadrate in the female, the metasternal lobes contiguous or subcontiguous (male) or moderately distant (female). Tegmina elliptical, lateral, about as long as the prozona. Fore and middle femora distinctly tumid in the male; hind femora short and moderately stout, the hind tibiae with 8-11, generally 9, spines in the outer series. Extremity of the male abdomen subclavate, upturned, the margin of the subgenital plate with no basal ampliation, straight or very feebly sinuate, the apex rounded and not angulate, protruding beyond the tip of the supraanal plate by less than half the length of the latter; furcula consisting of a pair of exceptionally broad lobes scarcely protruding beyond the margin of the last dorsal segment; cerci compressed, moderately broad, subequal and arcuate or subarcuate.

R. palmeri may be taken as the type.

The genus is known only from Texas and Mexico, where three species occur.

ANALYTICAL KEY TO THE SPECIES OF RHABDOTETTIX.

A¹. Sides of the disk of the pronotum with a narrow light colored stripe, rarely indistinguishable from the rest of the disk, followed, on the upper portion of the lateral lobes, by a broad dark stripe; cerci of male not narrowed before the middle.

- b¹. Interspace between the mesosternal lobes of male about twice as long as broad, the lobes rounded on their inner margin; cerci of male feebly and regularly incurved throughout, almost half as broad as the supraanal plate..... 1. *concinus* (p. 33).
 b². Interspace between the mesosternal lobes of male only a little longer than broad, the sides parallel; cerci of male bent distinctly inward on apical third, much less than half as broad as the supraanal plate..... 2. *palmeri* (p. 34).
 A². Sides of the dist. and of the upper half of the lateral lobes of the pronotum with no distinct stripes; cerci of male narrowed before the middle..... 3. *pilosus* (p. 35).

I. RHABDOTETIX CONCINUS, new species.

A. D. 1822.

(Plate III, fig. 2.)

Body very sparsely but not briefly pilose, brownish testaceous above, luteo-testaceous below, marked with blackish castaneous and dull luteous and more or less tinged with ferruginous. Head luteo-testaceous, profusely and delicately mottled with fuscous on face and genae, the vertex black or blackish castaneous, bounded by a narrow luteous stripe behind the upper part of the eyes, separating from it a broad black or blackish band behind the middle of the eyes, which again is followed by a broad luteous patch behind the lower part of the eyes; face, including frontal costa and the front of the genae, sparsely punctate; antennae luteo-testaceous more or less infuscated. Pronotum with a very broad, median, blackish castaneous band crossing the prozona, separated from an equally broad, similar, percurrent, posteriorly widening band on the upper half of the lateral lobes (but here less pure) by a rather narrow dull luteous stripe, the continuation of that behind the upper part of the eyes; metazona mostly ferrugineo-testaceous; rest of the body blackish castaneous above, with a broad, irregularly margined, broadening, dull luteous or luteo-ferruginous, median stripe; lower portion of lateral lobes of the pronotum luteous or luteo-testaceous. Tegmina black in the interstices of the pale testaceous veins. Fore and middle femora greenish with a very strong ferruginous tinge above; hind femora ferruginous above, yellowish luteous beneath, the outer face olivaceous more or less infuscated above, the genicular are piceous; hind tibiae olivaceous green, the apical half of the spines black, ten spines in the outer series. Supraanal plate of male triangular with slightly convex sides, the lateral margins slightly raised, the inner half tectate with a rather deep and slender median sulcus on the summit, extending from the base to the middle of the plate; furcula consisting of a pair of scarcely projecting exceedingly broad plates, each of which is much more than half as wide as its half of the supraanal plate beneath it, separated from each other by a considerable interval; cerci thinly laminate, the outer side slightly convex transversely, pretty broad, the basal half subequal, the apical half bent strongly upward in a curve, the apex rounded, the whole gently incurved, subfalcate; lateral margins of the subgenital plate slightly and broadly convex as seen from the side, falling toward the apex, which is not at all angulate; pallium capable of erection as a high pyramid.

Length of body, male, 15 mm., female, 18 mm.; antennae, male, 9 mm., female, 7 mm.; tegmina, male, 2.75 mm., female, 3.5 mm.; hind femora, male, 10 mm., female, 10.75 mm.

One male, 2 females. Waco, McLennan County, Texas, October 4, 6 (Museum Comparative Zoology); Texas, Belfrage, October 13.

The broader cerci, incurved throughout and not abruptly bent inward apically, separate this species clearly from *R. palmeri*. In one view their base may be said to be narrower than the apical portion and so the description of Stål's species would be applicable to this, but the interval between the mesosternal lobes of the male is here nearly twice as long as broad, while in *R. pilosus* it is more nearly quadrate.

2. RHABDOTETRIX PALMERI, new species.

(Plate III, fig. 3.)

Body thinly but not briefly pilose, luteo-testaceous beneath, black or blackish ferruginous (male) or ferrugineo-testaceous (female) above, marked with dull luteous; the darker parts are found in a dorsal stripe from the front of the vertex to the front of the metazona, on the upper half of the lateral lobes of the pronotum, and on the sides of the abdomen. Head luteo-testaceous, more or less deeply infuscated; frontal costa feebly punctate above; antennae luteous or testaceous, apically infuscated. Pronotum with the dark portions mentioned separated by a narrow light stripe, which begins behind the upper part of the eyes and on the head is bright luteous, but in passing over the pronotum, especially in the female, becomes much duller and is sometimes scarcely distinguishable; in most vivid examples it crosses the pronotum, but even in the male it usually becomes obsolescent on the metazona, which is mostly ferrugineo-testaceous in both sexes, rarely black mesially in the male; the lateral stripe on the pronotum generally margined more or less distinctly with black; lower portions of lateral lobes luteous or luteo-testaceous, narrowly edged beneath with testaceous; abdomen with a widening dorsal stripe of ferrugineo-testaceous. Fore and middle femora ferruginous, slightly infuscated apically; hind femora green, ferruginous above, the upper genicular lobe and sometimes the whole geniculation black; hind tibiae green, the spines black-tipped, usually nine but varying from nine to eleven in the outer series. Supraanal plate of male triangular with slightly convex sides, which are slightly elevated and separated by a broad valley from the median tectate portion; the latter is considerably elevated and carries a deep slender median sulcus more than half the length of the plate; furecula consisting of a pair of broad plates, whose advance beyond the posterior line of the last dorsal segment is scarcely perceptible, each about a quarter the basal width of the supraanal plate; cerci moderately broad, compressed, straight and slightly diminishing in size for about two-thirds their length, then suddenly and considerably curved inward and bent upward, narrowing more rapidly and

ending roundly; lateral margins of the subgenital plate almost straight, the apex well rounded; pallium capable of a considerable pyramidal erection.

Length of body, male, 13 mm., female, 18 mm.; antennae, male and female, 6 mm.; tegmina, male, 2.75 mm., female, 3.2 mm.; hind femora, male, 8 mm., female, 10.5 mm.

Eight males, 12 females. Montelovez, Cohahuila, Mexico, September 22, E. Palmer. [U.S.N.M. No. 704, male and female.]

The antennae of the male are scarcely so long in this species as in the others; it differs decidedly from *R. concinnus* in the bent and narrow cerci as well as in the more nearly quadrate interspace between the mesosternal lobes of the male; from *R. pilosus*, to which it seems more nearly allied and for which I at first mistook it, it differs in the cerci of the male, which do not narrow before the middle, in being a smaller insect, besides having a duller coloring with more contrasted markings, to judge from Stål's description.

3. RHABDOTETTIX PILOSUS.

Pezotettix pilosus STÅL, Bih. Sv. Vet.-Akad. Handl., V, No. 9 (1878), pp. 10-11.

Paraidemona pilosa BRUNNER, Rév. Syst. Orth. (1893), p. 145.

I have not seen this species, and accordingly give Stål's description, Englished. The description is mainly a comparative one, the basis of comparison being *Aidemona azteca*, next which Stål placed it, in the same section of *Pezotettix*.

Olivaceous; legs yellowish olivaceous; hind tibiae greenish olivaceous, the base and geniculation proper of the hind femora black; tegmina rudimentary. Length of male 16 mm.

Male.—Interspace between mesosternal lobes a little longer than broad, with parallel sides, much narrower than the lobes themselves; metasternal lobes subcontiguous; eyes large, rather convex; apical margin [of the pronotum] gradually and obtusely sinuate, slightly emarginate in the middle, destitute of a lobe; supraanal plate furnished with a gradually narrowing sulcus, extending beyond the middle of the plate; cerci gently curved, compressed and rather broad throughout, before the middle slightly narrowed; subgenital plate short, very strongly recurved; abdomen posteriorly tumescent and somewhat recurved.

Distinguished from *Aidemona azteca* by the front and prozona less densely punctate, frontal costa obtusely subsulcate, narrower between the antennae, the sides parallel but slightly narrowed at the base, the interspace between the eyes narrower, the disk of the pronotum smooth, abbreviate and truncate anteriorly, the metazona about half as long as the prozona, tegmina rudimentary, widely separated, elliptical, extending slightly beyond the median segment, shorter than the pronotum, the abdomen blunter at tip, posteriorly more tumid and recurved, the cerci broader, the last dorsal segment of the abdomen

with no obtuse apically emarginate lobe [furcula], the hind femora slenderer and longer, prosternal spine conical, and the antennae longer, more than half as long as the body; hind tibiae in the specimen described furnished exteriorly with eight black spines, greenish olivaceous at the base.

A female specimen, in which the dorsum of the body and of the hind femora are ferruginous, with smaller eyes, the interspace between the mesosternal lobes subtransverse and scarcely narrower than the lobes themselves, and metasternal lobes moderately distant, is very probably to be referred to the species described above. In this specimen the antennae are mutilated and the hind tibiae armed exteriorly with nine spines.

Mexico (Brunner's collection).

To this I may add that the present species is certainly very close to the others described above under this genus, but seems to be slightly larger than either, and to differ by the cerci of the male to a greater degree than either of these do from each other. It is evidently also of a lighter color, and no mention is made by Stål of a very distinct dark lateral band, which is characteristic of the other two.

10. CYCLOCERCUS, new genus.

(κύκλος, circle; κέρκος, tail.)

Body shaped much as in *Paraidemona*, male and female, rather sparsely and not very briefly pilose. Head not prominent, the vertex moderately arched, scarcely elevated above the pronotum, but the fastigium rapidly descending, more or less sulcate especially in the male, much broadened anteriorly; face moderately retreating, the frontal costa generally more or less sulcate and broadening slightly from above downward, generally percurrent; interval between the eyes narrow (male) or rather narrow (female), generally narrower than the upper part of the frontal costa; eyes moderately prominent, especially in the male, generally much (male) or scarcely (female) longer than the posterior infraocular portion of the genae; antennae much (male) or scarcely if at all (female) longer than the head and pronotum together. Pronotum scarcely (male) or considerably (female) enlarging from in front backward, both front and hind margins truncate, the latter sometimes slightly emarginate, the surface transversely convex with feeble or no median carina and no lateral carinae, the disk passing almost insensibly into the vertical lateral lobes; prozona about twice as long as the metazona and less closely and less regularly punctate, the transverse sulci as in *Sinaloa*. Prosternal spine erect, blunt, conical; interval between mesosternal lobes at least as long as broad in the male, a little transverse in the female, the metasternal lobes attingent or sub-attingent in the male, approximate in the female. Tegmina shorter than the pronotum, lateral, linear. Fore and middle femora distinctly more gibbous in the male than in the female; hind femora rather short

and stout, the outer margin of the hind tibiae with nine or ten spines. Extremity of abdomen bluntly rounded (whence the generic name), the lateral margins of the subgenital plate straight from the very base, in no way angulate on meeting apically, but protruding beyond the apex of the supraanal plate by more than half the length of the latter; cerci conical, acuminate, sometimes with an inferior median tooth; furcula wholly wanting.

Three species occur in northern Mexico and southern Texas.

C. bistrigata may be taken as the type. *C. valga* is somewhat aberrant, and should perhaps be separated generically.

ANALYTICAL KEY TO THE SPECIES OF CYCLOCERCUS.

A.¹ Interspace between mesosternal lobes of male nearly twice as long as broad; anal cerci of male slender, simple.

b.¹ Hind femora relatively stout; upper surface of body with a distinct bright stripe running from the upper margin of the eye backward over the region of the lateral carinae on each side..... 1. *bistrigata* (p. 37).

b.² Hind femora relatively slender; upper surface of body with at most an obscure stripe in the region specified..... 2. *accola* (p. 38).

A.² Interspace between mesosternal lobes of male subquadrate; cerci of male stout, with an inferior median tooth..... 3. *valga* (p. 39).

1. CYCLOCERCUS BISTRIGATA, new species.

(Plate III, fig. 4.)

Dark almost blackish chocolate brown, striped with bright yellow testaceous. Head testaceous, often clouded, occasionally mottled, with fuscous, the summit to below the middle of the eyes posteriorly blackish brown, with a narrow but widening testaceous stripe behind the upper half of the eyes; lateral margins of the fastigium, particularly between the eyes, elevated to a rounded ridge, more prominent and rounded in the male than in the female, reversely arcuate; frontal costa moderately broad, subequal, sulcate (more deeply in the male than in the female), above feebly punctate at the sides, occasionally obsolescent at base in the female; lateral carinae of face distinct, slightly divergent; antennae testaceous. Both prozona and metazona ruguloso-punctate in the male, the prozona coarsely, bluntly and rather sparsely punctate in the female; pronotum with the postocular testaceous stripe of the head continued, in the male as a slender, sharply defined stripe across both prozona and metazona, in the female as a slightly broader stripe across or nearly across the prozona only, fading posteriorly and less sharply defined above; episterna testaceous; meso- and metathorax and abdomen of male blackish above, with a broad mediodorsal testaceous stripe, and testaceous below; of female more or less blackish along the middle of the sides, sometimes margined above with a broad, posteriorly evanescent, often broken, testaceous stripe, generally almost or quite obsolete, the dorsum proper brown. Interval between the mesosternal lobes of male nearly twice as long as broad. Tegmina slender, linear, very slightly and regularly enlarging to the well rounded tip, about as

long as the prozona. Hind femora rather stout, olivaceo-ruddy brown, sometimes fulvo-testaceous, the incisures of the outer face fuscous, the apex more or less infuscated; hind tibiae glaucous, the apical half of the spines black. Supraanal plate of male broadly triangular, with slightly convex sides and roundly angulate apex, with a shallow basal median sulcus, bordered by slightly elevated broad walls; furcula wholly absent, the last dorsal segment emarginate in the middle; cerci tapering rather rapidly in the basal two-fifths, beyond very slightly tapering, very slender, subacuminate, straight, reaching the top of the supraanal plate.

Length of body, male 16 mm., female 19.5 mm.; antennae, male, female, 8 mm.; tegmina, male 3 mm., female 3.5 mm.; hind femora, male, 11 mm., female 11.5 mm.

One male, 4 females. Venis Mecas, San Luis Potosi, Mexico, June 6, E. Palmer; Mt. Alvarez, San Luis Potosi, Mexico, E. Palmer; Sierra Nola, Tamaulipas, Mexico, December 3-6, E. Palmer.

It is possible that the male, which comes from Venis Mecas, may be distinct from the females, which come from all the localities; in that case the name should be retained for the male as the most characteristic form.

2. CYCLOCERCUS ACCOLA, new species.

(Plate III, fig. 5.)

With the same general color and markings as *C. bistrigata*, but without the distinct carinal stripe of that species. Head testaceous, blackish above, with a little of the postocular stripe in the female; fastigium distinctly sulcate, broadening in front; interspace between the eyes slightly narrower than in *C. bistrigata*, the frontal and lateral costae as there; antennae fusco-testaceous. Prozona with coarse dull punctation in the female, transversely ruguloso-punctate in the male, the metazona in both closely punctate; posterior margin of prozona faintly emarginate, the sulcus dividing the lobes being slightly angulate; dorsum of pronotum darker or lighter testaceous, the lower portion of the lateral lobes flavo-testaceous, the upper portion blackish brown, forming part of a broad, dark, arcuate belt, more sharply defined below than above, which passes down over the mesothoracic epimera; abdomen testaceous, with a broad piceous lateral band on its proximal half. Interspace between mesosternal lobes of male nearly twice as long as broad. Tegmina fusco-testaceous. Hind femora rather slender, fusco-testaceous, yellowish on inner face, much infuscated and sometimes strongly tinged with bluish green on outer face, the geniculation wholly testaceous; hind tibiae testaceous at extreme base, the remainder bluish green, the spines pallid on basal, black on apical, half. Supraanal plate small, triangular, with roundly pointed apex, and a short deep basal sulcus, bounded by high rounded walls; furcula wanting; cerci small, slender, shorter than the supraanal plate, tapering gently in basal half, beyond equal or subequal, very slender, blunt tipped, straight.

Length of body, male, 12.5 mm., female, 21 mm.; antennae, male, 6.5 mm., female, 7.5 mm.; tegmina, male, 2 mm., female, 3.5 mm.; hind femora, male, 8 mm., female, 11.5 mm.

Two males, one female. Corpus Christi Bay, Nueces County, Texas, December 11-20, E. Palmer; Lerdo, Durango, Mexico, December (L. Bruner).

3. CYCLOCERCUS VALGA, new species.

(Plate III, fig. 6.)

Brownish testaceous with blackish and dull luteous markings. Head dull luteo-testaceous, the whole summit of the head to below the middle of the eyes posteriorly blackish, with a narrow and somewhat obscure luteous stripe on either side, following the sides of the entire fastigium around the eyes to the middle and then passing backward, continuing across the prozona on the upper margin of the lateral lobes; fastigium feebly sulcate between the eyes, which are separated by a narrow space, much narrower than the rather broad and subequal frontal costa; this becomes obsolescent below and is shallowly sulcate in the middle and sparsely and feebly punctate throughout, like the rest of the face and the genae; antennae luteo-testaceous. Pronotum with a broad blackish fuscous dorsal stripe, crossing the whole prozona between the luteous stripes mentioned, coarsely and feebly rugoso-punctate; metazona finely and closely rugoso-punctate, rufo-testaceous; lateral lobes pallid luteous below, crossed above by a very broad mixed luteo-castaneous and blackish band, greatly broadening and weakening on the metazona, where it becomes rufo-testaceous; episterna pale greenish luteous; epimera subpiceous. Interspace between mesosternal lobes of male subquadrate. Tegmina dark fuscous with luteous veins, about as long as the prozona, linear, slightly and regularly enlarging to the rounded apex. Hind femora flavo-luteous like the under surface of the abdomen, pale rufo-testaceous above, the outer field with a bluish green upper margin, the whole geniculation pale rufo-testaceous; hind tibiae feebly incurved apically (whence the specific name), blue-green with a testaceous base, the apical half of the spines black. Supraanal plate of male shield-shaped, with strongly sinuous sides, much longer than broad, with a rather narrow sulcus on the basal half, bounded by slight ridges; furcula wanting and the last dorsal segment parted in the middle; cerci somewhat tumid and large at base, tapering rapidly in the basal half, the apical half laminate, tapering, acuminate, with an inferior dentation at its base.

Length of body, male, 18.5 mm.; antennae, 8.5 mm.; tegmina, 4 mm.; hind femora, 11.25 mm.

One male. Sierra Nola, Tamaulipas, Mexico, December 3-6, E. Palmer.

This species differs widely from the two preceding.

11. SINALOA, new genus.

(Geographical name.)

Body shaped much as in *Paraidemona*, male and female, briefly pilose. Head a little prominent, the vertex well arched and the fastigium rather rapidly descending, shallowly sulcate, the frontal costa not very broad, about as broad as the interval between the eyes, subequal, percurrent, sulcate; face but little retreating; eyes separated by a tolerably narrow interval, narrower in male than female, rather prominent in the male, considerably (female) or very much (male) longer than the anterior infraocular portion of the genae; antennae moderately stout, in the male much longer than the head and pronotum together. Pronotum subequal in the male, but with slightly expanding front margin and metazona, distinctly enlarging posteriorly in the female, both front and hind margin truncate, the latter feebly emarginate, with slight percurrent median carina and no lateral carinae, the lateral lobes vertical; prozona almost twice as long as, and less feebly punctate than, the metazona, cut in the middle by a transverse sulcus, followed behind by a sinuous or broadly W-shaped sulcus, both tolerably distinct. Prosternal spine erect, conical, bluntly pointed; interval between mesosternal lobes feebly transverse in both sexes, the metasternal lobes not very close. Tegmina brief, lobiform, lateral. Fore and middle femora of male tumid; hind femora moderately long but stout, the spines of the outer row of hind tibiae ten to eleven in number. Margin of subgenital plate of male straight from the base, which is in no way ampliate; cerci compressed laminate, subequal, slender; furcula consisting of a pair of parallel, attingent, slender, spine-like processes.

The only species known is from Mexico.

SINALOA BEHRENSII, new species.

(Plate III, fig. 7.)

Body fusco-testaceous above, flavo-testaceous beneath, the two colors separated on the sides by a broad blackish-fuscous band, extending from behind the eyes across the lateral lobes of the pronotum, subequal and well defined throughout but, at least in the female, slightly enlarged and a little obsolescent on the metazona, continued, at least in the male, on the sides of the base of the abdomen. Head flavo-testaceous, with a mediodorsal, widening, blackish fuscous or dull fuscous stripe from the base of the fastigium backward, sometimes broken; face with extremely feeble signs of delicate puncta, no more abundant on the frontal costa than elsewhere; antennae flavo-testaceous, growing infuscated apically. Pronotum with the metazona transversely and subrugosely punctate, especially in the male and on the lateral lobes, simply punctate on the disk in the female, transversely striate in the region of the lateral carinae on the prozona, the median carina sometimes blackish fuscous in continuation of the stripe on the head. Tegmina fusco-testaceous, somewhat darkest on anterior half, hardly so long as the prozona,

rounded acuminate at tip, fully twice as long as broad. Hind femora flavo-testaceous, the angulate incisures of the outer face rather broadly fuscous; hind tibiae flavous or flavo-testaceous, the spines black excepting their base. Supraanal plate of male short triangular, with feebly convex sides, rectangulate apex, and with a pair of short, oblique, rather prominent, rounded ridges before the middle of the basal half of either side; furcula consisting of cylindrical, equal, blunt fingers fully a third the length of the supraanal plate; cerci compressed laminate, rather slender, narrowed in the middle by the arcuation of the upper margin, bluntly rounded at tip, gently incurved throughout, and hardly so long as the supraanal plate; apex of subgenital plate a little angulate, extended no great distance beyond the supraanal plate.

Length of body, male, 16.5 mm., female, 25 mm.; antennae, male, 9.25 mm.; tegmina, male, 3 mm., female, 4 mm.; hind femora, male, 11 mm., female, 15 mm.

One male, 1 female. Sinaloa, Mexico, collected by Koels; received from J. Behrens, of San Francisco, after whom it is named.

12. PARAIDEMONA.

(παρά, beside; Aidemona, a genus of Melanopli.)

Paraidemona BRUNNER (pars); Rév. Syst. Orth. (1893), p. 145.

Body compact, not slender, subcylindrical, a little compressed, slightly enlarged at the metathorax, especially in the female, the abdomen of the male feebly clepsydral, the apex tumescent and rounded, and somewhat recurved. Head not prominent, the vertex well rounded, the eyes separated narrowly in the male, not widely in the female, rather prominent, particularly in the male, and large, much larger than the infraocular portion of the genae, subangulate above in the female; antennae very much longer than head and pronotum together, especially in the male. Pronotum truncate at both extremities, enlarging very slightly posteriorly, more in the female than the male, with slight, percurrent, median carina, no lateral carinae; prozona twice as long as the metazona, both equally and somewhat similarly punctato-rugulose, the transverse sulci of the prozona lightly impressed, one of them dividing the prozona in equal halves and percurrent. Prosternal spine moderate, blunt, conical, erect; interval between mesosternal lobes of male longer, sometimes much longer, than broad; of female (where known) a little longer than broad; metasternal lobes narrowly attinent. Apterous in both sexes. Fore and middle femora of male distinctly tumescent; hind femora not very long. Lateral margins of subgenital plate straight from the base, which is not ampliate and is concealed behind the preceding segment; cerci styliiform, conical; furcula consisting of a pair of parallel, attinent, cylindrical processes, terminating bluntly.

As here restricted, *Pezotettix punctatus* Stål is the type.

The genus is confined to Texas and northern Mexico, so far as known.

ANALYTICAL KEY TO THE SPECIES OF PARAIDEMONA.

Supraanal plate of male, excepting the tip, subquadrate, the lateral margins rectangular..... 1. *punctata* (p. 42).
 Supraanal plate of male triangular with nearly straight sides.... 2. *mimica* (p. 43).

I. PARAIDEMONA PUNCTATA.

(Plate III, figs. 8, 9.)

Pezotettix punctatus STÅL, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 11.*Pezotettix nudus* SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), p. 77; Cent.

Orth. (1879), p. 66.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Paraideмона punctata BRUNNER, Rév. Syst. Orth. (1893), p. 145.

Interspace between eyes as broad as (male) or rather broader than (female) the first antennal joint; frontal costa moderate, equal, flat above, sulcate at, below, and to some extent a short distance above, the ocellus. Pronotum expanding a very little posteriorly, mostly on the posterior half, the front and hind margins truncate, the latter sometimes almost imperceptibly emarginate in the middle, especially in the male, the lateral carinae wholly wanting; the whole pronotum is equally subrugoso-punctate throughout, unless it be that the disk is coarser than the deflected lobes; meso- and metanota, and the basal segments of the abdomen similarly but more obscurely punctured. The general color is a greenish yellow more or less tinged with brown, brighter in the male than in the female, and marked with blackish fuscous; the darker markings consist, principally, of a dorsal stripe, which either extends over the pronotum as a broad equal band, often fainter in the middle, with a triangular extension on the head, and sometimes a narrowing infuscation on the meso- and metanota (male), or forms an obovate patch along the middle of the anterior lobe of the prothorax, with the same triangular extension on the head, and reappears sometimes on the meso- and metathorax, and always on the abdominal joints, as a series of obliquely-descending, triangular, lateral patches, separated from one another by a yellowish median line (female); also of a broad lateral band, which extends from behind the eye backward, either to the hinder edge of the prothorax, its upper margin straight, its lower arcuate (male), or across the prozona only, occasionally in an obscure manner across the metazona also, both margins arcuate (female); beyond this the lateral band extends over the remainder of the thorax and over the abdomen, often broken into spots on the latter, and always enlivened on the former by an oblique yellowish line, which crosses it on the metathoracic episterna. The face partakes of the color of the under surface, as do the bases of the antennae; beyond, the antennae become slightly rufous; just behind its narrowest point the vertex has a transverse blackish line. Hind femora greenish yellow, the lower portion of their outer face more or less embrowned, deepening frequently into black, which occasionally covers the whole; hind tibiae pale green, the spines black tipped. Subgenital plate of male twice as broad as long, tumid, the upper edge a little and angularly produced in the middle; supraanal

plate nearly quadrate, tapering very slightly, the outer angles slightly produced, and the posterior edge with a median, triangular, pointed extension, a third as wide as the extremity of the plate and longer than broad; furcula consisting of a pair of attingent, depressed, rather stout, scarcely tapering, blunt-tipped fingers, fully half as long as the supraanal plate and slightly upturned at the tip; anal cerci very simple, being slight conical projections, tapering mostly in their basal half, the tip blunt, the whole not so long as the disk of the supraanal plate, omitting its apical extension.

Length of body, male, 16.5 mm., female, 23 mm.; antennae, male, female, 8 mm.; hind femora, male, 10 mm., female, 12.25 mm.

Thirteen males, 21 females. Dallas, Texas, J. Boll; Texas, June 13, 28, 29, July 5, August 3, Belfrage (U.S.N.M.,—Riley collection); Carrizo Springs, Dimmit County, Texas, A. Wadgymar, August 28 (the same); Goliad, Texas, December 3, E. Palmer; Corpus Christi Bay, Nueces County, Texas, December 11–20, E. Palmer. Stål's specimens came from Texas.

2. PARAIDEMONA MIMICA, new species.

(Plate III, fig. 10.)

Yellowish testaceous, heavily banded with black, especially on the sides, and more markedly in the male than the female. Head with the interspace between the eyes very narrow, especially in the male, the fastigium between them sulcate, narrowly in the male, the sulcation continuing so as to be subcontinuous with that of the frontal costa, which is sulcate in its whole extent, equal, and broader than the interspace between the eyes. Pronotum punctate as in *P. punctata*, and as there a glabrous spot free of punctuation occurs on the prozona at the summit of the lateral lobes. A black stripe, sometimes wanting or feebly fuscous in the female, begins at some point on the fastigium and continues backward, broadening on the head so as to include nearly the entire vertex, and crosses the pronotum as a broad mediodorsal band, as broad as the length of the metazona, or in the female even broader; it is sometimes obscure or wholly obsolete in the female, while in the male it is always distinct, at least on the prozona, and generally continues, though narrowed, over the meso- and metanota. The lateral band, generally rufo-piceous, is still broader and is sharply defined above and below, often uninterrupted on the metazona in the female, where it widens so as to include behind the whole of the thoracic pleura (excepting the episterna) and the sides of the first four abdominal segments; above it is more or less distinctly accompanied in the female by a testaceous stripe. The dorsum of the abdomen of the female lacks the double series of oblique lateral dashes found in *P. punctata*, or has them very feebly marked. Hind femora yellowish testaceous, the outer face growing darker below, giving there a broken irregular blackish stripe; hind tibiae glaucous, the pallid spines black tipped. Supraanal

plate of male triangular, with the lateral margins slightly convex in the middle (scarcely shown in the figure), with a pair of slightly distant, short, longitudinal, subapical ridges; furcula consisting of a pair of attingent, depressed, equal, parallel, blunt tipped fingers, less than a third as long as the supraanal plate; cerci simple, conical, pointed, hardly half as long as the supraanal plate.

Length of body, male, 13 mm., female, 20 mm.; antennae, male and female, 7 mm.; hind femora, male, 9 mm., female, 10.5 mm.

Four males, 5 females. Fort Worth, Tarrant County, Texas, May, ([No. 705] U.S.N.M.,—Riley collection); Columbus, Colorado County, Texas, June 21 (the same); southwest Texas, Schaupp (L. Bruner); Uvalde, Texas, last week of July, E. Palmer.

This species resembles *P. punctata* to such a degree as with difficulty to be distinguished from it, except by the abdominal appendages of the male, which are remarkably distinct. There is no sign in the female of the dark mediodorsal fusiform patch on the pronotum, and the coloring of the female in both species is very variable.

There are two other forms of *Paraidemona* known to me, which I deem probably distinct from either of the above, but being known only by the female, I only allude to them. Both have relatively heavy hind femora.

One is almost wholly olivaceous, the abdominal carina marked with yellow, and with yellow shades upon the sides of the dorsum of the thorax; it comes from Carrizo Springs, Texas (U.S.N.M.).

The other is almost wholly yellowish testaceous, with no dorsal stripe and relatively feeble and fleeting lateral stripes; it comes from Dallas, Texas (U.S.N.M.), and Venis Mecas, San Luis Potosi, Mexico, January 6, E. Palmer.

13. AIDEMONA.

(αἰδήμων, modest.)

Aidemona BRUNNER, Rév. Syst. Orth., 1893, p. 145.

Body compact, moderately slender, parallel sided but enlarged at the mesothorax. Head not prominent, the vertex well rounded, rising above the level of the pronotum, the space between the eyes narrow but not very narrow, the face broadly rounded and a little retreating; frontal costa a little prominent above, broad, much broader than the interspace between the eyes, plane, percurrent, subequal, and heavily punctate; eyes moderately prominent but little more so in the male than in the female, rather large, broad ovate, much larger than the subocular portion of the genae; antennae slender, rather shorter than the head and pronotum together. Pronotum scarcely enlarging posteriorly, transversely quadrate, the dorsum plane or very feebly convex, with the lateral lobes set sharply at right angles to it, but otherwise with no raised lateral carinae, a feeble median carina on metazona only,

the front margin truncate, the hind margin subrectangulate; prozona and metazona of subequal length, the sulcus separating them distinct but not deep, suddenly angulate in the middle by the emargination of the prozona, the posterior sulcus of the prozona arcuate or angulate so as to approach it in the middle, the middle sulcus subparallel to this but more nearly transverse and crossing the middle of the prozona, the front of the prozona in no way elevated to receive the head. Prosternal spine quadrate, appressed, broadly truncate; interspace between mesosternal lobes subquadrate, a little longer than broad in the male, the reverse in the female, the metasternal lobes attingent over some space (male) or approximate (female). Tegmina and wings fully developed, the former with scarcely any ampliation of the costa near the base. Fore and middle femora but little more gibbous in the male than in the female; hind femora not very long, the hind tibiae with ten spines on the outer side. Margin of subgenital plate of male straight from the base, which is not ampliate, a little elevated at the apex; cerci styliform, about as long as the supraanal plate, the furcula nearly obsolete.

The genus is confined so far as known to Mexico and Central America.

AIDEMONA AZTECA.

(Plate IV, fig. 1.)

Platyphyma azteca SAUSSURE, Rev. Mag. Zool., 1861 (1861), p. 161; Orth. Nov. Amer., II (1861), p. 12.—WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 716.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 223.

Pezotettix aztecus STÅL, Bih. K. Sv. Vet.-Akad. Handl., V (1878), No. 9, p. 10.

Aidemona azteca BRUNNER, Rév. Syst. Orth. (1893) p. 145.

Brownish fuscous above, sometimes deepening to blackish fuscous, especially on the upper half of the lateral lobes of the pronotum, testaceous below, often deeply infuscated. Head mostly testaceous, heavily punctate throughout excepting on the vertex, where the puncta are obscure and subdued, and where the color is dark; fastigium with more or less elevated but rounded lateral walls; frontal costa slightly widened just above the ocellus; antennae testaceous, more or less infuscated, especially toward apex. Pronotum heavily and almost equally punctate throughout, both on dorsum and lateral lobes, but less crowded on the posterior half of the lateral lobes of the prozona, and with a small, free, glabrous patch above on either half of the prozona; lower half of the lateral lobes testaceous, in greater or less contrast to the blackish upper half, the darker portion widening on the metazona; but while this feature is sometimes very marked, in specimens in which the testaceous under surface becomes flavous, it is sometimes scarcely to be detected, so infuscated may the lower half become. Tegmina far surpassing the abdomen, rather slender, well rounded apically, griseous from a profuse and rather minute fuscous flecking on a semi-pellucid base, the flecking more or less confluent in the basal third;

wings pellucid, feebly infuscated apically, the veins and cross veins blackish fuscous. Hind femora very variable, the outer face varying from olivaceo-testaceous with fuscous incisures to dark almost blackish fuscous, the most distinctly marked specimens with the base broadly and obliquely yellowish testaceous, and a middle oblique band of no great width of the same color; inner side red; hind tibiae obscure glaucous, becoming luteous toward the base, rather densely pilose, the spines black-tipped. Supraanal plate of male triangular, rather small, tectate especially apically, with a narrow basal median sulcus, bounded by high and heavy walls, which do not extend over half the plate; furcula composed of a pair of very small, rounded, attingent lobes, barely projecting beyond the edge of the last dorsal segment; cerci about as long as the supraanal plate, slender, tapering throughout but slightly more in the basal than the apical half, feebly compressed, acuminate, feebly incurved in the apical half; infracercal plates brief, concealed.

Length of body, male, 17 mm., female, 21 mm.; antennae, male, 5.5 mm., female, 6 mm.; tegmina, male, 14 mm., female, 18 mm.; hind femora, male, 10 mm., female, 11.75 mm.

Forty-one males, 35 females. Mexico, Sumichrast; Mexico, April, Botteri; Orizaba, Mexico, January (L. Bruner); Venus Mecas, San Luis Potosi, Mexico, January 6, E. Palmer; San Luis Potosi and Savinito, San Luis Potosi, Mexico, E. Palmer; Aguas Calientes, Mexico, L. Bruner; Tehuantepec, Mexico, February, Sumichrast; Realejo, Nicaragua, April, McNeil.

Specimens in my collection, poorly preserved, seem to indicate the presence of two other species of this genus in Mexico, one at Vera Cruz, the other at Tehuantepec.

14. HYPOCHLORA.

(ὑπόχλωρος, greenish yellow.)

Hypochlora BRUNNER (pars), Rév. Syst. Orth. (1893), p. 145.

Body slender, compressed, very thinly pilose. Head not prominent, the summit gently arched, the fastigium descending with moderate rapidity, the face retreating considerably; interspace between the eyes broad, the fastigium scarcely sulcate, the frontal costa rather narrow, not nearly so broad as the space between the eyes, sulcate, percurrent, and subequal; eyes moderate in size, not very prominent, similar in the two sexes, about half as long again as broad, and distinctly longer than the anterior infraocular portion of the genae; antennae moderately stout, somewhat longer (male) or a little shorter (female) than the head and pronotum together. Pronotum subequal, even in the female, very feebly and gradually enlarging in passing backward, with a distinct percurrent median carina, the disk very broadly subtectate, passing by a rounded angle hardly forming a lateral carina into the vertical lateral

lobes, the front margin subtruncate, the hind margin very obtusely angulate, the very coarsely, feebly, and sparsely punctate prozona half as long again as the finely and suddenly punctate metazona, its posterior margin faintly angularly emarginate, the transverse sulci feeble, one dividing it into two equal halves and straight, the other a third the way behind it to the metazona and sinuate. Prosternal spine erect, moderately slender, conical; interspace between mesosternal lobes more than twice as long (male), or nearly half as long again (female) as its middle breadth, the shape being strongly clepsydral from the convexity of the inner margin of the lobes, the metasternal lobes subattending, especially in the male. Tegmina abbreviate, acuminate, attinent or overlapping, about as long as the pronotum. Fore and middle femora slightly tumid in the male; hind femora slender, somewhat compressed, the lower genicular lobe not free from markings, the hind tibiae with nine to ten spines in the outer series. Abdomen of male not clavate nor curved upward apically, the lateral margins of the subgenital plate straight from the very base, acutaugulate at tip, with a slight, blunt, apical tubercle; cerci very slender and simple; furcula consisting of a pair of slight cylindrical slender fingers, subparallel or more or less crossing one another, perhaps parallel in life.

This genus was established by Brunner upon three species, one of which must be referred to *Hesperotettix*, since the lateral margins of the subgenital plate are clearly ampliate at the base; while another has here been placed in a near and neighboring genus, *Campylacantha*, leaving *H. alba* as the type and at present the only known member of the genus. It is found in our Western States only, east of the Rocky Mountains, and from Nebraska southward.

HYPOCHLORA ALBA.

(Plate IV, fig. 2.)

Pezotettix alba DODGE!, Can. Ent., VIII (1876), p. 10.—BRUNER!, *ibid.*, IX (1877), p. 144.—THOMAS, Ann. Rep. Chief Eng., 1878, 1845 (1878).—BRUNER!, Rep. U. S. Ent. Comm., III (1883), p. 59; Bull. Div. Ent. U. S. Dep. Agric., IV (1884), p. 58.—RILEY, Stand. Nat. Hist., II (1884), pp. 201-202.—BRUNER!, Bull. Washb. Coll., I (1885), p. 136; Rep. U. S. Ent., 1885 (1886), p. 307.—OSBORN, Proc. Iowa Acad. Sc., I, Pt. II (1892), p. 117.—BRUNER!, Publ. Nebr. Acad. Sc., III (1893), p. 27.

Hypochlora alba BRUNNER, Rév. Syst. Orth. (1893), p. 145.

Pale yellowish green with very feeble markings. Head pale yellowish green, often more or less grayish and punctate or irrorate with pale ferruginous, and sometimes with a feeble inconspicuous pallid stripe from the upper margin of the eye backward; antennae pale luteous at base becoming ferruginous and at tip sometimes infuscated. Pronotum pale yellowish green, sometimes grayish, rarely brighter green, not infrequently sprinkled with ferruginous dots, the position of the lateral carinae in best-marked specimens marked with an inconspicuous pale yellow stripe, sometimes very inconspicuous, deepening in color

from above downward; the lower half of the lateral lobes rather lighter colored than the disk of the pronotum. Tegmina pale grass green. Fore and middle legs greenish yellow; hind femora pale yellowish green, sometimes a little infuscated especially above, occasionally sprinkled sparsely with ferruginous dots; hind tibiae very pale faintly bluish green, the spines with only their extreme tips brownish or blackish. Supraanal plate of male pretty regularly triangular with subacuminate apex, the surface tectate and the mesial ridge divided in two by a narrow percurrent sulcus, deep on the basal half of the plate; furcula composed of a pair of adjacent, straight and very slender, cylindrical, bluntly acuminate processes, several times longer than broad; cerci very delicate, tapering on the basal half, beyond very slender, equal, compressed, cylindrical, apically bluntly subacuminate, the apical half considerably and gradually incurved; infracercal plates narrow, laterally arcuate, a little shorter than the supraanal plate, concealed by the recumbent cerci.

Length of body, male, 14.5 mm., female, 21.5 mm.; antennae, male, 7 mm., female, 6.5 mm.; tegmina, male, 4.5 mm., female, 5.4 mm.; hind femora, male, 9.5 mm., female, 12 mm.

Thirteen males, 23 females. Bismarck, Burleigh County, North Dakota, August 9 (L. Bruner); Fort Robinson, Dawes County, Nebraska, August 21-22, L. Bruner (U.S.N.M.—Riley collection); Nebraska, G. M. Dodge (S. H. Scudder; S. Henshaw; U.S.N.M. [No. 706]—Riley collection); Gordon, Sheridan County, Nebraska, L. Bruner (U.S.N.M.—Riley collection); Valentine, Cherry County, Nebraska, L. Bruner (the same); Finney County, Kansas, September, H. W. Menke (University of Kansas); between Smoky Hill, Kansas, and Denver, Colorado, L. Agassiz (Mus. Comp. Zool.); Colorado, 5500 feet, Morrison; Pueblo, Colorado, 4700 feet, August 30-31.

The species was originally described from Glencoe, Dodge County, Nebraska. It has since been reported from Manitoba, Minnesota, Dakota, Montana, and from Fort McKinney, Johnson County, Wyoming, and Kansas by Bruner, from Iowa by Osborn, and Colorado by Thomas. "Here in Nebraska," says Bruner, "it is one of our commonest species, when one knows where to look for it." It feeds, according to the same writer, on what is called in the West "white sage," *Artemisia ludoviciana*, with which its colors closely correspond.

13. CAMPYLACANTHA, new genus.

(*καμπύλος*, bent (backward); *ἀκανθα*, (prosternal) spine.)

Hypochlora BRUNNER (pars), Rév. Syst. Orth. (1893), p. 145.

Body somewhat compressed, rather densely pilose. Head rather prominent, especially in the male, the genae being rather tumid and the summit strongly arched and distinctly elevated above the level of the pronotum, the fastigium descending rapidly, but the face moder-

ately retreating; interspace between the eyes rather broad (male) or broad (female), the fastigium feebly if at all sulcate, the frontal costa distinctly broadest between the antennae, where it is nearly as wide as (male) or still much narrower than (female) the interspace between the eyes, percurrent, sulcate at least below the ocellus; eyes not very prominent nor very large, longer in proportion to breadth in the female than in the male, and yet in the female hardly, in the male distinctly, longer than the anterior infraocular portion of the genae: antennae rather coarse, more than half as long as the body in the male, distinctly longer than head and pronotum together in the female. Pronotum subequal (male) or distinctly and very gradually broadening posteriorly (female), with a rather slight median carina, sometimes interrupted between the sulci, the disk very broadly subtectate, passing by a rounded angle, without forming lateral carinae, into the vertical (female) or subvertical (male) lateral lobes, the front margin subtruncate, in no way flaring, the hind margin obtusely angulate, the impunctate or very feebly rugulose prozona nearly or quite half as long again as the punctate or distinctly rugulose metazona, its transverse sulci moderately distinct, that in the middle straight, and followed a third of the way to the metazona by a similar but arcuate sulcus. Prosternal spine blunt conico-cylindrical, more or less retrorse; interspace between mesosternal lobes nearly twice as long (male) or half as long again (female) as broad, the inner margins of the lobes nearly straight: metasternal lobes attingent (male) or subattingent (female). Tegmina abbreviated, generally but not always a little longer than the pronotum, rounded or subacuminate at tip, their inner margins overlapping or separated. Fore and middle femora distinctly gibbous in the male; hind femora variable, as also the coloring of the inferior genicular lobe; hind tibiae with nine to ten, generally nine, spines in the outer series. Abdomen of male very feebly clavate, very feebly upturned, the lateral margins of the subgenital plate not ampliate at the base, the apex bluntly angulate at tip, with a distinct but not very large tubercle, extending beyond the inner side of the apical margin; furcula consisting of a pair of slight, rounded, feebly projecting lobes.

This genus is closely allied to *Hypochlora*, but is composed of generally stouter forms, in which the antennae are longer, the pronotum is usually rugulose rather than punctate, and the males of which have more tumid anterior femora, besides the differences pointed out in our table of genera.

C. acutipennis may be taken as the type.

The genus occurs only in the West, where it ranges east of the Rocky Mountains from Nebraska to Texas, and occurs again in Durango, Mexico.

ANALYTICAL KEY TO THE SPECIES OF CAMPYLACANTHA.

- A¹. Distal half of anal cerci of male less than half as broad as the extreme base.
- b¹. Hind femora relatively slender, the greatest breadth in the male being no greater than the length of the prozona.
- c¹. General colors griseous, with a slight greenish tinge; hind tibiae livid, finely flecked with griseous 1. *acutipennis* (p. 50).
- c². General colors olivaceous; hind tibiae yellowish green.... 2. *olivacea* (p. 51).
- b². Hind femora relatively stout, the greatest breadth in the male being a little greater than the length of the prozona; hind tibiae bluish green, lutescent apically..... 3. *similis* (p. 52).
- A². Distal half of anal cerci of male more than half as broad as the extreme base. 4. *rivar* (p. 52).

I. CAMPYLACANTHA ACUTIPENNIS.

(Plate IV, fig. 3.)

Pezotettix acutipennis SCUDDER!, Proc. Bost. Soc. Nat. Hist., XVII (1875), p. 472; Ent. Notes, IV (1875), p. 71; Cent. Orth. (1879), p. 16.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 58; Bull. Washb. Coll., I (1885), p. 136.

Hypochlora acutipennis BRUNNER, Rév. Syst. Orth. (1893), p. 145.

Brownish fuscous with a dull olivaceous tinge, giving a griseous aspect; excepting the abdomen pilose throughout. Head mottled irregularly with darker and lighter shades, a dark triangular spot in the middle of the posterior part of the summit, and generally an obscure dark band passing backward from the hinder edge of the eyes and crossing a portion of the sides of the pronotum; antennae pale yellowish, infuscated at extreme tip. Pronotum delicately rugulose, the median carina distinct, the dorsum more distinctly tectate in the female than in the male. Tegmina less than half as long as the body, but longer than the pronotum, tapering to a blunt point, dark brown, the veins and cross veins generally paler and olivaceous. Legs dusky, the middle femora blackish externally; hind femora more or less indistinctly trifasciate with blackish; hind tibiae livid, mottled minutely and profusely with brown, the apical half of the spines black. Supra-anal plate of male triangular with nearly straight sides, acutangulate at tip, the apex blunt, the basal half with a deep sulcus between slightly converging elevated ridges, the apical half more or less depressed, but showing faint signs of the continuation of the median sulcus; furcula consisting of a pair of slight, rounded, adjacent lobes, projecting very slightly; cerci straight, slender, and short, scarcely reaching the tip of the supraanal plate, nearly straight on the inferior margin, above narrowing rapidly in basal, gradually in apical, half, again more rapidly at extreme tip, the apex bluntly acuminate; infracercal plates broad at base, regularly tapering, with nearly straight outer margin, failing to attain the tip of the supraanal plate, visible outside the recumbent cerci.

Length of body, male, 20.5 mm., female, 24.5 mm.; antennae, male, female, 10.5 mm.; tegmina, male, female, 8 mm.; hind femora, male, 13 mm., female, 15 mm.

Eight males, 4 females. Texas, Belfrage (U.S.N.M.—Riley collection); Texas, Lincecum; Dallas, Texas, J. Boll; Bosque County, Texas, G. W. Belfrage; Fort Worth, Tarrant County, Texas, May (U.S.N.M.—Riley collection); San Antonio, Bexar County, Texas (L. Bruner). It is also reported from McPherson, Labette, Shawnee, and Barber counties, Kansas, by Bruner. Boll took the species in September and October in woods, on plants and bushes; Belfrage in October on prairies.

2. CAMPYLACANTHA OLIVACEA.

(Plate IV, fig. 4.)

Pezotettix olivaceus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XVII (1875), p. 472; Ent. Notes, IV (1875), p. 71; Cent. Orth. (1879), p. 16.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 58; Ins. Life, III (1891), p. 229; Bull. Div. Ent., U. S. Dep. Agric., XXIII (1891), p. 14; Publ. Nebr. Acad. Sc., III (1893), p. 27.

Bright olivaceous green, occasionally somewhat infuscated and so approaching in appearance *C. acutipennis*. Summit of head with a dark-green median stripe, broadening posteriorly, sometimes including a median yellowish thread; sides of head and sometimes the front tinged with yellow; antennae green at base, beyond orange, infuscated at the extreme tip. Pronotum covered rather profusely with short longitudinal dashes of lemon yellow, rather irregularly distributed but distinctly marking the median carina, excepting at its posterior extremity, and also the two extremities, rarely the whole, of the lateral carinae. Tegmina green, generally half the length of the abdomen, occasionally but little longer than the pronotum, rarely half as long again. Legs stout, yellowish green, the fore and middle femora more or less tinged with dull orange; outside of hind femora slightly infuscated, the tibial spines black-tipped. Supraanal plate of male and furcula wholly similar to the same parts in *C. acutipennis*; cerci straight and slender, shorter than the supraanal plate, usually partially erect, at least in cabinet specimens, the basal half tapering, the apical less than half as broad, equal, the tip rounded but a little produced below, the outer surface slightly sulcate on the apical half; infracercal plates as in *C. acutipennis*.

Length of body, male, 21 mm., female, 29 mm.; antennae, male and female, 10.5 mm.; tegmina, male, 8.5 mm., female, 13.5 mm.; hind femora, male, 13.5 mm., female, 17.5 mm.

Twenty males, 20 females. Lincoln, Nebraska (L. Bruner); Douglas County, Kansas, 900 feet, September (University of Kansas); Texas, September 14, Belfrage; Bosque County, Texas, October 24-27, Belfrage; Dallas, Texas, September 9, J. Boll; Fort Worth, Tarrant County, Texas, May (U.S.N.M.—Riley collection). Frequently found sitting on fences in the autumn, according to Belfrage.

This species very closely resembles the preceding, and may perhaps yet be proved but a dimorphic form of the same; it appears to be commoner and to have a wider range. Bruner states that he has seen it

"in beet fields several times under such circumstances as led [him] to think it feeds upon that plant. It is also quite partial to *Helianthus* and *Chenopodium*."

3. *CAMPYLACANTHA SIMILIS*, new species.

(Plate IV, fig. 5.)

Dark bluish green, more or less infuscated and enlivened by various shades of green. A broad, longitudinal, sordid yellow stripe behind the upper half of the eyes, beginning at their nearest approximation, leaves on the top of the head a broad, equal, dark bluish green dorsal stripe; the genae are more or less mottled with olivaceous and the antennae are ferruginous, deeply infuscated. Pronotum more or less deeply tinged with dark olivaceous, the upper half of the lateral lobes of the prozona alone pure bluish green, though the dorsum of the metazona approaches it. Tegmina dull green, infuscated basally, nearly or quite half as long as the abdomen, subacuminate. Fore and middle femora dull ferruginous, apically dark olivaceous; hind femora stouter than in the two preceding species, bluish green on the outer face, slightly infuscated at the incisures, greenish fuscous above feebly bifasciate with fuscous, flavo-luteous below and within, and with a feeble and broken testaceous pregenicular annulus; hind tibiae pale bluish green, deepest at base, followed by a dull luteous annulus and becoming lutescent apically, the spines tipped with black. Supraanal plate of male similar to that of the two preceding species, but flatter, with lower ridges; furcula as there; cerci almost as long as the supraanal plate, tapering very rapidly in the basal third, beyond slender, less than half as broad as the base, subequal, expanding feebly beyond the middle and then tapering again, the lower portion of the tip very slightly produced and very feebly curved downward; infracercal plates much as in the preceding species or perhaps broader basally.

Length of body, male, 23.5 mm., female, 35 mm.; antennae, male, female, 10.5 mm.; tegmina, male, 9 mm., female, 11.5 mm.; hind femora, male, 13.5 mm., female, 17.5 mm.

One male, 1 female. Lerdo, Durango, Mexico, November (L. Bruner).

This species, though closely allied to the preceding, is distinguishable from it not only by its colors, but by the greater stoutness of the hind femora, more easily recognized than described.

4. *CAMPYLACANTHA VIVAX*.

(Plate IV, fig. 6.)

Pezotettix vivax SCUDDER¹, Ann. Rep. Geol. Surv. W. 100th mer. 1876 (1876), p. 284; Ann. Rep. Chief Eng. 1876 (1876), p. 504.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Head large, prominent, yellowish green, mottled with brown, which on the summit forms a very broad longitudinal stripe; vertex between the eyes as broad as the frontal costa, the fastigium slightly sulcate;

frontal costa equal, rather deeply sulcate below the ocellus; antennae light brown, the basal joint unusually small. Pronotum small, equal, compressed, the dorsum flat, the whole so much smaller than the head as to give the insect a strangulated appearance, brownish green, mottled with darker and lighter markings, the lateral carinae with a yellowish stripe and the lateral lobes with a similar oblique stripe descending to the lower anterior angle; the metazona is profusely punctate, the transverse sulci deeply impressed, the median carinae obsolescent, the lateral carinae wholly obtuse, the posterior margin very obtusely angulate. Prosternal spine not very stout, cylindrical, very bluntly tipped, inclined rather strongly backward. Tegmina about as long as the pronotum, slender, short, lanceolate; wings rudimentary. Hind femora slender, yellow, tinged on the upper half with brownish, and obscurely, narrowly and transversely bifasciate above with the same; hind tibiae glaucous (?), the spines reddish, tipped with black; arolium extremely large. Abdomen yellowish, tinged above with greenish brown, the last segment of the male scarcely upturned. Supraanal plate of male broad triangular, with a deep percurrent median sulcus, the margins of which are strongly elevated in the basal half, gently elevated in the apical half, the apex slightly less than rectangular, blunt; furcula consisting of a pair of minute, rounded, slightly projecting, adjacent lobes; cerci compressed laminate, scarcely reaching the tip of the supraanal plate, gently incurved, tapering on the basal half, scarcely enlarging beyond, where it is more than half as broad as at the base, the tip broadly rounded, but slightly produced below.

Length of body, male, 18.5 mm.; antennae, 9.5 mm.; tegmina, 4.15 mm.; hind femora, 9 mm.

One male. Plains of northern New Mexico, eastern slope, October 14-31, Lieutenant W. L. Carpenter.

16. EOTETTIX, new genus.

(ἠώς, dawn, i. e. eastern; τέττιξ, grasshopper.)

Body slender, elongate, feebly compressed, with very sparse pilosity. Head relatively large and rather prominent but short, apart from the prominent eyes almost broader than the pronotum, the face not very oblique, the genae not tumescent, all the carinae prominent; vertex faintly arched, not raised above the pronotum; fastigium rather narrow but greatly broadening anteriorly, very little declivent, shallowly sulcate; frontal costa about as broad as the interspace between the eyes, broadening above, the margins distinctly elevated throughout; eyes large and very prominent, rather broad oval, about half as long again as broad, separated above by a moderate interval; antennae slender, slightly depressed. Pronotum moderately long, equal, compressed, with rounded subteclate but otherwise plane disk, the median

carina sharp, equal and percurrent, the lateral carinae distinct but confined to the anterior lobe of the prozona, and somewhat approximated, the two sections of the prozona independently and rather abruptly tumid on the upper part of the lateral lobes, the transverse sulci of the prozona obscure but straight, the front margin truncate, the hind margin produced but obtusangulate. Prosternal spine sharply acuminate; meso- and metastethia together much longer than broad; the mesosternal lobes approximate in the male, the metasternal attingent. Tegmina abbreviate, broad lanceolate, acuminate, attingent. Hind femora not very long, the lower genicular lobe pallid except for a narrow, basal, transverse, fuscous streak; hind tibiae with 12 spines in the outer series. Abdomen of male compressed, the subgenital plate equal, its middle with a pronounced, backward directed, apical tubercle, the lateral margins basally ampliate; furcula distinctly developed; cerci styliform, straight, acuminate.

A single species is known, from Florida.

EOTETTIX SIGNATUS, new species.

(Plate IV, fig. 7.)

Pezotettix signata McNEILL!, MS.

Of medium size, glistening flavo-testaceous. Head prominent, light fusco-olivaceous, above broadly infuscated along the middle line and with a narrow piceous postocular stripe, bordered by flavous; vertex feebly tumid, not rising above the level of the pronotum, the interspace between the eyes fully half as broad again as the first antennal joint; fastigium almost twice as broad anteriorly as posteriorly, little declivent, broadly and shallowly sulcate; frontal costa distinctly percurrent, equal below the ocellus, distinctly broader above it, so as to be as broad there as the interspace between the eyes, the lateral borders elevated throughout but rounded and not acute, densely punctate throughout; lateral carinae of face prominent; eyes large, very prominent, nearly half as long again as the infraocular portion of the genae; antennae luteous. Pronotum equal, in no way flaring on the metazona, the lateral lobes with a not very broad, percurrent, glistening, blackish fuscous, postocular stripe, directly beneath which the lateral lobes are more brightly colored than below; disk broadly convex, passing into the vertical lateral lobes almost insensibly, except on the anterior section of the prozona, where there are distinct lateral carinae, which are separated from each other by only about three-fourths the entire width of the prozona; median carina sharp, percurrent, equal, but on the metazona diminishing posteriorly; front margin truncate, hind margin bluntly obtusangulate; prozona distinctly longitudinal, sparsely punctate, nearly half as long again as the rather closely and finely punctate metazona. Prosternal spine small and rather short, acutely conical; interspace between mesosternal lobes very narrow, much more than

twice as long as broad; metasternal lobes broadly attingent. Tegmina scarcely longer than the pronotum, broad lanceolate, acuminate, with strongly convex costal margin, pale testaceous. Fore and middle femora very tumid in the male; hind femora uniform flavo-testaceous, with no markings except a feeble and narrow, transverse, fuscous stripe at the base of the geniculation, and a fuscous upper edging to the genicular arc; hind tibiae very pale red or pink, the spines pallid on the basal, black on the apical half, 12 in number in the outer series. Extremity of male abdomen feebly clavate, scarcely recurved, the supraanal plate triangular, tectate, rising to a pair of high but rounded converging ridges, inclosing between them the deep triangular sulcus, which crosses the basal half of the plate; furcula consisting of a pair of stout and coarse, subparallel, rather distant, subequal, blunt projections, a little longer than broad and than the last dorsal segment; cerci slender, delicate, conical, straight, finely acuminate, about as long as the supraanal plate; subgenital plate rather small, considerably longer than broad, equal, terminating in a backward-directed, bluntly rounded tubercle, seated on the middle of the apical portion of the plate, the apical and lateral margins in the same plane, the former well rounded, entire.

Length of body, male, 19 mm.; tegmina, 6.25 mm.; hind femora, 11.5 mm.

One male. East Florida, William H. Ashmead (J. McNeill).

17. HESPEROTETTIX.

(ἑσπερος, western; τέρτιξ, grasshopper.)

Hesperotettix SCUDDER, Bull. U. S. Geol. Surv. Terr., II (1875), p. 262.

Body almost parallel-sided, very little enlarged at the metathorax, more or less but not greatly compressed, more so in the male than in the female. Head not very prominent; vertex usually very narrow between the eyes, with a slight depression or sulcation between; fastigium broadening in front of it, declivent, with a median depression or longitudinal sulcation, sometimes distinct, sometimes obscure, the sides rounded; front straight, somewhat oblique, the frontal costa equal, only slightly contracted at the extreme summit, generally as broad as if not broader than the interval between the eyes, sulcate throughout; antennae slightly (female) or considerably (male) longer than the head and pronotum together; eyes slightly prominent, a little more so in the male than in the female, rather long oval, much longer than the infraocular portion of the genae. Pronotum long and slender, the dorsum fully half as long again as broad, the prozona the longer, sometimes half as long again as the metazona, with less distinction in surface and sculpture between them than common, alike broadly tectiform, the median carina slight but alike or nearly alike in both, the descending lateral lobes separated by no angle or ruga; posterior margin very obtusely angulate, the angle rounded, the border delicately margined. Prosternal spine rather long, bluntly conical; meso- and

metastethia together much longer than broad; interspace between mesosternal lobes generally twice as long as broad in the male, almost equally narrow or subquadrate in the female, the metasternal lobes subattingent in both sexes. Tegmina and wings always present, generally fully developed or a little abbreviate, but sometimes lobate. Fore and middle femora of male tumid; hind femora long and slender, somewhat compressed, generally surpassing the abdomen, the superior carina slight, unarmed; hind tibiae feebly ampliate apically, with spines of similar length on the two sides; first joint of hind tarsi scarcely longer than the third, the second small, with a large inferior apical lobe; arolium rather large, nearly twice as long as broad. Subgenital plate of male furnished with a prominent, subapical, more or less conical tubercle, the lateral margins of the plate suddenly ampliate at base; furcula always distinctly present as a pair of projecting lobes; last abdominal segment of female not abbreviate, the ovipositor normally exerted.

The type is *H. festivus* Scudder, a species mistaken for *H. viridis* Thomas at the time the genus was described.

This genus is closely related to *Hypochlora* and *Campylacantha*, but is separated from them by the basal ampliation of the margins of the subgenital plate of the male. One of the species indeed (the most aberrant one) was originally placed by Brunner in *Hypochlora*. The genus is still more closely allied to *Aeoloplus*, from which it is separable by the form of the pronotum and the slenderness of the body.

It is found across the United States, but only a single species is known east of the Great Plains, and that one has only been found on or near the Atlantic border. It is generally characteristic of the West.

Many of the species are very closely allied and have hitherto been confounded by all observers. A large amount of material now enables me to distinguish them and to find characters which will rarely fail of tolerably certain separation.

ANALYTICAL KEY TO THE SPECIES OF HESPEROTETTIX.

A¹. Metazona of pronotum distinctly punctate on dorsum; prozona smooth, except sometimes feebly punctate on dorsum; nowhere rugulose.

b¹. Pronotum highly and irregularly diversified in color, or else nearly devoid of markings of any kind, the dorsum nearly plane; tegmina in the diversified species marked with a white or pallid stripe on the division line between the discoidal and anal areas.

c¹. Transverse sulci of the pronotum distinctly marked in black; hind femora with a distinct pregenicular annulation.

d¹. Relatively slender-bodied, with slender femora; tegmina rarely as short as the body and then only in male; antennae of male slender, distinctly longer than the head and pronotum together 1. *viridis* (p. 57).

d². Relatively stout-bodied, with stout femora; tegmina surpassing the body only in the male and then but slightly; antennae of male coarse, scarcely longer than the head and pronotum together 2. *meridionalis* (p. 59).

e². Transverse sulci of pronotum not marked in strong colored contrast to surroundings; hind femora without red pregenicular annulation or only faint signs of one 3. *festivus* (p. 60).

*b*². Pronotum diversified in color only by longitudinal stripes, the dorsum distinctly tectiform; tegmina without pale stripes (though they are occasionally indicated).

*c*². Tegmina lobiform, no longer than the pronotum.

*d*¹. General color dark brown, occasionally with a tinge of green; tegmina short ovate, distinctly shorter than the pronotum 4. *pacificus* (p. 61).

*d*². General color grass-green; tegmina long oval, scarcely shorter than the pronotum 5. *curtipennis* (p. 62).

*c*². Tegmina fully developed or abbreviate, fully twice or nearly twice as long as the pronotum.

*d*². Tegmina and wings abbreviate, much shorter than the body.

6. *brevipennis* (p. 63).

*d*². Tegmina and wings distinctly surpassing the abdomen, or sometimes in the female only equaling it 7. *pratensis* (p. 64).

*A*². Pronotum tectiform; both prozona and metazona, both on dorsum and lateral lobes, equally and distinctly rugulose 8. *speciosus* (p. 66).

1. HESPEROTETTIX VIRIDIS.

(Plate IV, fig. 8.)

Caloptenus viridis THOMAS, Ann. Rep. U. S. Geol. Surv. Terr., V (1872), p. 450, pl. II, fig. 3.—GLOVER, Ill. N. A. Ent., Orth. (1872), pl. II, fig. 3.

Ommatolampis viridis THOMAS (pars), Rep. U. S. Geol. Surv. Terr., V (1873), p. 156; ? Rep. Geol. Geogr. Surv. 100th mer., V (1875), p. 892.—BRUNER, Can. Ent., IX (1877), p. 144.

Hesperotettix viridis UHLER (pars), Bull. U. S. Geol. Surv. Terr., III (1877), p. 795.—? THOMAS, Ann. Rep. Chief Eng., 1878 (1878), p. 1845.—BRUNER (pars), Rep. U. S. Ent. Comm., III (1883), p. 59; Bull. Washb. Coll., I (1885), p. 137.—? COQUILLETT, Rep. U. S. Ent., 1885 (1886), pp. 295, 297.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 26.

Pezotettix viridis STÅL, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 14.

Hesperotettix montanus BRUNER!, MS.

Head varying from olivaceous to ochraceous, sparsely and rather coarsely punctate with fuscous, the costae, front, and inferior margins of the genae more or less pallid, an infraocular black bar and infra-antennal black band, the clypeal incisures black; fastigium more or less infuscated or blackish, and the vertex with a longitudinal black stripe, broadening posteriorly and there sometimes inclosing a pallid thread; sides of the head behind the eye more or less streaked longitudinally with blackish; antennae warm testaceous, with a greenish tinge near base. Pronotum of the same ground color as the head, but the dorsum often with more or less of a testaceous or subferruginous tint, the sulci narrowly marked in black, a moderately broad mediodorsal bright or dull white stripe rather narrowly margined, sometimes with the exception of the metazona, with black or fuscous; lateral lobes much variegated on the prozona by an irregular assortment of brief, longitudinal, black, rarely dark-green bars, sometimes more or less connected to form a gently oblique moderately broad belt. Pleura and tegmina as in *H. festivus*, and the femora similar, but the hind femora almost always furnished with a moderately broad pregenicular salmon colored complete annulation; hind tibiae and tarsi as in *H. festivus*. Supraanal

plate of male triangular with roundly acute apex, about as long as broad, the margins straight and upturned, leaving between them and the basal U-shaped elevated ridge a broad deep sulcus, on which is further impressed a slight median longitudinal sulcus from the extremity of the basal ridge; furcula consisting of a pair of slight subtriangular projections overlying the two bases of the basal ridge; cerci simple, subconical, scarcely so long as the supraanal plate, tapering but little and that wholly in the basal half, the apex rather blunt, rounded, gently incurved; infracereal plates inconspicuous, shorter than the supraanal plate.

Length of body, male, 17 mm., female, 20 mm.; antennae, male, 7.4 mm., female, 8 mm.; tegmina, male, 13.3 mm., female, 19.2 mm.; hind femora, male, 9.75 mm., female, 14.75 mm.

Twenty-four males, 40 females. Sidney, Cheyenne County, Nebraska, August, L. Bruner; Lakin, Kearny County, Kansas, 3,000 feet, September 1; Colorado, 5,500 feet, Morrison (S. Henshaw; U.S.N.M.—Riley collection); Custer County, Colorado, Cockerell (U.S.N.M.); Plains of southern Colorado, July 25, F. H. Snow (University of Kansas); Chaves, New Mexico, September 6; Dallas, Texas, Boll; San Antonio, Bexar County, Texas (U.S.N.M.—Riley collection); Carrizo Springs, Dimmit County, Texas, A. Wadgymer, June (L. Bruner); Fort Grant, Graham County, Arizona (U.S.N.M.—Riley collection); Tighes, San Diego County, California, Palmer; Siskiyou County, California (U.S.N.M.); Montague, Siskiyou County, California (L. Bruner).

The species was originally described from Colorado, Wyoming, and Kansas, and has since been reported from [New Jersey] (Uhler), [Minnesota] and Iowa (Bruner), Nebraska (Thomas, Bruner), Kansas and Colorado (Bruner), Beaver Brook and the Grand Canyon of the Arkansas (Uhler); Texas [and Mexico] (Uhler); [Utah] (Bruner), and San Joaquin Valley, California (Coquillet). Localities which are in doubt or in error are placed in brackets.

This species closely resembles *H. festivus*, but while generally of a little larger size is distinguished from it by the black-marked sulci of the pronotum, the generally but not invariably greater irregularity of the markings of the lateral lobes of the pronotum, the red annulation of the hind femora (though this will probably be found in some individuals of *H. festivus*) and the ground color of the head and pronotum, as well as in slight differences in the abdominal appendages of the male. The eyes are slightly more elongate in *H. festivus* than in the present species, at least in the female.

It is wholly uncertain to what species belongs the reference by Thomas¹ to an insect with tegmina only one-third the length of the abdomen, taken in northern New Mexico or Colorado. I have placed it here with a query.

I possess a couple of females, collected by R. Ridgway in Ruby

¹ Ann. Rep. Chief Eng., 1878, 1845.

Valley, Nevada, but preserved after long immersion in spirits, which, until fresh specimens are obtained for study, I regard as belonging to this species. They are, however, remarkable for the brevity of the tegmina, which are only as long as the pronotum, and the species has not been otherwise recorded from this region. They seem to represent a short-winged form of this species, their tegmina overlapping like the normal form and not lobate, as in the strictly brachypterous species of this genus.

2. *HESPEROTETTIX MERIDIONALIS*, new species.

(Plate IV, fig. 9.)

This species differs but little from *H. festivus*, but has even more strikingly contrasted colors, the green of which is deeper and of a bluer tint and the femora are stouter. The face is yellow with a slight greenish tint, coarsely and distinctly punctate with blackish brown; the intercostal interspace below the antennae is heavily infuscated and the usual short bar below the eyes is present; vertex yellow, the fastigium heavily infuscated and behind it a widening blackish stripe, posteriorly inclosing a median yellow thread; antennae fuscous, the joints feebly and narrowly annulate with pale ferruginous. Pronotum yellow, more or less olivaceous, and on the metazona often heavily suffused with bright ferruginous, all the transverse sulci and particularly that close to the front margin heavily marked in black, which cuts the heavy black-bordered mediodorsal yellow stripe; upper portion of the lateral lobes more or less heavily marked with black on the prozona; pleural sutures heavily marked in black. Tegmina of about the length of the abdomen, bluish green, the discoidal and posterior ulnar veins with a narrow pallid yellow stripe. Fore and middle femora dull ferruginous; hind femora with the outer face dull greenish luteous, the superior carina heavily flecked and punctate with fuscous, and a faint, broad, dull coral red, pregenicular annulation; hind tibiae greenish blue, the spines white with black tips, the tarsi more or less testaceous. Supraanal plate of male much as in *H. festivus*, the furcula consisting of a pair of minute but boldly projecting rounded lobes, separated by twice their own width; cerci slightly compressed, subconical, tapering much more rapidly in the proximal than in the distal half, the latter being nearly equal, the tip rounded but slightly produced and gently incurved, the whole scarcely so long as the supraanal plate; infracercal plates inconspicuous, apically tapering, almost as long as the supraanal plate.

Length of body, male, 21 mm., female, 26 mm.; antennae, male, 8 mm., female, 7.75 mm.; tegmina, male, 15.5 mm., female, 20 mm.; hind femora, male, 12 mm., female, 15.7 mm.

One male, 2 females. Guanajuato, Mexico, A. Duges (U S.N.M. [No. 707]); Sierra Nola, Tamaulipas, Mexico, December 2-6, E. Palmer.

There is also a male from Mexico in the Museum of Comparative

Zoology which may belong here (as the cerci indicate), but the tegmina are longer than in the specimens described above and the whole appearance and the proportions are those of *H. festivus*.

Besides the colorational features which distinguish this species from *H. viridis*, the body is relatively stouter, the antennae coarser and shorter in proportion to the pronotum, the latter is more acutely angulate behind (though the difference is but slight), the hind femora are shorter and stouter, and the tegmina and wings relatively shorter.

3. HESPEROTETTIX FESTIVUS, new species.

(Plate IV, fig. 10.)

Hesperotettix viridis SCUDDER!, Bull. U. S. Geol. Surv. Terr., II (1876), p. 262.—THOMAS, Proc. Dav. Acad. Sc., I (1876), p. 262.—SCUDDER!, Rep. U. S. Ent. Comm., II (1881), App., p. 24.—BRUNER (PARIS), *ibid.*, III (1883), p. 59.

Face varying from green-yellow to pallid yellow, more or less deeply infuscated in the intercostal space below the antennae, the frontal costa sulcate throughout excepting above, and faintly and distantly punctate with fuscous on the margins; genae pallid or greenish pallid except for a short, slender, oblique, blackish stripe below the eye. Summit of head and dorsum of pronotum buff, greenish buff, rarely green, or olivaceous, with a median, black-margined, white or pallid stripe, the stripe reduced to a thread on the head, the black edging remaining; on the sides, above the middle, is a more or less irregular black stripe, more interrupted or broken in the female than in the male, extending from behind the eyes, where it is reduced to parallel longitudinal streaks, to the hinder edge of the prozona, bordered broadly below and above with pallid, above forming a stripe which begins narrowly along the upper edge of the eyes and continues also across the metazona, occupying the position of lateral carinae; excepting for stripes at the median and lateral carinae, the metazona is uniformly buff or rarely green and is very shallowly punctate; both meso- and metapleura with an oblique, fusiform, pallid stripe, margined more broadly in some places than in others with black. Tegmina of about the length of the abdomen, rather dark bluish green, the anal area more or less deeply tinged with buff, the discoidal and posterior ulnar veins white, the veinlets impinging on the apical margin distinctly blackish. Fore and middle femora buff, inclining to ferruginous; hind femora buff, but purplish on the outer face and more or less infuscated, the geniculation with a blackish crescent on the outer and inner sides; hind tibiae bluish green, becoming more or less pallid or testaceous distally, the spines white with black tips, the tarsi testaceous or greenish testaceous. Supraanal plate of male triangular, of about equal length and breadth, broadly rounded apically, with straight and slightly upturned margins, the surface with a pair of converging stout elevated ridges, forming a basal triangular pit between them, and in the distal half of the plate beyond the united ridges a slight median sulcus; furcula consisting of a pair

of minute rounded lobes, separated by about their own width; cerci simple, subconical, tapering a very little, more rapidly in the proximal than in distal half, subacutely pointed, as long as the supraanal plate and feebly incurved; infracercal plates not very broad, as long as the supraanal plate, completely concealed by the recumbent cerci.

Length of body, male, 15.5 mm., female, 20.5 mm.; antennae, male, female, 7 mm.; tegmina, male, 12 mm., female, 13 mm.; hind femora, male, 9.1 mm., female, 11 mm.

Sixty-six males, 58 females. Salt Lake Valley, Utah, 4,300 feet, July 26, August 1-4 (S. H. Scudder; U.S.N.M. [No. 708]); American Fork Cañon, Utah, 9,500 feet, August 2-3; Provo, Utah, August 23-24; Spring Lake Villa, Utah County, Utah, August 1-4, E. Palmer; Los Angeles County, California, Coquillett (U.S.N.M. [No. 708].—Riley collection).

The species has previously been reported (under another name) from Lake Point, Salt Lake and Salt Lake Valley (Scudder), Mount Nebo and Spring Lake, Utah (Thomas), and Utah (Bruner).

The contrasts of colorings in this species render it a more variegated insect than any of the other species of the genus, particularly when the buff colors are deepest and bring out the black and white with greatest vividness.

4. *HESPEROTETTIX PACIFICUS*, new species.

(Plate V, fig. 1.)

Hesperotettix pacificus BRUNER!, MS.—KOEBELE!, Bull. Div. Ent. U. S. Dep. Agric., XXII (1890), p. 94.—undescribed.

Body feebly but not briefly pilose; general color dark brownish testaceous, frequently tinged more or less with olivaceous. Head sparsely punctate, with a variable broad black bar below the eyes, sometimes reduced to a V-shaped spot and in greener specimens dark olivaceous; a similar broad dark stripe behind the eyes, and the summit generally with a mediodorsal black stripe, sometimes having a median light thread through it; fastigium generally sulcate, sometimes reduced to a pit in front of the eyes; frontal costa equal, about as wide as the space between the eyes, more or less feebly sulcate; antennae testaceous, generally darker apically and sometimes pallid basally, about as long as (female) or much longer than (male) the head and pronotum together. Pronotum scarcely enlarged from in front backward, rounded tectiform, with the bluntest possible median carina, the prozona smooth or very feebly and sparsely punctate, the metazona about two-thirds as long as the prozona and punctate, the hind margin very obtusely angulate, the angle broadly rounded; there is a slender pallid or testaceous median stripe, more distinct on the prozona than on the metazona, on the former and occasionally on the latter margined, generally narrowly, with black; on the upper part of the lateral lobes of the prozona is a broad black band, often obscure and on greenish specimens sometimes obsolete, and where most pronounced bordered broadly below and nar-

rowly above with white. Tegmina uniform greenish fuscous, short ovate, less than twice as long as broad, shorter than, sometimes hardly more than half as long as, the pronotum. Hind femora dark testaceous with the outer face light testaceous, its distal third blackish and a premedian angulate blackish bar (on greenish specimens almost wholly green, enlivened on upper surface with a ruddy tint); hind tibiae fusco-glaucous or glaucous, the spines black tipped. Supraanal plate of male triangular, the sides feebly and angularly emarginate, the apex acute, with a basal median sulcus of similar shape not reaching the middle, the interspaces on either side very shallowly, broadly and roundly sulcate, and a slender tolerably deep median sulcus apically; fureula consisting of a pair of slightly projecting, subattinent, rounded lobes; cerci slender, tapering gently in basal half, beyond equal or very feebly expanded, the tip rounded but slightly produced, the apical half feebly incurved; apical tubercle of subgenital plate feeble, blunt, seen from behind broadly rounded.

Length of body, male, 18 mm., female, 22.5 mm.; antennae, male, 10 mm., female, 7 mm.; tegmina, male, 3.5 mm., female, 4 mm.; hind femora, male, 12 mm., female, 12.5 mm.

Two males, 8 females. Los Angeles, California, October 27, Coquillett (U.S.N.M. [No. 709.])—Riley collection); Los Angeles, California, Koebele (L. Bruner); San Buenaventura, California (U.S.N.M. [No. 709.])—Riley collection). Koebele reports it from the Shasta district in northern California.

The abdomen, which is carinate, sometimes has the carina distinctly lighter than the body.

This species most resembles *H. festivus* of the longer winged forms, but is very different from it.

5. *HESPEROTETTIX CURTIPENNIS*, new species.

Hesperotettix curtipennis BRUNER!, MS.

Body feebly and rather briefly pilose; general color green with an olivaceous tinge. Head with a yellow front margin to the genae, bordered posteriorly with a short dark greenish or bluish green bar below the eyes; behind the eyes is a broad dark green stripe (not so dark as the bar) margined with yellow, the inner margin passing along the upper edge of the eye; summit sometimes with a dark green median stripe; fastigium with a slight pit between the eyes and more or less sulcate on the expanded portion in front; frontal costa of somewhat irregular breadth, but about as wide as the interval between the eyes, distinctly sulcate; antennae testaceous, about as long as head and pronotum together in the female. Pronotum rounded tectiform, scarcely enlarging from in front backwards, the carina and carinal markings as in *H. pacificus*, the lateral lobes similarly marked, with a broad, yellow-bordered, blackish green bar crossing the prozona, its lower margin slightly oblique; hind margin broadly rounded, scarcely angulate, the

prozona plainly though feebly, sparsely and rather coarsely punctate, the metazona closely punctate. Tegmina rather long ovate, nearly twice as long as broad, and scarcely shorter than or at least three-quarters as long as the pronotum, green. Hind femora green, the outer half of the upper surface ruddy, the under surface and the carina beneath the outer field luteous; hind tibiae green, the spines pale green with black tips. Abdomen green, becoming darker above, the carina marked heavily with yellow and margined with blackish green.

Length of body, female, 23 mm.: antennae, 7.75 mm.; tegmina, 6 mm.: hind femora, 12.5 mm.

Two females. Colorado, Morrison (U.S.N.M. [No. 710]; L. Bruner).

Of the long-winged forms, this species most resembles *H. festivus*, but is easily distinguished from it, apart from the great difference in the tegmina.

6. HESPEROTETTIX BREVIPENNIS.

(Plate V, fig. 2.)

Ommatolampis brevipennis THOMAS!, Bull. U. S. Geol. Surv. Terr., I, No. 2 (1874), 1st Ser., p. 67.

Hesperotettix viridis UHLER (pars), Bull. U. S. Geol. Surv. Terr., III (1877), p. 795.—MORSE!, Psyche, VI (1892), p. 262; VII (1894), p. 106.

Head pea green, fusco-punctate in front, with a short blackish stripe below the eyes, behind the pallid callosity; streaks of dark green pass backward from the eye, and the vertex has a slender, mediodorsal fuscous stripe, narrowing anteriorly and ending at the base of the fastigium in a round blackish spot; antennae pale ferruginous, slightly infuscated apically. Pronotum shaped as in *H. pratensis*, pea green, with a moderately broad, bright ferruginous, obscurely fuscous, margined, mediodorsal stripe, generally broader in the female than in the male; and above the middle of the lateral lobes, but not reaching the front margin nor passing beyond the prozona, a blackish fuscous bar, sharply delimited below, fading out above, bordered beneath and sometimes interrupted posteriorly above with pallid; sides of the body green except that the metapleura have an oblique pallid stripe, bordered on the upper posterior and lower anterior sides with black. Tegmina considerably shorter than the abdomen in both sexes, but particularly in the female, the anal area and a little more than that ferruginous, its upper limit sometimes infuscated, the remainder pea green. Femora almost precisely as in *H. pratensis*; hind tibiae varying from pea green to pale bluish green, the spines pale on basal, black on apical half; hind tarsi concolorous with tibiae or sometimes a little yellower. Supraanal plate of male triangular, with straight sides and rounded subacute apex, about as long as broad, with a broad and rather high tectate ridge parallel to the margins, inclosing a deep, basally broad, triangular sulcus; furcula consisting of a pair of slightly projecting, moderate sized,

rounded lobes, separated by half their own diameter; cerci a little shorter than the supraanal plate, simple, conical, but slightly more rapidly tapering on basal than on apical half, bluntly acuminate; infra-cercal plates broad triangular, scarcely shorter than the supraanal plate, slightly ridged on its margins; last dorsal segment deeply emarginate, so as to be less than half as broad in the middle as at the sides.

Length of body, male, 16 mm., female, 24 mm.; antennae, male, 7.25 mm., female, 8 mm.; tegmina, male, 10.25 mm., female, 10 mm.; hind femora, male, 11 mm., female, 12.5 mm.

Ten males, 10 females. Wellesley, Norfolk County, Massachusetts, July 16–August 1 (A. P. Morse); New Jersey (U.S.N.M. [No. 711]); Georgia, Morrison.

This species has been previously recorded only from New Jersey (Thomas, Uhler), where Uhler says it is “not uncommon in the cranberry fields of Atlantic County;” and from Wellesley, Massachusetts, by Morse, who tells me that his specimens were taken in a very restricted locality, “a steep gravelly hillside, forming the terminal portion of a part of the gravel-plain formation of Wellesley,” where they were captured “by sweeping vigorously the short-tufted growth of bunch grass, *Andropogon scoparius*, which with other wild grasses and running blackberry vines sparsely clothed the gravelly soil.” All his specimens were taken between mid July and mid August. Since writing me this, Mr. Morse has found another locality near the previous, where on July 10 he took both sexes mature and nymphs; the surroundings were similar.

This species is very closely allied to *H. pratensis*, but differs from it in its shorter tegmina and wings, the more regularly conical cerci of the male, the slightly different form of the supraanal plate and the markings; it is also of a smaller size.

7. HESPEROTETRIX PRATENSIS, new species.

(Plate V, fig. 3.)

Ommatolampis viridis THOMAS (pars), Rep. U. S. Geol. Surv. Terr., V (1873), p. 156.

Hespero.ettix viridis UHLER (pars), Bull. U. S. Geol. Surv. Terr., III (1877), p.

795.—BRUNER (pars), Rep. U. S. Ent. Comm., III (1883), p. 59; Rep. U. S. Ent., 1885 (1886) p. 307.

Head yellowish green, sparsely punctate with fuscous in front, the lower portion of the face more or less obscured with purplish, a short fuscous stripe depending from the eye, in front of which the callosity is livid; vertex with a more or less distinct, rather narrow, fuscous or blackish stripe, narrowing anteriorly, and ordinarily with a median thread of yellow, the fastigium generally discolored, sometimes and especially in the female reddish. Pronotum scarcely (male) or slightly (female) increasing in breadth from in front backward, equally throughout and with no angle in the middle, yellowish green, occasionally, especially in Southern examples and apparently in the female only,

with a pallid line along the position of the lateral carinae of the prozona, extending also across the head where it follows the upper hinder margin of the eyes; above the middle of the lateral lobes, on the prozona, is a more or less distinct and irregular fuscous bar, generally darkest below, including on the hinder section a whitish dash in its upper part, and sometimes more or less margined with pallid, especially below; there is usually present, sometimes conspicuously, a narrower or broader mediodorsal stripe, sometimes pale yellow or pale yellow margined more or less broadly, and generally more broadly behind than in front, with reddish pink or fuscous, at other times, and especially in the female where it is at least generally broader, wholly reddish pink more or less infuscated. Tegmina of about the length of the abdomen in both sexes, green or yellowish green, the anal area and often a little more than that sometimes reddish pink, especially in the female. Legs green, the fore and middle femora more or less plainly annulate with coral red before the geniculation, and occasionally with a line of red above the upper margin of the outer face, the geniculation with a fuscous crescent both on the outer and inner side; hind tibiae pale bluish green, becoming more or less yellowish apically, the spines pallid on their basal, blackish brown on their apical half; hind tarsi pale green, more or less yellowish, especially at the apices of the joints. Supraanal plate of female triangular, subacutely but bluntly angulate, of about equal length and breadth, the margins nearly straight, the middle of either half with a rather broad moderately elevated ridge, the two converging beyond the middle of the plate and inclosing a deep basal sulcus; furcula consisting of a pair of minute rounded lobes, nearly twice as distant as their width; cerci considerably shorter than the supraanal plate, simple, regularly conical on basal half, the apical half subequal, bluntly pointed, very feebly downcurved; infracercal plates almost as long as the supraanal plate, inconspicuous; last dorsal segment broadly rounded and rather deeply emarginate.

Length of body, male, 18.5 mm., female, 30 mm.; antennae, male, 8.25 mm., female, 10.25 mm.; tegmina, male, 13 mm., female, 20 mm.; hind femora, male, 11.6 mm., female, 17.5 mm.

Forty males, 68 females. Red River of the North [Minnesota or Manitoba], Uhler; southern Illinois, Kennicott; Crawford County, Iowa, July 13-24, J. A. Allen; Denison, Crawford County, Iowa, July 20, J. A. Allen; Jefferson, Greene County, Iowa, July 20-24, J. A. Allen; Dallas County, Iowa, August, J. A. Allen; Valentine, Cherry County, Nebraska, L. Bruner (U.S.N.M. [No. 712]); Fort Robinson, Dawes County, Nebraska, August 22, L. Bruner (U.S.N.M. [No. 712]); Chadron, Dawes County, Nebraska, L. Bruner (U.S.N.M. [No. 712]); Nebraska, Dodge, Hayden; West Point, Cuming County, Nebraska (L. Bruner); Bismarck, North Dakota, July 23, G.W. Sweet (U.S.N.M. [No. 712]); Wyoming, Morrison (U.S.N.M. [No. 712]); Fort McKinney, Johnson County, Wyoming, July 26 (U.S.N.M. [No. 712]); Fort Benton, Choteau County, Montana,

July 20 (U.S.N.M. [No. 712]); Brown's, Colville Valley, eastern Washington, July 24 (Museum Comparative Zoology); La Chapples, Yakima River, Washington, July 16 (Museum Comparative Zoology); Umatilla, Oregon, June 24 (Museum Comparative Zoology); Los Angeles, California, Coquillett (U.S.N.M. [No. 712]); San Diego, California, Blaisdell (L. Bruner); Tighes, San Diego County, California, E. Palmer; American Fork Canyon, Utah, 9,500 feet, August 23; Monument Park, El Paso County, Colorado, July 19 (U.S.N.M. [No. 712]); Manitou, El Paso County, Colorado, August 24-25; Beaver Brook, Jefferson County, Colorado, P. R. Uhler; Colorado, 8,000 feet, Morrison; latitude 38°, Lieutenant Beckwith; San Antonio, Bexar County, Texas, (U.S.N.M. [No. 712]); Dallas, Texas, July 18, Boll; Pecos River, Texas, Captain Pope; Orizaba, Mexico, January (L. Bruner). Nearly all the specimens from the National Museum are from the Riley collection.

Dr. J. A. Allen found the insect in Iowa only in dry prairies on the grass, excepting that the least-marked specimens occurred in groves, and there only.

Occasionally a specimen, and especially a female, is found in which there is no trace of ferruginous on the tegmina, which are then green with a pallid stripe along the dividing line between the discoidal and anal areas, reminding one of *H. viridis* or *H. festivus*.

The specimen above referred to from Orizaba, a female, differs slightly in its somewhat abbreviated tegmina, and the mottled markings of pallid yellow and green upon the lateral lobes of the pronotum; it possibly indicates another species.

8. HESPEROTETTIX SPECIOSUS.

(Plate V, fig. 4.)

Pezotettix speciosus SCUDDER!, Final Rep. U. S. Geol. Surv. Nebr. (1871), p. 250.—GLOVER, Ill. N. A. Ent., Orth., pl. XVII, fig. 4 (1874).—THOMAS, Bull. U. S. Geol. Surv. Terr., IV (1878), p. 484.—BRUNER, Can. Ent., IX (1877), p. 144.—STÅL, Bih. K. Sv. Vet.-Akad. Handl., V (1878), No. 9, p. 14.

Acridium frontalis THOMAS, Ann. Rep. U. S. Geol. Surv. Terr., V (1872), p. 448, pl. II, fig. 1.—GLOVER, Ill. N. A. Ent., Orth. (1872), pl. XI, fig. 1.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 169.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 58; Bull. Washb. Coll., I (1885), p. 135; Bull. Div. Ent. U. S. Dep. Agric., XIII (1887), p. 11.—OSBORN, Ins. Life, IV, p. 51 (1891); Rep. Ent. Soc. Ont., XXII (1891), p. 70; Bull. Div. Ent. U. S. Dep. Agric., XXVII (1892), p. 59.—BRUNER, Ibid., XXVIII (1893), pp. 12-13, fig. 3; Publ. Nebr. Acad. Sc., III (1893), p. 26.

Hypochlora speciosa BRUNNER, Rev. Syst. Orth. (1893), p. 145.

Grass green. Head without markings, except that sometimes the lateral margins of the frontal costa, especially its upper portion, and the apex of the fastigium are tinged or flecked with roseate, also occasionally seen on the lateral carinae of the face; vertex more or less rugulose; eyes moderately distant, especially in the female, the frontal costa slightly narrower than the interspace between the eyes, equal, sulcate, the tip of the fastigium also impressed; antennae pale pink,

pallid at base, slightly darker and sometimes infuscated at tip, nearly as long as (female) or much longer than (male) head and pronotum together. Pronotum tectiform with a feeble blunt and equal median carina, which is often but not always, sometimes conspicuously, pink roseate; prozona much longer than, in the male half as long again as, the metazona, rugulose, the raised portions generally more or less yellowish and having often a transverse, never a longitudinal trend; the metazona equally rugulose, but with a distinct longitudinal trend to the raised portions; hind margin obscurely and obtusely angulate. Tegmina green or yellowish green, the longitudinal veins being yellow and the ground green; they taper to a roundly acuminate tip and are of variable length in both sexes, but always considerably longer than the pronotum, in the male usually about two-thirds the length of the abdomen, in the female generally varying from two-thirds as long as to quite or nearly as long as the abdomen; wings pellucid green, with green veins. Hind femora green, the outer half of the upper surface below the carina often roseate, and the inner surface generally pale yellow; a faint sign of a pregenicular roseate annulation often appears; hind tibiae green, the spines pallid or yellowish green with black tips. Supraanal plate of male triangular, with slightly sinuate sides, the apex sometimes acute, sometimes rounded, with a rather broad and deep median sulcus in the basal half, bounded by a rather high and acute ridge on either side, between which and the margin is a rather deep and very broad valley; a slight median sulcus appears in the apical half; furcula consisting of a pair of approximate, little protruding, triangular lobes; cerci delicate and slender, tapering gently and more on basal than on apical half, though sometimes the apical half is nearly equal, bluntly acuminate at tip and with the outer half distinctly incurved; apical tubercle prominent, conical, more or less appressed; sometimes slightly transverse as viewed from behind, and occasionally (as in the figure; by accident in drying?) bifid.

Length of body, male, 22.5 mm., female, 34 mm.; antennae, male, 10 mm., female, 11.5 mm.; tegmina, male, 9 mm.,¹ female, 18.5 mm.; hind femora, male, 14 mm., female, 18.5 mm.

Twelve males, 27 females. Nebraska, Dodge, Scudder; Nebraska City and banks of Platte River, Nebraska, Hayden; Finney County, Kansas, September, H. W. Menke (University of Kansas); Lakin, Kearny County, Kansas, 3,000 feet, July 9, September 1; Garland, Costilla County, Colorado, 8,000 feet, August 28; Texas, Belfrage; Dallas, Texas, Boll; San Antonio, Bexar County, Texas (L. Bruner); Fort Worth, Tarrant County, Texas, May (U.S.N.M.—Riley collection); Gulf coast of Texas, Aaron; Pecos River, Texas, Captain Pope.

Since writing this, Mr. C. F. Baker has sent me specimens from Horse-tooth Mountain, 6,000 feet, west of Fort Collins, Colorado.

The species has also been reported from Dakota or Montana (Thomas),

¹ The male selected for measurement has unusually short tegmina.

Dakota, Wyoming, Iowa, Nebraska and Missouri (Bruner), Kansas (Thomas), Garden City, Kansas (Bruner, Osborn), Barber and Shawnee counties, Kansas (Bruner), Colorado or Northern New Mexico (Thomas), Colorado and New Mexico (Bruner), and Washington County, Texas (Bruner).

This species can hardly be confounded with any other, though it bears a close general resemblance to *Campylacantha acutipennis*, from which it is strongly separated by the prominence of the base of the lateral margin of the subgenital plate of the male. It is dimorphic in wing length.

18. AEOLOPLUS, new genus.

(αἰόλος, variegated; ὄπλον, armor.)

Body relatively short and stout, considerably enlarged at the metathorax, even in the male. Head normal, the eyes moderately distant, not very prominent except sometimes in the male, the summit well arched, the fastigium slightly sulcate between the eyes, the frontal costa moderately broad, subequal, plane or nearly plane; antennae moderately stout, cylindrical, equal, slightly longer (male) or slightly shorter (female) than the head and pronotum together. Pronotum stout, regularly increasing in size from in front backward, the disk gently convex transversely, the prozona slightly and independently tumid, with no or an exceedingly feeble median carina, distinguishing it from the flat carinulate metazona; posterior margin of pronotum very obtusely angulate, the angle more or less rounded; prozona about half as long again as the metazona, generally slightly broader than long or quadrate. Prosternal spine conical, erect; interval between mesosternal lobes of male about twice as long as broad, often clepsydral from the convexity of the inner margins of the lobes, of female varying from the same to quadrate, the metasternal lobes attingent or subattingent in the male, a little distant in the female. Fore and middle femora considerably tumid in the male, the hind femora relatively short and stout, occasionally furnished inferiorly in the male with a basal tooth protecting the calcaria when the tibiae are closed upon the femora. Tegmina generally completely developed, but often somewhat abbreviate, rarely lobate. Subgenital plate of male with the lateral margins very strongly ampliate and arched at the base, and furnished with a distinct but not very prominent subapical tubercle, the apical margin of the plate forming its inner base; furcula scarcely or not apparent; cerci tapering, apically very slender, simple; terminal segments of female abdomen more or less considerably abbreviated, the ovipositor only partially exerted.

Aeoloplus regalis may be taken as the type.

This genus is closely related to *Hesperotettix*, and these two genera are the only ones in the section of Melanopli with ampliate base to the lateral margins of the subgenital plate, in which the abdomen termi-

nates in a tubercle distinct from the margin itself, though it is a rather common feature in the alternate section; accordingly I have arranged these two genera in such an order that they directly follow those of the other section, and the remaining genera in such sequence as that arrangement required. It is composed of insects of a much heavier build than *Hesperotettix*, the principal distinctions between the two genera being given in the table (page 11).

The genus is confined to the western half of the United States from the Yellowstone to the Mexican border,¹ but it does not appear to have been found in California² or farther east than western Kansas and Nebraska; it does not reach the prairie region, and is mostly found apparently at elevations not far from 3,000 to 6,000 feet above the sea.

According to Bruner, *Acoloplus turnbullii* and *Acoloplus chenopodii*, and therefore probably all the members of the genus, or at least those of the division A¹ of the following table, are similar in their food habits, confining their attention "almost entirely to the various species of plants of the botanical family Chenopodiaceae, which abound in the regions where they occur, being particularly fond of the grease-wood, *Sarcobates vermicularis*."

ANALYTICAL KEY TO THE SPECIES OF AEOLOPLUS.

A¹. Pronotum longitudinally striped with lighter and darker colors; tegmina more or less (excepting in *Acoloplus elegans*), though sometimes feebly, flecked with contrasting colors; lower genicular lobe of hind femora crossed by a dark basal band.

b¹. Tegmina at rest extending as far as or beyond the tip of the abdomen, particularly in the male.

c¹. Tegmina relatively long and slender, in the middle narrower than the prozona; wings elongate, fully twice as long as broad.

d¹. Smaller species, the males less than 15 mm. long; tegmina maculate; apical half of male cerci very slender..... 1. *tenuipennis* (p. 70).

d². Larger species, the males scarcely less than 20 mm. long; tegmina immaculate; apical half of male cerci relatively stout..... 2. *elegans* (p. 71).

c². Tegmina relatively short and stout, in the middle as broad as the prozona; wings not elongate, distinctly less than twice as long as broad.

d¹. Tegmina and wings not or scarcely surpassing the abdomen in either sex; subapical tubercle of male abdomen prominent, about as high as broad.

3. *regalis* (p. 71).

d². Tegmina and wings much surpassing the abdomen in both sexes; subapical tubercle of male abdomen but slightly elevated, less than half as high as broad..... 4. *californicus* (p. 73).

b². Tegmina at rest falling distinctly, sometimes considerably, short of the tip of the abdomen.

c¹. Tegmina lobiform, not so long as pronotum..... 5. *chenopodii* (p. 74).

c². Tegmina merely abbreviate, about twice as long as pronotum.

d¹. Cerci of male tapering only in the basal half, the apical half slender and equal..... 6. *turnbullii* (p. 75).

d². Cerci of male tapering almost uniformly through the basal three-fourths, only the apical fourth equal..... 7. *plagosus* (p. 76).

¹And beyond it, for I have females of an undescribed species from San Louis Potosi.

²Though Bruner states that a species occurs on the "Pacific Coast."

A². Pronotum, tegmina (usually), and lower genicular lobe of hind femora unicolorous, unstriped.

b¹. Inferior base of hind femora of male with no depending tooth.

8. *uniformis* (p. 77).

b². Inferior base of hind femora of male with a distinct depending tooth.

c¹. Eyes of male moderately prominent, as seen from above less than half as high as long 9. *arizonensis* (p. 78).

c². Eyes of male very prominent, as seen from above fully half as high as long..... 10. *oculatus* (p. 79).

1. AEOLOPLUS TENUIPENNIS, new species.

(Plate V, fig. 5.)

Head pallid fuscous, flecked on the sides with brown and with a mediodorsal blackish brown stripe, which fills the narrow sulcus of the fastigium and passes backward much broadened, continuing with less depth of color but with equal width upon the pronotum, as far as the posterior limit of the prozona; a similar but weaker brown stripe passes from behind the eye a similar distance, broader and weaker upon the pronotum; antennae pale salmon red, paler at base; frontal costa equal, as wide as or slightly wider than the interval between the eyes, feebly sulcate below the ocellus; fastigium narrowly and rather deeply sulcate, the sulcation of equal width but varying depth. Ground color of pronotum yellowish brown, the posterior margin distinctly but obtusely and not sharply angulate, the disk of the prozona distinctly though but slightly transverse, with no median carina. Prosternal spine short, conical, erect. Tegmina considerably surpassing the abdomen, exceptionally slender, with very slight subbasal expansion of the costal area, subacuminate apically, brown, but with the larger distal portion pellucid, flecked with brown by the alternately deeper and lighter brown of the veins, the cross-veins mostly white or pellucid; wings not much shorter than the tegmina, not very broad, the veins blackish brown anteriorly, brownish blue in the anal area. Hind femora dull luteous, the outer face with three more or less confluent, transverse, blackish brown stripes, indicated by transverse fuscous cloudy bars on the upper faces, the arc of the geniculation heavily marked in black; hind tibiae pink, becoming gradually plumbeous distally, the spines pallid on the basal, black on the apical half. Supraanal plate of male subtriangular with sinuous sides and a produced and rounded apex, the surface plane or nearly plane, but with two pairs of very slight longitudinal ridges, one pair bounding the basal median sulcation, which narrows distally and terminates beyond the middle of the plate, the other lateral, oblique, and less sharp, proximally at the lateral margin, distally a little removed from it and terminating at a similar distance from the base as the other pair; furcula barely indicated by an attingent pair of scarcely projecting disks; cerci rapidly tapering at base, nearly the entire distal three fifths subequal, slender, cylindrical, straight, blunt-tipped, surpassing slightly the length of the supraanal plate; subapical tubercle of subgenital

plate moderately prominent, erect, somewhat sharply conical as seen from behind.

Length of body, male, 13.5 mm.; antennae, 6.5 mm.; tegmina, 11.25 mm.; hind femora, 8.5 mm.

One male. Fort Grant, Graham County, Arizona (U.S.N.M. [No. 13]).

2. AEOLOPLUS ELEGANS, new species.

(Plate V, fig. 6.)

Head pale greenish yellow, the vertex deeper yellow, with a medio-dorsal pale bluish green stripe from the front of the fastigium backward; antennae pale salmon, pallid at base and fuscous at tip; fastigium broadly and very shallowly sulcate throughout; frontal costa rather broader than the interspace between the eyes, equal, faintly sulcate below the ocellus. Pronotum very pale testaceous with a slight greenish tinge, more pronounced on the metazona, with a very broad pale bluish green mediodorsal stripe inclosing one of pale testaceous, and with some greenish clouds upon the lateral lobes of the prozona; posterior margin very obtusely angulate, the angle rounded; prozona feebly transverse with no median carina. Prosternal spine short, conical, erect. Tegmina considerably surpassing the abdomen, exceptionally slender for the genus, with scarcely any subbasal expansion of the costal area, tapering very gradually, the apex well rounded, subpelucid with greenish yellow veins; wings not much shorter than the tegmina, fully twice as long as broad, the veins greenish, faintly infuscated. Hind femora dull luteous, with three transverse fusco-olivaceous stripes, more or less confluent on the outer face; hind tibiae pale glaucous; the spines paler glaucous with black tips. Supraanal plate of male somewhat distorted in the only specimen seen, but apparently triangular, with slight median emargination of the sides and a shallow basal sulcus, bounded by convergent walls; furcula practically absent; cerci rather stout, tapering on the basal half, equal and hardly less than half as wide as the base on the apical half, the tip rounded and very feebly decurved; subapical tubercle of subgenital plate rather prominent, large, very bluntly conical.

Length of body (contracted), male, 18 mm.; antennae, 9 mm.; tegmina, 17.5 mm.; hind femora, 11 mm.

One male. Las Cruces, Donna Ana County, New Mexico, August 8, T. D. A. Cockerell (U.S.N.M. [No. 714]).

3. AEOLOPLUS REGALIS.

(Plate V, fig. 7.)

Caloptenus regalis DODGE, Can. Ent., VIII (1876), pp. 11-12.—BRUNER, *ibid.*; IX (1877), p. 145.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 43.—BRUNER, *ibid.*, III (1883), p. 60.

Melanoplus regalis BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 28.

Head yellow, more or less deeply tinged with testaceous, marked with a dark bluish green median stripe extending from the front of

the fastigium to the hinder margin, broadening posteriorly and continuing across the pronotum, where it is very much broader, broadest in the middle or at the hinder extremity and sometimes inclosing a slender thread or stripe of testaceous; there is also a lateral blue-green band, its upper limit at the summit of the lateral lobes of the pronotum, which starts from behind the eye and crosses the prozona, where it is much the widest, occupying from a third to a half the length of the lateral lobes, and occasionally suffusing the metazona; rest of pronotum brownish testaceous, sometimes with a yellow tinge; frontal costa equal, as wide as the interval between the eyes, slightly depressed at the ocellus; antennae orange. Pronotum obtusely angulate posteriorly, the median carina distinct on the metazona, feebly indicated on the prozona in the male and occasionally in the female. Prosternal spine rather slender, conical, reaching the level of the pectus. Tegmina generally slightly longer than the abdomen, especially in the male, sometimes only as long as it, rather broad, especially just beyond the base, brownish green, with darker green fleckings and yellowish crossveins; beyond the subbasal enlargement they taper regularly and gently, the tip rounded; hind wings a little shorter than the tegmina, moderately broad, the veins bluish green, slightly infuscated next the costa. Hind femora testaceous yellow, with two broad angulate and sagittate blue-green bands, darkest above; hind tibiae pale blue-green, pallid at base and pallescent apically, the spines pallid, with the apical half blackish brown. Supraanal plate of male subtriangular, with broadly angulate sides, as long as broad, the acutely angulate tip rounded, the surface nearly plane but faintly elevated to the slight ridges which mark the boundaries of the rather broad and shallow median sulcus that extends over the basal half, narrowing slightly in its passage; there is besides, on either side, an oblique and narrow ridge, extending from the extreme outer base toward the middle of the distal half of the opposite side, terminating halfway there; furcula consisting of a pair of scarcely projecting, minute, attingent, angulate or subangulate lobes; infracercal plate as long as the supraanal, concealed by the recumbent cerci; cerci feebly compressed, of the length of the supraanal plate, tapering in the basal half, beyond slender, cylindrical, subequal, but apically tapering and feebly curved downward and inward; subapical tubercle of the subgenital plate moderately prominent, erect, very bluntly conical as seen from behind.

Length of body, male, 19.5 mm., female, 27.5 mm.; antennae, male, 8 mm., female, 9.75 mm.; tegmina, male, 14 mm., female, 19 mm.; hind femora, male, 11.5 mm., female, 16.5 mm.

Five males, 41 females. Cheyenne County, Kansas, F. W. Cragin (L. Bruner); Lakin, Kearny County, Kansas, 3,000 feet, July-September; between Smoky Hill, Kansas, and Denver, Colorado, L. Agassiz (Mus. Comp. Zool.); Pueblo, Colorado, July-August; Colorado, Morrison (S. Henshaw); Colorado (U.S.N.M.); Grand Junction, Mesa County, Colorado, June (L. Bruner); Pecos River, Texas, Captain Pope.

It has also been reported from Nebraska (Dodge) and Wyoming (Bruner).

The single specimen from Grand Junction is of an exceptionally small size, a female only 17 mm. long.

This is the largest species of the genus and is not uncommon at the eastern base of the Rocky Mountains in Colorado. I have considered it probable that this is the species described by Dodge under the name *Caloptenus regalis*, but the description does not very well apply to it. I am guided partly by a sketch of the markings of the tegmina sent me many years ago by Mr. Dodge, and partly by the impossibility of applying the description to any other known species.

4. AEOLOPLUS CALIFORNICUS, new species.

(Plate V, fig. 8.)

Head luteo-ferruginous, with a broad, obscure fuscous, median stripe on the summit, not including the fastigium; frontal costa equal, as broad as the interspace between the eyes, plane; antennae bright orange. Pronotum obtusely angulate posteriorly, the angle rounded, the median carina generally feeble but sometimes distinct on the metazona, wanting on the prozona, the latter with a pair of approximate, anteriorly converging, dull olivaceo-fuscous, rather obscure, narrow stripes; on the upper half of the lateral lobes the transverse sulci are marked in fusco-olivaceous, and there are sometimes fuscous clouds in the same region, but nowhere distinct. Prosternal spine as in *Ae. regalis*. Tegmina much surpassing the abdomen in both sexes, at their broadest as broad as the metazona, beyond the subbasal enlargement tapering very gradually, the tip rounded, fulvo-testaceous, flecked feebly, especially along the middle, with fuscous, the longitudinal veins interruptedly fuscous and pallid in the apical half; wings slightly shorter than the tegmina, moderately broad, distinctly less than twice as long as broad, the veins and cross-veins glaucous. Hind femora and tibiae precisely as in *Ae. regalis*. Supraanal plate of male triangular, with strongly sinuate sides and produced and rounded apex, with a basal, apically narrowing, moderately broad median sulcus, bounded by sharp but low walls and reaching halfway across the plate, and an oblique ridge on each side, as in *Ae. regalis*, but much less prominent; furcula indicated merely by a pair of thickenings of the inner angles of the mesially parted terminal dorsal segment; cerci as in *Ae. regalis*, but with the apical portion less slender and straighter; infracercal plate just shorter than the supraanal, concealed by the recumbent cerci; subapical tubercle of subgenital plate feebly prominent, very blunt and rounded.

Length of body, male, 24.5 mm., female, 26.5 mm.; antennae, male, 9 mm., female, 8.5 mm.; tegmina, male, 22 mm., female, 23 mm.; hind femora, male, 13.5 mm., female, 14 mm.

One male, 4 females. California, Burrison (S. Henshaw).

This species is very closely allied to *Ae. regalis*, but has much longer tegmina, is slighter in form, has a less pronounced subapical tubercle to the male abdomen, and differs slightly in color and markings as well as in the abdominal appendages.

5. AEOLOPLUS CHENOPODII.

(Plate V, fig. 9.)

Pezotettix chenopodii BRUNER!, Ins. Life, VII (1894), pp. 41-42; Rep. St. Hort. Soc. Nebr., 1894 (1894), p. 163; Bull. Div. Ent. U. S. Dep. Agric., XXXII (1894), pp. 12-13.

Head varying from livid to warm testaceous, faintly, feebly, and sparsely punctate with brown, with mediodorsal and postocular stripes of black as in the neighboring species, the former generally broadening posteriorly and thereafter inclosing a yellow thread; antennae brownish yellow, pallid basally and infuscated apically; fastigium more or less shallowly sulcate in its narrowest part, the frontal costa about as wide as the space between the eyes, equal, nearly fading out before reaching the clypeus, and plane throughout. Pronotum testaceous, sometimes punctate with brown above, with a broad and posteriorly broadening mediodorsal blackish stripe on the prozona, including a similarly widening testaceous thread or stripe; upper half or rather less of the lateral lobes of the prozona with a similar more or less distinct blackish brown belt, generally accompanied by a testaceous dot at the middle of the upper margin; hinder margin of the pronotum hardly angulate, but well rounded in a uniform curve; median carina slight on the metazona, wanting or rarely indicated on the prozona. Prosternal spine short, conical, rather blunt. Tegmina subovate, less than twice as long as broad, apically obliquely truncate in the female, not pointed, fuliginous, with crowded brownish and yellowish veins. Hind femora luteo-testaceous, with three broad, transverse angular bands of bluish black, which are but little confluent on the outer face and somewhat less conspicuous on the upper face, the genicular are black; hind tibiae pale glaucous (sometimes pink, according to Bruner) with the knee and a subbasal annulus pale yellow; the spines black with pallid base. Supraanal plate of male triangular with faintly sinuous sides and roundly pointed apex, the surface flat but with a pair of convergent, rather sharp, but only slightly elevated ridges, inclosing a rather narrow basal longitudinal sulcus, not reaching the middle of the plate; there are besides two short, strongly oblique, blunt ridges on the basal half, fading at their extremities; furcula wholly wanting; cerci moderately broad and compressed at base, tapering gradually and regularly over a little more than the basal half, beyond subequal, subcylindrical, but pointed, the apex scarcely incurved and extending scarcely beyond the supraanal plate; subapical tubercle of subgenital plate small, directed upward and backward, very short and bluntly conical as viewed from behind.

Length of body, male, 17 mm., female, 20.5 mm.; antennae, male, 6.5 mm., female, 6 mm.; tegmina, male, 3 mm., female, 3.75 mm.; hind femora, male, 9.5 mm., female, 10 mm.

Two males, 2 females. Grand Junction, Mesa County, Colorado, June, L. Bruner.

6. AEOLOPLUS TURNBULLII.

(Plate V, fig. 10.)

Caloptenus turnbullii THOMAS!, Ann. Rep. U. S. Geol. Surv. Terr., V (1872), p. 452, pl. II, fig. 10; Rep. U. S. Geol. Surv. Terr., V (1873), p. 158; Rep. U. S. Ent. Comm., I (1878), p. 42.—GLOVER, Ill. N. A. Ent., Orth. (1872), pl. XI, fig. 10.—SCUDDER!, Can. Ent., XII (1880), p. 75.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60; Bull. Div. Ent. U. S. Dep. Agric., IV (1884), p. 58.

Melanoplus turnbullii BRUNER, Bull. Washb. Coll., I (1885), p. 139; Publ. Nebr. Acad. Sc., III (1893), p. 28.

Head varying from pallid testaceous to brownish testaceous, the genae sometimes clouded with fuscous; a broad blackish stripe, usually broadening posteriorly, extends from the front of the fastigium across the summit, nearly occupying the whole of the fastigium except the sides of the expanded portion and sometimes invading this; a broader band extends longitudinally behind the eyes; antennae pale salmon red, more or less deeply infuscated apically; fastigium not sulcate; frontal costa nearly or quite as broad as the narrowest space between the eyes, shallowly sulcate below the ocellus. Pronotum varying from testaceous to dark brownish yellow, the metazona generally feebly infuscated in parts, especially on the disk, the prozona and generally the front half of the metazona with a broad, obscurely bordered, blackish fuliginous, mesial stripe, sometimes including a yellowish thread; upper half of the lateral lobes of the prozona similarly colored, forming a broad bar, which sometimes extends as a cloud upon the metazona; posterior margin obtusely angulate, the angle rounded; median carina on the metazona only. Prosternal spine conical or pyramidal, rather pointed, moderately long. Tegmina brown, variably flecked with dull yellowish, the basal portion of the anal vein often so marked, falling distinctly short of the tip of the abdomen, the costal margin somewhat but not greatly expanded beyond the base, beyond tapering regularly, the tip well rounded; wings at rest protruding slightly beyond the tegmina. Hind femora clay yellow, thrice broadly banded with blue black, the bands generally more or less blended on the outer face, the whole genicular arc inky black; hind tibiae glaucous, suffused apically with pale yellow, and with a narrow subbasal yellowish annulus, the pallid spines black tipped, the tarsi clay yellow. Supraanal plate of male triangular, the apex acute and bluntly pointed, the sides nearly straight, the surface feebly arched, with a basal, triangular, apically narrowing sulcus, which hardly extends to the middle of the plate and is bounded by sharp walls; a short, moderately sharp but low, oblique ridge starts from the outer base of the plate and runs a similar dis-

tance; furcula consisting of a pair of adjacent, obtusely angled, scarcely projecting, small lobes; cerci long and slender, fully as long as the supraanal plate, tapering not rapidly and on the basal half only, the apical half slender, a little compressed, slightly arcuate, and feebly downcurved apically; subapical tubercle of subgenital plate moderate, suberect, as viewed from behind very bluntly conical.

Length of body, male, 18 mm., female, 23 mm.; antennae, male, 7.25 mm., female, 7.8 mm.; tegmina, male, 10 mm., female, 13 mm.; hind femora, male, 9.5 mm., female, 12 mm.

Nine males, 6 females. Yellowstone, Montana, October 9, C. V. Riley (U.S.N.M.); Sweetwater, Wyoming, Thomas (U.S.N.M., [No. 715]); Wyoming, Morrison (U.S.N.M.); Newcastle, Weston County, Wyoming (L. Bruner); Gordon, Sheridan County, Nebraska, August (L. Bruner); Explorations in the Upper Missouri and Yellowstone, F. V. Hayden.

The species was originally reported from "between Red Buttes and Independence Rock, Wyoming," but it has since been recorded by Bruner (doubtless in some cases by mistake for some of the allied species here first separated) from Garden City, Finney County, Kansas, western Nebraska, Arizona, New Mexico, Montana and the Pacific Coast.

According to Bruner, this species in the Yellowstone region "only feeds upon two species of plants, as nearly as I could ascertain by observation, viz., the 'pigweed' and a small greenish white plant of a similar nature. Those found on the pigweed are somewhat glaucous yellow, while those feeding on the other plant are more of a whitish color, mingled with greenish blue instead of greenish yellow," the color of the insects resembling to a considerable degree that of the plants on which they feed.

7. AEOLOPLUS PLAGOSUS.

(Plate VI, fig. 1.)

Pezotettix plagosus SCUDDER!, Ann. Rep. Chief Eng., 1876 (1877), p. 504; Can. Ent., XII (1889), p. 75.

Brownish yellow marked with dark brown or brownish fuscous: especially noticeable is a dark mediodorsal stripe, extending from the middle of the vertex between the eyes, where it is not half so broad as the interspace, to or nearly to the posterior end of the pronotum, broadening as it goes, on the posterior half of the pronotum inclosing a median pale line and fading out before the end of the metazona; there is also a broad dark belt at the upper limit of the lateral lobes on the prozona, extending forward to the eyes and fading inferiorly; interspace between the eyes slightly broader than the frontal costa, the fastigium broadly and rather shallowly sulcate, the frontal costa equal, narrowly sulcate below the ocellus. Pronotum broadening slightly posteriorly, the metazona punctate, the median carina distinct only

here, the slight lateral carinae moderately abrupt and obtuse, the posterior border obtusely angulated, the angle rounded. Prosternal spine very short, straight, stout, pyramidal, pointed. Tegmina not much shorter than the abdomen, obscure brown, mottled with many pale and darker spots (due to the broken color of the veins), mostly arranged longitudinally in the median field; the costal field is broadly enlarged near the base, and beyond it the whole tapers nearly to the rounded tip; veins of the apical half of the preanal field of the wings dusky or blackish. Hind femora with two median, angulate, moderately broad, brownish fuscous bands, the arc of the geniculation black; hind tibiae pale dull glaucous, pale at the base, the spines black-tipped. Supra-anal plate of male triangular, nearly as long as broad, flat, with a shallow median furrow of moderate width in the basal half and a slender mesial groove at apex; furcula consisting of a pair of minute, attingent, triangular lobes; cerci broad at base, rapidly tapering on the compressed, conical, basal half, very slender and nearly equal on the apical half, a little incurved at tip; subapical tubercle of subgenital plate rather small, erect, appressed, bluntly conical as seen from behind.

Length of body, male, 18.5 mm., female, 21 mm.; antennae, male, 8 mm., female, 7.5 mm.; tegmina, male, 11 mm., female, 11.2 mm.; hind femora, male, 10.5 mm., female, 11.8 mm.

One male, 1 female. Northern New Mexico, August to September, Lieutenant W. L. Carpenter.

I have seen no other males of this species since its first description, but I have before me three new females, which from the greater brevity of their tegmina I am inclined to place here rather than in *Ae. turnbullii* (from which the females at least are with difficulty separated), and which come from Colorado (Cañon City, Fremont County, Morrison and Uhler.—U.S.N.M. [No. 716]). The specimen collected by Morrison was obtained on the plains at an elevation of 5,000 feet, and is almost wholly grass-green with the lighter parts yellowish green.

8. AEOLOPLUS UNIFORMIS, new species.

(Plate VI, Fig. 2.)

The color of the only specimens seen are probably changed somewhat from their having been killed in spirits and are now of a light dead-leaf color; probably in life they were uniformly testaceous, with perhaps a greenish tinge. The pronotum shows, at least on the prozona, signs of a broad, paler, mediodorsal band, and a similar band on the middle of the lateral lobes; the outer face of the hind femora shows indications of a pair of dusky transverse bands, mesial and extramesial, and the apical half or more of the hind tibial spines are black. The fastigium of the vertex is scarcely in the least impressed, excepting at its very base between the eyes; the frontal costa has a row of puncta on either side,

removed from the margin, and below the ocellus it is narrowed, sulcate, and fails to reach the clypeal suture. Prozona feebly and sparsely, metazona densely and rather strongly, punctate on the disk, the former anteriorly with a submarginal transverse series of more distinct puncta, becoming mesially a double series; the posterior sulcus of the prozona swerves broadly backward and is completely continuous; that in front of it is rather short, not infringing on the lateral lobes, rigidly transverse and feebly continuous. Supraanal plate of male triangular, with almost straight lateral margins, subacuminate apex, fully as long as broad, with a pair of submedian, subparallel, rather elevated ridges, fading posteriorly, inclosing a deep median sulcus; furcula consisting only of a rather distinct but obtuse angle on either side of a rectangular median emargination of the last dorsal segment; cerci very slender (slenderer than appears by the figure), as long as the supraanal plate, tapering considerably in the basal half, equal and very feebly incurved in the apical half, apically blunt: infracercal plates rather broad, hardly narrowing apically, shorter than the infraanal plate.

Length of body, male, 17.25 mm., female, 18.5 mm.; antennae, male, 7 mm., female, 5.7 mm.; tegmina, male, 16 mm., female, 9 mm.; hind femora, male, 8.3 mm., female, 10.2 mm.

One male, 1 female. Fort Whipple, Yavapai County, Arizona, E. Palmer; Truckee Valley, Nevada, R. Ridgway.

The tegmina are considerably larger than the abdomen in the male from Arizona; somewhat shorter than the abdomen in the female from Nevada. I am not at all confident that the two belong together, and my description is therefore based almost wholly upon the male.

9. AEOLOPLUS ARIZONENSIS, new species.

(Plate VI, fig. 3.)

Hesperotettix viridis SCUDDER!, Ann. Rep. Chief Eng., 1876 (1876), p. 506; Ann. Rep. Geol. Geogr. Surv. 100th mer., 1876 (1876), p. 286.

Uniform in coloring throughout, and probably testaceous (all specimens seen have been immersed in alcohol), except that the transverse sulci of the pronotum appear to have been marked with black or fuscous, there are some slight fuscous markings on the upper half of the lateral lobes of the prozona, the tegmina are clouded and obscurely dotted with fuscous, the hind femora are sometimes twice barred with fuscous and have a large fuscous lunule on the geniculation, and the tibial spines are black tipped. The eyes of the male are tolerably prominent; the fastigium, except at apex, is distinctly and uniformly but not deeply sulcate: the frontal costa is subequal, depressed at but not sulcate below the ocellus, percurrent. Prozona punctate above only in the submarginal sulcus; metazona densely and rather strongly punctate; posterior sulcus of the prozona oblique on either side, making a very open rounded angle mesially, and percurrent, while that next in front of it is occasionally subobliterated mesially. Tegmina considera-

bly longer than the abdomen in the male, nearly or quite as long as the abdomen in the female. Supraanal plate of male subtriangular, with a slight, rounded, lobiform, apical prolongation, the surface nearly flat, with a slight, rather broad median sulcus on the basal half or more; furcula consisting of a pair of very slightly projecting but moderately large, rounded, attingent lobes; cerci compressed more than commonly in this genus, broad at base, tapering pretty regularly in the basal two-thirds, mostly by the excision of the upper side, beyond equal, apically bluntly rounded, scarcely incurved; infracercal plates apically narrow, nearly as long as the supraanal plate.

Length of body, male, 19 mm., female, 23 mm.; antennae, male, 7.75 mm., female, 7.25 mm.; tegmina, male, 16.25 mm., female, 16 mm.; hind femora, male, 10.1 mm., female, 11.75 mm.

Five males, 4 females. Fort Whipple, Yavapai County, Arizona; Mohave Desert, Loew (U.S.N.M. [No. 717]).

This species differs slightly from *Ae. uniformis* in markings, but more in the sculpture of the face and of the male abdominal appendages, which are very distinct in the basal breadth of the cerci and the flatness of the supraanal plate.

10. AEOLOPLUS OCULATUS, new species.

(Plate VI, fig. 4.)

Pale yellowish testaceous, uniform, the only variations from it being in the pale reddish antennae, chocolate brown eyes, the faint, fuscous, crowded, and delicate punctuation of the submarginal sulcus of the prozona and of the whole of the metazona, the bluish main rays of the wings, the feeble, plumbeo-fuscous, sagittate banding of the hind femora, the narrow purplish crescent of the genicular lobes and the very pale purplish hind tibiae, the spines of which are yellowish in the basal, black in the apical half. The eyes of the male are very large and prominent, the fastigium pretty deeply and rather narrowly sulcate between the eyes, the frontal costa moderately broad, subequal, nowhere sulcate, and rather indistinctly percurrent. Posterior sulcus of the prozona swerving backward mesially to form a very broad W, and yet in the middle much nearer the sulcus in front than that behind; sulcus in front of it percurrent, straight, but angularly bent forward laterally. Tegmina considerably longer than the abdomen in the male. Supraanal plate of male triangular, with the apex slightly produced and rounded, nearly flat, with a rather broad and shallow median sulcus, suddenly narrowed and almost immediately terminated in the middle of the plate, the margins sharply defined; furcula consisting of a pair of juxtaposed, small, rounded lobes, scarcely perceptible by any projection; cerci broad at base and equal on basal fifth, but in the next two fifths rapidly tapering, almost entirely by the falling slope of the upper side, beyond subequal, bluntly pointed, longer than the supraanal plate

and feebly compressed basally, scarcely incurved; infracercal plate as long as the supraanal by the apical prolongation of the narrowing plate.

Length of body, male, 17 mm.; antennae, 6 mm.; tegmina, 15 mm.; hind femora, 9.25 mm.

One male. Mohave, Arizona, Wickham (L. Bruner).

In details of structure this species closely resembles *Ae. arizonensis*, but is remarkable for its compressed form and its large and prominent eyes, in which points it exceeds even that species.

19. BRADYNOTES.

(βραδύνω, to loiter.)

Bradynotes SCUDDER, Can. Ent., XII (1880), p. 76.

Body stout, compact, heavy, generally, and especially in the female, very broad at the metathorax. Head stout, slightly broader below than above, the genae full; eyes separated by a wide space, wider and generally much wider than the broad frontal costa; front well rounded, vertical, the frontal costa prominent, broad, and generally somewhat sulcate, at least above; antennae slender for such bulky insects, equal, shorter and generally much shorter than the hind femora. Thorax very stout, the pronotum very short, not covering the whole of the mesonotum, truncate at either extremity, the metazona only about half as long as the prozona and rugulose, while the prozona is smooth; lateral lobes sometimes separated from the dorsum by distinct rugae. Prosternal spine very much abbreviated, becoming in the female a mere blunt tubercle, and in the male very short and conical; mesostethium and metastethium together, in both sexes, but particularly in the female, no longer or scarcely longer than broad; the interspace between the mesosternal lobes wide in both sexes, but showing a remarkable degree of variation quite unknown in any other of the genera of *Melanopli*; the metasternal lobes distant, sometimes very distant, in the female, approximate or moderately distant in the male. Tegmina and wings altogether wanting. Fore and middle femora of male tumid; hind femora (excepting in *B. hispida*) rather short, moderately stout, reaching beyond the abdomen in the male, but generally not in the female, the upper carina smooth. Terminal abdominal joints of the female short, with slightly exerted ovipositor, making the tip blunt, as in *Oedaleonotus* and *Aeoloplus*, but perhaps to a greater degree; abdomen of male apically clavate, upturned, the subgenital plate long and tumid, without apical tubercle; furcula absent or (in one species) represented by feeble lobes; cerci simple, conical, straight.

B. obesa (Thomas) is the type.

This somewhat remarkable genus is, so far as known, confined to the extreme northwestern United States, but will probably be found also in British Columbia. It extends from the Pacific to Montana and Wyoming, and has so far been reported only north of the latitude of

39°. Excepting the monotypic *Asemoplus* found in the same region, and some of the genera peculiar to the South, no other genus of Melanopli has so limited a range.

ANALYTICAL KEY TO THE SPECIES OF BRADYNOTES.

A¹. Interspace between the eyes not much greater than the least width of the frontal costa; hind femora fully three times as long as pronotum and relatively slender; last dorsal segment of male abdomen with slight lobes for furcula.... 1. *hispida* (p. 81).

A². Interspace between the eyes nearly twice the least width of the frontal costa; hind femora distinctly less than three times as long as pronotum and relatively stout; last dorsal segment of male abdomen quite unarmed.

b¹. Interspace between mesosternal lobes not (male) or at most a little (female) wider than the lobes themselves, the metasternal lobes varying from subcontiguous to a little more than half as distant as the mesosternal (male), or from more than half to nearly as distant as the mesosternal lobes (female); male cerci about as long as the supraanal plate.

c¹. Interspace between mesosternal lobes scarcely more than half the width of the lobes themselves (male) or not wider than they (female), the metasternal lobes subcontiguous (male); last segment of male abdomen not greatly upturned.

d¹. Interspace between mesosternal lobes of male scarcely more than half the width of the lobes themselves, the metasternal interspaces in the female hardly more than half as broad as the mesosternal..... 2. *caurus* (p. 83).

d². Interspace between mesosternal lobes of male almost as wide as the lobes, the metasternal interspace in the female fully three-quarters that of the mesosternal..... 3. *expleta* (p. 84).

c². Interspace between mesosternal lobes about equal to the width of the lobes themselves (male) or a little wider (female), the metasternal lobes moderately distant (male) or fully three-fourths as wide as the mesosternal interspace (female); last segment of male abdomen considerably upturned.

d¹. Hind tibiae wholly coral red..... 4. *pinguis* (p. 85).

d². Hind tibiae red only on apical half.

e¹. Relatively large. No great contrast in color between upper and lower half of lateral lobes of pronotum, the lower portion not being very light; dark cross bands of hind femora crossing only the inner, not (or obscurely) the outer half of the upper surface; outer face almost uniformly dark.

5. *obesa* (p. 87).

e². Relatively small. The darker superior half of lateral lobes of pronotum strongly contrasted with the lighter inferior half; dark cross bands of hind femora crossing both inner and outer half of upper surface, the outer face broken in color by their continuation..... 6. *referta* (p. 88).

b². Interspace between mesosternal lobes considerably wider than (male) or twice as wide as (female) the lobes themselves, the metasternal lobes nearly as distant; male cerci not half so long as the supraanal plate..... 7. *satur* (p. 89).

I. BRADYNOTES HISPIDA.

(Plate VI, fig. 5.)

Pezotettix hispidus BRUNER!, Can. Ent., XVII, 1885, pp. 12-14.

Body moderately stout, very slightly compressed, but little enlarged in the metathoracic region, even in the female, feebly pilose. Head full, the vertex gently tumid, the interspace between the eyes not much greater than the least width of the frontal costa, the fastigium considerably declivent, slightly expanding apically, broadly sulcate,

anteriorly punctate in the male, the lateral margins moderately prominent but rounded; frontal costa moderately broad, a little broader than the basal joint of the antennae, subequal, sulcate below the ocellus and sparsely punctate; eyes moderately large, more prominent in the male than in the female, about as long as the infraocular portion of the genae, anteriorly truncate, especially in the female; antennae a little more (male) or a little less (female) than half as long again as head and pronotum together. Pronotum subequal, in the female feebly constricted in the middle and slightly broadened posteriorly; metazona less than half as long as the prozona, the posterior sulcus of the latter as distinct as the anterior which divides it in the middle, all the sulci cutting the slight and equal median carina; posterior margin truncate or very faintly and broadly emarginate; mesonotum fully half (male) or distinctly less than half (female) as long as the metanotum. Interspace between the mesosternal lobes a little cuneiform, about as large as (male) or a little larger than (female) the slightly transverse lobes; interspace between the metasternal lobes much less than half (male) or considerably more than half (female) the width of the mesosternal interspace. Fore and middle femora of male considerably but not greatly inflated; hind femora slender, twice as long as head and pronotum together. Abdomen relatively slender, with a sharp but slight median carina, the extremity scarcely enlarged in the male (as viewed from above) and but gently upturned; supraanal plate of male shield shaped, the proximal half of the lateral margins ridged and the broad median sulcus margined with prominent ridges, higher in the proximal than the distal half; furcula consisting of a pair of small, moderately distant beads; cerci as long as the supraanal plate, subconical, but tapering much more rapidly in the basal than the apical half, the tip very feebly down-curved; infracercal plate of either side large, sulcate, much exposed, nearly meeting its mate, and extending slightly beyond the supraanal plate.

The body is brownish ochraceous, heavily banded with blackish brown, the proportions of the two varying somewhat. The head (excepting the vertex and a broad stripe behind the eyes which are blackish brown) and the fore and middle legs are dirty ochraceous, darker in the female than in the male, with an olivaceous tinge, and the same color is found on the whole under surface of the body and the lower half or less of the lateral lobes of the pronotum; the broad dark band behind the eyes continues across the upper half of the lateral lobes and the whole of the abdomen, bordered above by an ochraceous stripe, which begins between the eyes, bordering their upper margin, and continues to the end of the abdomen, often becoming duller in color as it approaches the extremity and is more narrowly separated from its mate; sometimes the intervening dark stripe, which occupies most of the vertex of the head, and is always broader anteriorly than posteriorly, is interrupted at the metazona and on the meso- and metanota, so that the lighter bands here unite. Hind femora varying from brownish

to yellowish fuscous, feebly clouded, especially above, with fuscous in the middle and in the middle of the distal half, the under and inner surfaces more or less deeply tinged with coral red; hind tibiae and tarsi fusco-luteous, only the apical half or less of the spines blackish or brown.

Length of body, male, 18.5 mm., female, 21 mm.; antennae, male, 9.5 mm., female, 10.5 mm.; pronotum, male, 3.6 mm., female, 4.5 mm.; hind femora, male, 10.75 mm., female, 12.5 mm.

One male, 3 females. Colville Valley, eastern Washington, July 24 (L. Bruner; Museum Comparative Zoology).

In the exceptional length of the hind femora, the feeble metathoracic enlargement of the body, and the development of the furcula, as well as in some minor features, this is the most aberrant species of the genus.

2. BRADYNOTES CAURUS, new species.

(Plate VI, fig. 6.)

Bradynotes opimus BRUNER!, Can. Ent., XVII (1885), p. 15.

Body similar in shape and clothing to *B. hispida*. Head full, the vertex gently tumid, the interspace between the eyes twice as great as the least width of the frontal costa, the fastigium strongly declivent, narrowing rather than expanding anteriorly, broadly but shallowly sulcate, the lateral margins rather prominent but rounded; frontal costa rather broad, much broader than, sometimes twice as broad as, the basal joint of the antennae, generally a little sulcate throughout, especially in the male, punctate at the margins; eyes not very large, scarcely more prominent in the male than in the female, about as long as the infraocular portion of the genae, anteriorly truncate particularly in the female; antennae a little longer (male) or a little shorter (female) than the head and pronotum together. Pronotum subequal, expanding posteriorly a very little, especially in the female; metazona half (female) or slightly less than half (male) as long as the prozona, the sulci of the latter equally indistinct, and neither of them cutting the median carina, which is nearly obliterated on the prozona, especially in the female; posterior margin as in *B. hispida*; mesonotum more than half (male) or less, sometimes much less, than half (female) as long as the metanotum. Interspace between the mesosternal lobes as wide (female) or hardly more than half as wide (male) as the lobes themselves, the metasternal lobes subcontiguous (male) or half as distant as the mesosternal (female). Fore and middle femora of male somewhat inflated; hind femora short but not very stout, hardly half as long again as head and pronotum together. Abdomen relatively rather slender with a slight and blunt median carina, the extremity scarcely enlarged in the male, as viewed from above, and but gently upturned. Supraanal plate of male subtriangular with rounded apex, about equally long and broad, tumid by reason of a pair of very coarse, elevated, rounded ridges, with a

very deep basal sulcus between them; furcula absent; cerci slightly longer than the supraanal plate, subconical, faintly compressed, a little downcurved apically, tapering with regularity; infracercal plates inconspicuous.

Body griseo fuscous, mottled, the face and inferior surface of body sordid brownish yellow, feebly punctate with fuscous. Vertex and fastigium brownish fuscous, the lateral margins of the latter feebly enlivened with orange, and the former mottled or streaked with livid brown. Both thorax and abdomen are heavily mottled with blackish fuscous, much more heavily in some individuals than in others, which is apt to be conspicuous in a pair of subdorsal bands, sometimes confined to the posterior edges of the segments, and to leave a narrow lighter dorsal stripe between them; the lower portion of the lateral lobes of the pronotum is always lighter than the upper half, which is often marked by a more or less distinct, sometimes abbreviated, broad black or blackish band, generally deeper in tint on its inferior half. Hind femora blackish fuscous feebly clouded with dull yellowish, the whole under surface and under portion of its outer face clay yellow; hind tibiae light coral red (male) or dark coral red on apical half and extreme base, passing into purplish red on the basal half (female), the spines blackish on their apical half at most.

Length of body, male, 16.75 mm., female, 21 mm.; antennae, male, female, 6.5 mm.; pronotum, male, 3.65 mm., female, 4.5 mm.; hind femora, male, 10 mm., female, 11.75 mm.

Two males, 6 females. Yakima River opposite Ellensburg, Kittitas County, Washington, July 8-9 (Museum Comparative Zoology; U.S.N.M. [No. 718]); Camp Umatilla, Washington, June 27 (Museum Comparative Zoology); Oregon City, Clackamas County, Oregon, July, W. G. W. Harford.

3. BRADYNOTES EXPLETA, new species.

(Plate VI, fig. 7.)

Body similar in shape and clothing to *B. hispida*, except that it is relatively a trifle stouter at the metathorax, especially in the female. Head broad and full, the vertex gently tumid, the interspace between the eyes nearly or quite twice as great as the least width of the frontal costa, the fastigium strongly declivent, shallowly sulcate, the lateral margins rather prominent, especially in the male, but rounded; frontal costa rather broad, considerably broader than the basal joint of the antennae, feebly sulcate if at all, and sparsely punctate, especially at the margins; eyes as in *B. caurus* (antennae more or less broken in all specimens seen). Pronotum regularly expanding posteriorly, very slightly in the male, distinctly but not greatly in the female; metazona about half as long as the prozona, the sulci of the former equally but feebly impressed, all cutting the feeble median carina, which is obsolescent on the prozona in the female; mesonotum nearly half (female) or

much less than half (male) as long as the metanotum. Interspace between the mesosternal lobes almost as broad as the lobes themselves (male, female), the metasternal lobes slightly distant (male) or fully three-fourths as distant as the mesosternal lobes (female). Femora as in *B. caurus*. Abdomen relatively slender, compressed, with a distinct but not prominent median carina, the extremity in the male slightly enlarged, as seen from above, and somewhat upturned; terminal appendages of male differing from those of *B. caurus* only in that the supraanal plate is a little more pointed, and the cerci coarser, a trifle shorter, more bluntly tipped, and not curved downward so much apically.

Body brownish fuscous above, sordid yellow below. Face livid brown, flecked with fuscous points; the ridged margins of the fastigium coral red, at least in the male; behind the eyes, in front of the position for the lateral carinae of the pronotum, is the beginning of a slender and feeble yellowish stripe, which crosses interruptedly to the pronotum and is there lost; below it, the upper half of the lateral lobes are dark brown, almost blackish, at least on the prozona, while below the lobes are much lighter colored. The abdomen is more or less flecked, especially laterally, at the posterior margins of the segments with testaceous, and there is a more or less conspicuous or broken piceous lateral band on the basal half of the abdomen. The hind femora are colored as in *B. caurus*, but the hind tibiae are coral red in the male, sordid yellow apically tinged with red in the female, feebly incurved, the spines black tipped. Lower external half of anal cerci of male distinctly darker than the upper.

Length of body, male, 16.25 mm., female, 28 mm.; pronotum, male, 4 mm., female, 4.5 mm.; hind femora, male, 8.25 mm., female, 14 mm.

Two males, 1 female. Easton, Kittitas County, Washington (U.S.N.M. [No. 719]).

This species is very closely allied indeed to *B. caurus*.

4. BRADYNOTES PINGUIS, new species.

(Plate VI, fig. 8.)

Body stout and clumsy, considerably enlarged in the metathoracic region, especially in the female, weakly and briefly pilose. Head full, the vertex gently tumid, the interspace between the eyes broad, about twice the breadth of the narrowest part of the frontal costa, the fastigium strongly declivent, considerably but broadly sulcate, its lateral margins ridged, continuous with the sometimes elevated, always dark-colored borders of the frontal costa; the latter broad, much broader than the basal joint of the antennae, variably sulcate, punctate but sparsely except on the margins; eyes rather large, more prominent in the male than in the female, equally truncate anteriorly in the two sexes, as long as the infraocular portion of the genae; antennae somewhat longer (male) or a trifle shorter (female) than head and pronotum together.

Pronotum regularly, and in the female considerably, enlarging posteriorly, with distinct (male) or indistinct (female) lateral carinae on the prozona, which is twice (male) or almost twice (female) as long as the metazona, its sulci approximated and equally distinct, but not so distinct as that separating the pro- and metazona and, unlike it, not cutting the median carina, which is yet often subobsolete on the prozona and especially on its posterior half, particularly in the female; exposed portion of mesonotum about half (male) or hardly more than a fourth (female) as long as the metanotum. Interspace between the mesosternal lobes three-fourths (male) or fully (female) as wide as the lobes themselves, the metasternal interspace half (male) or three-fourths (female) the width of the mesosternal interspace. Fore and middle femora pretty strongly inflated and arcuate in the male, the hind femora stout and heavy, hardly if at all more than half as long again as head and pronotum combined, the hind tibiae stout. Abdomen stout, tapering and then apically enlarged and considerably upturned in the male; supraanal plate of male triangular, shorter than its basal breadth, with a pair of broad, gently tumid ridges, which unite into a single median ridge, leaving between them in the basal half a shallow sulcus; furcula wanting; cerci as long as the supraanal plate, subconical, slightly compressed, tapering a little more rapidly in basal than in apical half, rather blunt at tip, straight throughout; infracerebral plate much shorter than the supraanal, scarcely perceptible.

Body brownish fuscous above much marked with clay yellow, beneath almost wholly clay yellow, more or less infuscated in the female. The head is more or less obscure yellow, the vertex at summit brownish fuscous, limited at most to a narrow median and two equally narrow submedian streaks, the latter continued along the marginal ridges of the fastigium down the sides of the frontal costa, but at the apical third of the fastigium more or less interrupted by or suffused with dull red; the antennae are yellow at base, gradually passing into fuscous. On the dorsum of the thorax and the front at least of the abdomen, the fuscous is more or less obscurely punctate or flecked with yellowish, and along the median line of the abdomen there is a distinct yellowish stripe beginning on the meso- and metanota as a mere thread; the prevailing tint of the lateral lobes of the pronotum is yellowish, but there is a more or less distinct blackish fuscous oblique bar on the prozona just above the middle, merging posteriorly in the general obscurity of the metazona; there is a distinct broad blackish fuscous oblique band crossing the meso- and metapleura, and the middle of the sides of the basal abdominal segments are piceous. The fore and middle legs are fusco-luteous; the hind femora yellowish, more or less obscured with fuscous and spotted with fuscous on the inner upper face and the outer face, which is generally almost black along its upper half; hind tibiae and tarsi coral red, brighter in the male than in the female, the external series of spines yellow with black apices. The sides of the supraanal plate of

the male show a black stripe, and the cerci, mesially yellow, are obscured with fuscous both above and below.

Length of body, male, 23 mm., female, 25.5 mm.; antennae, male, 8 mm., female, 9 mm.; pronotum, male, 4.75 mm., female, 5.5 mm.; hind femora, male, 12.5 mm., female, 14.25 mm.

Five males, 2 females. Washington, Morrison (U.S.N.M. [No. 720]); Reno, Washoe County, Nevada, Hillman (L. Bruner). Other specimens of Morrison's collecting in the collection of Mr. S. Henshaw were labeled by Morrison as coming from North Carolina, but of course by mistake; in all probability they came from Washington; he collected in both these States.

5. BRADYNOTES OBESA.

(Plate VI, fig. 9.)

Pezotettix obesus THOMAS!, Ann. Rep. U. S. Geol. Surv. Terr., V (1872), pp. 454-455, pl. II, figs. 13, 14.—GLOVER, Ill. N. A. Ent., Orth. (1872), pl. II, figs. 13, 14.—THOMAS!, Rep. U. S. Geol. Surv. Terr., V (1873), p. 146; Proc. Dav. Acad. Nat. Sc., I (1876), p. 259.—STÅL, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 15.

Bradynotes obesa SCUDDER!, Can. Ent., XII (1880), pp. 75-76.

Bradynotes opimus SCUDDER!, Rep. U. S. Ent. Comm., II (1881), app., p. 24.

Body wholly similar in form and clothing to that of *B. pinguis*, or it is even stouter in the metathoracic region in the female. Head not differing essentially from *B. pinguis*, and eyes and antennae with the same structure. Pronotum with similar but rather less distinct and continuous lateral carinae; metazona half (male) or distinctly less than half (female) the length of the prozona, the two sulci of the latter approximated, the hinder of them less distinct than the anterior, which is as well marked as that separating the prozona from the metazona, but neither traverse the median carina, which is equal and distinct though slight throughout; exposed portion of mesonotum half (male) or much less than half (female) as long as the metanotum. Sternal interspaces as in *B. pinguis*, as also the femora. Abdomen stout, with a more or less distinct median carina, in the male tapering and then apically enlarging and upturned; supraanal plate of male triangular, as long as its basal breadth, otherwise as in *B. pinguis*; furcula absent; cerci as long as the supraanal plate, straight, tapering regularly in the basal three-fifths, beyond equal or subequal, blunt tipped; infracercal plates blunt tipped, reaching the tip of the supraanal plate.

General color blackish griseous, more or less flecked with brown. Face and genae below the eyes varying from pale to pinkish livid, punctate with black, especially below, and divided by black stripes following the edges of the frontal costa and the lateral carinae of the face and also, generally, the arcuate posterior carinae of the genae, and an oblique line of punctures subparallel to it below the middle of the genae; summit of head with a median and a pair of arcuate lateral narrow black stripes,

the former the darker, the latter extending upon the lateral margins of the fastigium, on the anterior part of which they are supplanted by red; antennae testaceous near the base, blackish beyond. Prozona with a large central blackish spot on the disk, inclosing a pair of testaceous dots, laterally disposed; anterior and posterior margins of the pronotum, especially in the female, occasionally enlivened feebly with red; lateral lobes lighter below than above, speckled, with a broad, somewhat broken, black median band crossing the prozona. Abdomen varying from grizzly to blackish, the posterior edges of the segments dotted with minute longitudinal spots, and some of the posterior segments marked with a central, triangular, testaceous spot, seated on the posterior border. Hind femora with the outer face generally altogether black, occasionally lighter and marked with a central, oblique, pale dash above; upper and lower faces pale testaceous, the inner side of the upper face with a pair of black bars; hind tibiae deep purplish at base (with the basal outer tubercle deep red) passing into deep red beyond the middle, the under surface clay yellow; the spines of the basal half pale, of the apical half reddish, all black tipped. Male cerci clay yellow, edged below with blackish; supraanal plate yellow mesially, blackish laterally.

Length of body, male, 23 mm., female, 24 mm.; antennae, male, 9.5 mm., female, 10.5 mm.; pronotum, male, 5.5 mm., female, 5 mm.; hind femora, male and female, 12.25 mm.

Thirteen males, 20 females. Sierra Nevada, July 17-22, Baron Osten-Sacken; Mount Shasta, northern California, at forest line, A. S. Packard; Siskiyou County, California (U.S.N.M.—Riley collection); southern Montana, C. Thomas (U.S.N.M. [No. 721]); Montana (U.S.N.M.—Riley collection); Helena, Montana (L. Bruner); Humboldt River, Nevada, August, S. W. Burrison (S. Henshaw). It is also credited by Thomas to Wind River, Wyoming; to a point 40 miles from Virginia City, Montana, at a height of 8,000 feet; and to the dividing ridge between Idaho and southern Montana.

Since describing *B. opimus*, I have been able to compare it with the types of Thomas's *Pezotettix obesus* and find they are not distinct. The species is very close to *B. pinguis*, but differs from it in its markings, particularly in its darker antennae, its much less developed median abdominal stripe and its differently colored hind tibiae, and also in the more continuous and more developed median carina on pronotum and abdomen, and the slightly differing abdominal appendages of the male. It is evidently the commonest and most widely spread of the species of Bradynotes.

6. BRADYNOTES REFERTA, new species.

(Plate VI, fig. 10.)

Body similar in form to that of *B. hispida*, but with excessively sparse and feeble pilosity. Head full, the vertex gently tumid, the interspace between the eyes twice as broad as the narrowest part of the frontal

costa, the fastigium declivent, shallowly sulcate, with elevated rounded margins, continuous with the slightly elevated margins of the upper part of the frontal costa. The latter broad, subequal, feebly broadening below, much broader than the basal joint of the antennae, feebly sulcate in the male, and sparsely punctate; eyes not very large, slightly more prominent, and anteriorly slightly less truncate in the male than in the female; antennae about as long as (female) or a little longer than (male) the head and pronotum together. Pronotum subequal, but slightly enlarging posteriorly, especially in the female, with the faintest possible indications of lateral carinae in the male, the metazona, especially in the male, fully half as long as the prozona, the sulci of the latter scarcely less distinct than the principal sulcus, and similar, cutting the median carina, which is often but not always obsolete between the sulci and sometimes over the whole prozona; exposed portion of mesonotum fully half (female) or less than half (male) as long as the metanotum. Interspace between the mesosternal lobes fully equal to the lobes themselves (male, female), the metasternal interspace half (male) or much more than half (female) as wide as the mesosternal. Fore and middle femora considerably tumid in the male; hind femora moderately stout, about two and a half times as long as the pronotum. Abdomen with a distinct median carina, a little compressed, in the male tapering from the base, scarcely enlarged apically, but considerably upturned; supraanal plate of male fully as long as its basal breadth, dorsally ridged as in *B. obesa*; no furcula; cerci slightly longer than the supraanal plate, slightly compressed but externally tumid, tapering on the basal half, the apical subequal, moderately stout, slightly down-curved and rounded at the extremity; infracercal plates produced on the inner side nearly to the extremity of the supraanal plate.

General color and markings much as in *B. obesa*, but with lighter colored antennae, and with the upper half of the lateral lobes of the pronotum very dark, generally forming a distinct broad band in marked contrast to the lower half of the same, and in the female in contrast to the somewhat lighter griseous disk of the pronotum, the band crossing the metazona as well as the prozona. There is no red coloring upon the pronotum. Hind femora and tibiae as well as abdominal appendages similar in color to *B. obesa*, but the hind femora more variable.

Length of body, male, 19 mm., female, 20.25 mm.; antennae, male, 7.5 mm., female, 7 mm.; pronotum, male, 4 mm., female, 4.1 mm.; hind femora, male, 10 mm., female, 10.25 mm.

Two males, 3 females. Soldier, Logan County, Idaho (L. Bruner); mountains near Lake Tahoe, California, Captain Wheeler's expedition of 1876.

7. BRADYNOTES SATUR, new species.

(Plate VII, fig. 1.)

Body entirely similar to *B. pinguis* in form and vestiture. Head full, the vertex scarcely (male) or considerably (female) tumid, the interspace between the eyes much greater than the narrowest part of the

frontal costa, but not nearly twice so broad, the fastigium very strongly declivent, sulcate, with prominent lateral ridges which apically diverge slightly; frontal costa broad, considerably broader than the basal joint of the antennae, not constricted above, more or less sulcate, especially in the male, fading just below the ocellus, and very feebly punctate; eyes not very large, more prominent in the male than in the female, and roundly truncate anteriorly, alike in both sexes, but only in the male as long as the infraocular portion of the genae; antennae considerably longer (male) or somewhat shorter (female) than head and pronotum together. Pronotum regularly enlarged posteriorly, a little more in the female than in the male, with no trace of lateral carinae, the prozona fully twice (male) or nearly thrice (female) as long as the metazona, its approximated sulci similar to but less distinct than the principal sulcus, and like it continuous, the median carina hardly existing except on the metazona, where it is feeble; exposed part of mesonotum about half as long as the metanotum (male, female), the posterior border of the latter slightly (male) or distinctly (female) emarginate. Interspace between mesosternal lobes considerably wider than (male) or twice as wide as (female) the lobes themselves, the metasternal interspace nearly as great. Fore and middle femora very slightly tumid in the male, the hind femora moderately slender, nearly two and a half times as long as the pronotum. Abdomen stout with a distinct but slight median carina in the male, tapering on the basal half, hardly enlarging apically but considerably upturned; supraanal plate of male small, triangularly shield-shaped, broader than long, apically angulate, with an unimportant sulcate median ridge on basal half meeting a transverse ridge, beyond which it is depressed; no furcula; cerci very short, conical, blunt, not reaching beyond the middle of the supraanal plate; infracercal plates large, mesially ridged, reaching as far as the supraanal plate.

Body griseo-fuscous, flecked and tinted with sordid luteo-fuscous, lighter beneath, darker above. The vertex and mesial parts of the fastigium are fuscous, the lateral ridges of the latter lighter colored, but without a trace of red. The lower half of the lateral lobes of the pronotum are as light as the under surface, and the upper half as dark as any other part of the body, so as to form a faint dark band, but the contrasts are not great; the meso- and metanota, and the posterior borders of the abdominal segments are nearly black; the antennae are sordid luteous at the base, fuscous beyond. Hind femora externally clouded and feebly twice banded obliquely with fuscous; hind tibiae very dull luteous, clouded apically with fuscous in the female, the spines black or brown tipped.

Length of body, male, 18 mm., female, 28 mm.; antennae, male, 7.25 mm., female, 8 mm.; pronotum, male, 3.25 mm., female, 4.6 mm.; hind femora, male, 8.5 mm., female, 11.5 mm.

One male, 1 female. Placer County, California, September (U.S.N.M. [No. 722].—Riley collection).

This species is remarkable for the slenderness of the fore and middle femora of the male and the brevity of the cerci, exposing so fully the infracercal plates; it has considerably longer hind legs than *B. referta*, which it most resembles in general appearance.

20. DENDROTETTIX.

(*Δένδρορον*, a tree; *τέριτζ*, a grasshopper.)

Dendrotettix RILEY, Proc. Ent. Soc. Wash., I (1888), p. 86—name only; Ins. Life, V (1893), pp. 254-255.

Body stout, compact, transversely subquadrate, thinly pilose. Head large, broad, a little prominent, with the eyes fully as wide, at least in the male, as the length of the lateral carinae of the metazona, the summit well arched, raised a little above the level of the pronotum, the fastigium rapidly descending and forming an obtuse angle with the very straight and slightly receding face; eyes rather small but very prominent in both sexes, nearly as broad as long and no longer (female) or scarcely longer (male) than the anterior infraocular portion of the genae; interspace between the eyes exceptionally broad, in the female nearly as broad as the upper aspect of the eyes; fastigium feebly convex as far as the front margin of the eyes, in front of which it is depressed; frontal costa only moderately broad, much narrower than the interspace between the eyes, obsolescent below the ocellus; owing to the breadth of the face, the lateral carinae are more than usually divergent; antennae slender, long, about half as long as the body, even in the female. Pronotum feebly subsellate, the anterior margin flaring to receive the head, and the metazona both expanding and having its dorsum raised at a slight angle with the prozona; front margin slightly convex; hind margin slightly more convex, feebly emarginate, even in the macropterous forms; disk of prozona feebly convex transversely, of metazona plane, passing with a distinct angle into the vertical lateral lobes, more distinct on metazona than on prozona, so that, at least on the metazona, there are distinct lateral carinae, besides a well-defined percurrent, median carina; prozona smooth excepting its subrugose anterior margin, subtransverse, half as long again as the punctatorugulose metazona, cut rather deeply in the middle by a straight transverse sulcus, followed at less than half the distance to the metazona by a still deeper, scarcely arcuate, percurrent sulcus, from which there runs backward, on the middle of either side, a short impressed line. Prosternal spine stout, erect, conical; meso- and metastethia together distinctly longer than broad in both sexes, rapidly narrowing behind, so that the portion posterior to the metasternal lobes is only about half the greatest width of the metastethium; interval between the mesosternal lobes in both sexes distinctly transverse, broader than the lobes themselves; metasternal lobes rather distant (male) or distant (female), at least as widely separated as the breadth of the frontal costa. Tegmina fully developed or abbreviate, their inner edges in neither

case attinent at the base, at least in the female, in macropterous forms of exceptional breadth, especially in the distal half, broadly rounded apically, in micropterous forms no longer than the pronotum, well rounded apically.¹ Fore and middle femora a little tumid in the male; hind femora not very long nor stout, subcompressed; hind tibiae with nine to eleven, usually ten, spines in the outer series; arolium of unusual size. Extremity of the male abdomen not clavate, but upturned and bluntly rounded, the lateral margins of the subgenital plate strongly amplified at the base, the plate itself of unequal and of narrow breadth, well rounded apically; cerci short, a little torquate, apically depressed; furcula obscure; ovipositor normally exerted.

A single species occurs from Illinois to Texas, a tree-inhabiting species, living upon oaks.

DENDROTETTIX QUERCUS.

(Plate VII, fig. 2.)

Dendrotettix quercus RILEY!, Proc. Ent. Soc. Wash., I (1888), p. 86 [undescribed].—PACKARD, Rep. U. S. Ent. Comm., V (1890), pp. 214–215 [descriptions of immature forms only].—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 28 [name only].

Dendrotettix longipennis RILEY MS. fide BRUNER!, Can. Ent., XXIII (1891), pp. 191–192 [undescribed].—BRUNER, Ins. Life, IV (1891), p. 20 [undescribed]; Bull. Div. Ent. U. S. Dep. Agric., XXVII (1892), p. 33 [undescribed].—RILEY!, Ins. Life, V (1893), p. 255 [first description].—BRUNER!, Bull. Div. Ent. U. S. Dep. Agric., XXVIII (1893), p. 14–15, fig. 4.

Dendrotettix longipennis var. *quercus* RILEY!, Ins. Life, V (1893), p. 256 [undescribed]. [Post-oak locust, BRUNER, Bull. Div. Ent. U. S. Dep. Agric., XIII (1887), pp. 17–19.]

Body flavous and flavo-testaceous, marked with piceous. Head, excepting summit, flavous, more or less infuscated or clouded with olivaceo-fuscous, the summit brownish testaceous, with very variable blackish markings, sometimes consisting of a median posterior dash, sometimes of a pair of divergent stripes, sometimes longitudinally combed with black; there is a broad and greatly widening black stripe behind the whole eye; front of fastigium very broadly sulcate; frontal costa and whole face very sparsely punctate, the former broadly sulcate as far down as and including the ocellus; antennae flavous, sometimes a little infuscated. Pronotum flavo-testaceous above, the metazona distinctly olivaceous, the median carina heavily marked in black; upper half or rather more of the lateral lobes with a piceous band, occasionally obsolescent on the metazona, and often distinct only at its upper and lower margins, especially the former, the remainder flavous; abdomen banded with black along the sides. Tegmina lighter or darker

¹In the United States National Museum there is a single female from Texas in which the tegmina extend a little more than halfway to the tip of the abdomen and are of a very different shape, the basal third gradually and normally broadening, but beyond tapering rather rapidly, so that the rounded tip is narrower than the base; it looks like an abnormal development.

testaceous, the veins more or less flavous; wings (according to Riley; I have not seen spread specimens) "rather dark, becoming somewhat pellucid near their base, the veins dusky, especially on the apical half." Fore and middle legs flavous; hind femora luteo-testaceous, sometimes suffused with sanguineous, with two broad fuscous bands, antemedian and postmedian, the inner and lower face sanguineous, the whole geniculation black, preceded by a lemon-yellow annulus; hind tibiae black at base, beyond flavo-luteous, often, with the exception of a post-basal annulus, more or less olivaceous, the spines, excepting their anterior base, black. Subgenital plate of male wholly black; supraanal plate long triangular, with slightly convex sides, the surface transversely arched, with a pair of approximate, slight, longitudinal ridges, meeting rather abruptly beyond the middle and inclosing a shallow basal sulcus, the sides of the plate with a median, transverse, pyramidal tubercle; furcula consisting of a pair of rather distant, very slight, triangular projections, overlying the submedian ridges; cerci very short, small, rather stout, twisted a half circle, apically depressed and the tip bluntly rounded; infracercal plates of exceptional size, very broad at base, gradually narrowing and reaching the tip of the supraanal plate.

Length of body, male, 24.25 mm., female, 29 mm.; antennae, male, 14 mm., female, 13 mm.; tegmina (long-winged), male, 21 mm., female, 23.5 mm.; (short-winged), male, 5 mm., female, 6 mm.; hind femora, male, 13.5 mm., female, 13 mm.

Six males, 11 females. Missouri (U.S.N.M. [No. 723].—Riley collection; L. Bruner); De Soto, Jefferson County, Missouri, July 8, T. Pergande (U.S.N.M. [No. 723]); Washington County, Texas, June (Bruner); Dallas, Texas (U.S.N.M. [No. 723]); Manor, Travis County, Texas, July 13, E. Hill (U.S.N.M. [No. 723]). It is said by Bruner to occur also in southeastern Nebraska, southern Iowa, and Illinois.

I have retained the name *quercus* rather than *longipennis* for this species for several reasons: It was first called by this name both by Riley and Bruner; it was first described in its earlier stages under this name by Packard (copying Bruner's description, which was unaccompanied by a name); and the name is a far more fitting one than *longipennis*, considering that the insect appears both in brachypterous and macropterous forms, and that it is normally brachypterous, as the basal divergence of the tegmina shows. It may also be called a mistake (in which entomologists generally have erred, myself among them) to give any species of Orthoptera a name derived from the length or brevity of the tegmina. On the other hand, indubitably the species was first fully described from mature examples under the name *longipennis*, a name given by Riley on the assumption that it was distinct from his earlier named *quercus*. As both names were given by the same naturalist, no personal question enters, and I trust that in this settlement of the question at its first raising all will agree.

Our knowledge of the natural history of this species depends almost entirely upon what Bruner wrote in his first account of it in 1887, before it was named. He found it in destructive numbers in Washington County, Texas, feeding upon the post oak and "completely defoliating the trees of the forest even to the very topmost twigs." He gives the following account of its history and habits:

The egg pods are deposited in the ground about the bases of trees or indifferently scattered about the surface among the decaying leaves, etc., like those of all other ground-laying species. The young commence hatching about the middle of March, and continue to appear until into April. After molting the first time and becoming a little hardened they immediately climb up the trunks of the trees and bushes of all kinds and commence feeding upon the new and tender foliage. They molt at least five or six times, if we may take the variation in size and difference in the development of the rudiments of wings as a criterion. The imago or mature stage is reached by the last of May or during the first part of June.

The species is very active and shy in all its stages of growth after leaving the egg. The larva and pupa run up the trunks and along the limbs of trees with considerable speed, and in this respect differ considerably from all other species of locusts with which I am acquainted. I am informed that the mature insects are also equally wild and fly like birds. They feed both by day and night; and I am told by those who have passed through the woods after night, when all else was quiet, that the noise produced by the grinding of their jaws was not unlike the greedy feeding of swine.

The colors of the insect in life during the early stages are given in the same place by Bruner and copied by Packard.

Riley had previously reared the species in Missouri on oaks.

21. PODISMA.

(Ποδισμός, measuring by feet.)

Podisma LATREILLE, Cuvier, Règne Anim., V (1829), p. 188.

Pezotettix BURMEISTER, Germar, Zeitschr. Ent., II (1840), p. 51.

Form of body and of head as in *Melanoplus*; antennae as there, but rarely (*Podisma variegata*, e. g.) they are as long as the hind femora. Pronotum variable, but always short, sometimes subcylindrical, sometimes (and especially in the female) expanding considerably from in front backward, never mesially contracted, generally with very feeble transverse sulci, the lateral lobes obliquely truncate apically on the anterior section; front margin truncate, hind margin usually subtruncate or truncate and even emarginate, but sometimes also very obtusangulate, the prozona generally considerably longer than the metazona, sometimes twice as long, smooth or very faintly punctate, the metazona generally very densely punctate; median carina distinct, but sometimes slight on the metazona, generally feeble sometimes obsolete on the prozona; lateral carinae very variable, the disk sometimes passing quite insensibly into the lateral lobes, sometimes so abruptly and angularly as to form tolerably distinct lateral carinae. Prosternal spine always prominent, generally bluntly conical; meso- and metastethia together, at least in the male and nearly always in both sexes, distinctly longer than the width of the metastethium, the latter narrowing posteriorly, so that the

portion behind the metasternal lobes is not (or is hardly) more than half the greatest width of the metastethium and is twice as broad as long; interspace between mesosternal lobes of male distinctly transverse,¹ as broad or almost as broad as the lobes themselves; of the female distinctly or strongly transverse, often fully twice as broad as long, generally as broad as and sometimes broader than the lobes themselves; metasternal lobes of male generally distinctly distant, occasionally approximate, never attingent; of the female generally more distant, the interspace in the latter sex generally as broad as or broader than the frontal costa. Tegmina never fully developed, often wholly wanting, and when present either lateral, and then generally shorter than the short pronotum, or else attingent or overlapping, and then at most reaching the middle of the hind femora, and usually subacuminate. Hind femora moderately long and slender, the inferior genicular lobe as in *Melanoplus* and the spines of the hind tibiae generally rather fewer than in that genus, nine to eleven, by exception eight or twelve, in number in the outer series. Abdomen more or less compressed, the sides of the first segment with or (in some apterous Old World forms) without a distinct tympanum, the extremity in the male more or less clavate and recurved; subgenital plate of very variable form, often prolonged to a distinct apical conical tubercle involving the apical margin, the lateral margins basally ampliate; cerci very variable, but to a less degree than in *Melanoplus*, not infrequently styloform, of variable length; furcula usually developed, but only at most to a small degree; ovipositor of female variable, typically exserted, but sometimes exceptionally extended and at others partially withdrawn in the then obtusely terminating abdomen.

The limits between this genus and *Melanoplus* are difficult to formulate; while there is no difficulty in separating the bulk of the species in either group, there are a number which find their place almost equally well in either. I have here attempted to state anew the characters first expressed by Stål, though with such necessary modifications and expansions as a far larger series of forms entails. I can hardly hope that the conclusions I have reached will be sustained at every point, but I am confident that they must hold in the main. In doubtful cases I have endeavored to determine the affinities from the concurrent study of both sexes and not from either alone, which would have brought about other and sometimes discordant results; and I have assigned the greatest weight to the intervals between the sternal lobes.

As I have here employed a different generic term from that in current use in literature, I submit the following cogent reasons for the necessity of the change:

The generic name *Podisma* was proposed in a Gallic form (*Podisme*)

¹ A single exception is known to me in the subapterous Japanese *Podisma dairisana*, where it is slightly longitudinal.

by Latreille¹ in 1825 for short-winged Acridians with a prosternal spine, without specification of species. Its next use was by the same author in 1829² in its proper Latin form, and the European species now known as *Pezotettix pedestris* and *Platyphyma giornae* referred to it. The same two species, and these only, are again referred to *Podisma* by Serville³ in 1831, and to the same as a subgenus of *Acridium* by the same writer in 1839.⁴ Burmeister,⁵ however, in 1840, refers these same species, and these only to a new genus *Pezotettix*, to which he gives as a synonym "Podisma Latreille ex parte." In Burmeister's view the other portion of Latreille's genus included such species as *Stenobothrus parallelus* and *Chrysochraon dispar*.⁶ But these latter species are excluded by Latreille's definition, and in his writings I can not find that he has ever mentioned any other species as appertaining to the genus than the two first mentioned above.

The only other authors who had at this time employed the term were Brullé⁷ in 1832, who (as quoted by Fischer) referred to it only species of *Stethophyma* and *Stenobothrus*; Heyer,⁸ who in 1835 (?) employed it for *Chrysochraon dispar*; Stephens,⁹ who in 1835 had referred *pedestris* only to it; and Costa,¹⁰ who in 1836 had referred to it four supposed new species—*appulum*, *campanum*, *calabrum*, and *communis*, the first two of which are now regarded as synonyms of *Acridium aegyptium* L., the third as probably a Pamphagus, and the last as *giornae*. In view of the limitation of the genus by Serville (if Latreille ever intended its greater extension), this action of Brullé and of Costa has no force, and hence, if the name *Pezotettix* can be retained at all, it must be by regarding one of the two original species as the type of *Pezotettix*, the other of *Podisma*.

As far as I can discover, the first author to refer the two species to distinct genera was Fieber,¹¹ who in June, 1853 referred *giornae* to his new genus *Pelecyclus*, and *pedestris* to *Podisma*. Also in 1853, but later, his introduction being dated November, H. Fischer¹² referred the former species to his new genus *Platyphyma* and the latter to *Pezotettix*. Fischer has been generally followed, but it is plain that *Platyphyma* must give way to *Pelecyclus*, which in its turn must yield precedence to *Pezotettix*, of which *giornae* becomes the type, while *pedestris* becomes the type of *Podisma*.

¹Fam. Nat., p. 415.

²Cuvier, Règne Anim., V, p. 188.

³Rev. Méth. Orth., pp. 98-99.

⁴Hist. Nat. Orth., pp. 679-681.

⁵Germar, Zeitschr. Ent., II, p. 51.

⁶Compare Handb. Ent., II, p. 650, where "Podisma Latreille ex parte" is given as the equivalent of certain unnamed divisions.

⁷Exp. Morée.

⁸Germar, Faun. Ins., fasc. 17.

⁹Illustr., Mand., VI, p. 29.

¹⁰Faun. Reg. Nap., pp. 43-48.

¹¹Lotos, III, p. 119.

¹²Orth. Eur., pp. 369, 374.

The early use of the term *Podisma* previous to 1853 and after 1829 (other than given above) also sufficiently confirms the appropriateness of restoring *Podisma* for the species now generally included in *Pezotettix*; for Fischer de Waldheim¹ in 1846 used it for six species, of which the first three belong to *Pezotettix* of modern writers, the next two to *Chrysochraon*, while the last is not recognizable; von Borek in 1848² refers to it *pedestris* and *frigida*; and finally H. Fischer himself first used it in 1849³ for *frigida*. His reasons later⁴ for supplanting *Podisma* by *Pezotettix* can not be defended.

The type of *Podisma* is therefore *Gryllus pedestris* Linnaeus.

This genus is more widely extended than any other of the Melanopli, being the only one not confined to America. It is a distinctly boreal type and encircles the globe. The species are largely confined to high altitudes as well as high latitudes, a number being alpine or subalpine in their respective localities. In this country the species are known from two widely separated regions; in the west, the Rocky Mountain region from Alberta to northern New Mexico; and in the east from western Ontario and New York to Maine. In Europe they are largely confined to the mountains of southern Europe from the Pyrenees to Mount Parnassus or to Scandinavia; in Asia their distribution is less known, but species occur in eastern Siberia and in Japan.

In the following pages I have fully described only the American species, which are first treated separately; but I have thought well to complete the account of the Melanopli by including the Old World species as far as possible, figuring their abdominal appendages, giving a separate table for their determination, and adding brief diagnoses of two species which are unpublished. Their synonymy and distribution are mostly compiled from Brunner's Prodrömus Eur. Orthopteren.

ANALYTICAL KEY TO THE AMERICAN SPECIES OF PODISMA.

A¹. Tegmina wanting; upper valves of ovipositor elongate, straight, only faintly falciform apically; hind border of pronotum truncate or feebly emarginate.

b¹. Hind femora almost uniformly green; furcula of male extending over the supraanal plate by twice the length of the last dorsal segment; cerci relatively stout, in the middle distinctly more than half as broad as the base.

1. *glacialis* (p. 98).

b². Hind femora conspicuously fasciate with fuscous; furcula of male extending over the supraanal plate by not more than the length of the last dorsal segment; cerci very slender, in the middle distinctly less than half as broad as the base.

2. *variegata* (p. 101).

A². Tegmina present, abbreviate; upper valves of ovipositor distinctly falciform apically.

b¹. Hind border of pronotum distinctly angulate; tegmina overlapping, generally distinctly longer than the pronotum.

c¹. Tegmina distinctly overlapping, much longer than the pronotum; male cerci short and broad, hardly if at all more than twice as long as the middle breadth; subgenital plate as seen from behind more or less broadly truncate.

¹Orth. Russ., pp. 249-253.

²15 Jahresb. Mannh. ver. nat., p. 38.

³Skand. ritv. ins. nat. hist., pp. 87-92.

⁴Orth. Eur., p. 365, note.

- d*¹. Male cerci straight as seen laterally; furcula feebly developed, no longer than the last dorsal segment from which it springs; hind tibiae uniform red.
3. *nubicola* (p. 102).
- d*². Male cerci arcuate as seen laterally; furcula well developed, crossing fully a third of the supraanal plate; hind tibiae red with a broad pale basal annulus..... 4. *stupefacta* (p. 104).
- e*². Tegmina faintly overlapping, scarcely if any longer than the pronotum; male cerci slender, many times longer than the middle breadth; subgenital plate as seen from behind broadly conical, acute..... 5. *dodgei* (p. 105).
- b*². Hind border of pronotum broadly rounded or subtruncate, not angulate; tegmina at most subattingent, generally distinctly separated, no longer or scarcely longer than the pronotum.
- e*¹. Furcula not more than a fourth as long as the supraanal plate; subgenital plate with the lateral and apical margins in the same horizontal plane; interspace between mesosternal lobes of male fully or more than half as broad again as long.
- d*¹. Cerci of male slender, many times longer than the middle breadth; hind tibiae pale red 6. *ascensor* (p. 107).
- d*². Cerci of male broad, hardly more than twice as long as the middle breadth; hind tibiae fusco-glaucous..... 7. *marshallii* (p. 108).
- e*². Furcula nearly half as long as the supraanal plate; subgenital plate apically elevated; interspace between mesosternal lobes of male less than half as broad again as long..... 8. *oregonensis* (p. 110).

I. PODISMA GLACIALIS.

(Plate VII, Fig. 3.)

Pezotettix glacialis SCUDDER!, Bost. Journ. Nat. Hist., VII (1863), pp. 630-631, pl. XIV, figs. 9, 10.—SMITH, Proc. Portl. Soc. Nat. Hist., I (1868), p. 149.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 148.—SCUDDER!, Hitchc., Rep. Geol. N. H., I (1874), p. 374, pl. A, figs. 5, 10.—STÅL, Bih. K. Sv. Vet.-Akad. Handl., V, no. 9 (1878), p. 15.—GIRARD, Traité élém. d'ent., II (1879), p. 246.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.—RILEY, Stand. Nat. Hist., II (1884), p. 202.—FERNALD, Orth. N. E. (1888), p. 29; Ann. Rep. Mass. Agric. Coll., XXV (1888), p. 113.—MORSE, Psyche, VII (1894), p. 106.

Podisma glacialis WALKER, Cat. Salt. Brit. Mus., Suppl., V (1871), p. 72.

Pezotettix borealis GLOVER, Ill. N. A. Ent., Orth. (1872), pl. VI, figs. 16-18.

Dark olivaceous green above, greenish-yellow beneath in life, often in drying becoming ferruginous, clothed thinly with rather long pile. Head yellowish green with a greenish streak down the middle of the frontal costa, above dark olivaceous green; labium, maxillae, tip of labrum, and of clypeus pale bluish white, the palpi yellow with the terminal joint apically rimmed with brown, the mandibles black at tip and extreme base; vertex gently tumid, feebly elevated above the pronotum, the interspace between the eyes as broad (male) or twice as broad (female) as the first antennal joint; fastigium moderately declivent, straight, and not arcuate, in the male lying below the upper level of the eye so as to be hidden on a side view, shallowly (male) or very shallowly (female) sulcate, broadening anteriorly, especially in the male; frontal costa percurrent or almost percurrent, equal, as broad as (male) or distinctly narrower than (female) the interspace between the eyes,

sulcate throughout at least in the female and rather deeply below the ocellus, very feebly and sparsely punctate; eyes of moderate size, moderately prominent especially in the male, not at all elongate, but as long (male) or almost as long (female) as the infraocular portion of the genae; antennae yellowish brown, paler below, darkest at tip, greenish toward the base, almost as long (male) or three-fourths as long (female) as the hind femora. Pronotum subequal, faintly constricted mesially in the male, and faintly (male) or slightly (female) expanding on the metazona, dark olivaceous green, the lateral lobes bright greenish yellow below, with the principal sulcus marked in black and terminating below in a small black spot; above with a broad piceous postocular band which traverses the head and pronotum, expanding posteriorly on the metazona and continued interruptedly on the abdomen as a series of dark transverse streaks at the base of the segments; disk of pronotum strongly convex, passing insensibly into the vertical lateral lobes; median carina feeble, dull, percurrent, equal; front margin faintly convex with a minute mesial emargination; hind margin subtruncate with a broad but very feeble emargination; prozona longitudinal (male) or quadrate (female), nearly twice as long as the faintly punctate or smooth metazona. Prosternal spine short, blunt, conical; interspace between mesosternal lobes somewhat less than half as broad again as long (male) or nearly twice as broad as long, about as broad as the lobes (female), the metasternal lobes approximate (male) or almost as distant as the mesosternal (female); prosternum dusky, the spine tipped with brown, the rest of the sternum greenish yellow. Tegmina wanting. Fore and middle femora very tumid in the male, distinctly shorter than in the female; hind femora rather slender, compressed, yellowish grass green, broadly but very obscurely bifasciate with dark olivaceous green, the under surface and lower half of inner surface coral red, the geniculation black; hind tibiae green, the spines black nearly to their base, eight to eleven, usually nine to ten, in number in the outer series. Abdomen hardly (male) or distinctly (female) compressed, with a distinct though dull median carina, dark olivaceous green (female) or as described below (male), the sides of the first segments with a distinct tympanum, the extremity in the male a little clavate, much recurved, the supraanal plate triangular with acutangulate apex, the sides mesially contracted and but slightly elevated, the median sulcus distinct, deep, percurrent between rather stout walls; furcula consisting of a pair of approximate, very slender and tapering, acuminate black spines, crossing the basal fifth or less of the supraanal plate; cerci black, long, erect, externally tumid except at the dimpled apex, not strongly compressed, tapering in the basal half to two-thirds the basal breadth, beyond feebly expanding to a very slight degree, apically rounded but inferiorly angulate, the whole a little longer than the supraanal plate and straight, being neither arcuate nor incurved; subgenital plate very short and broad, broadly

conical, ending in a blunt but not large tubercle, the apical margin scarcely elevated, angulate, entire.

The colors of the above description, which are taken from life, are, unless otherwise specified, drawn entirely from the female, as the sexes differ considerably. The male differs in the following particulars: The front of the head and the pronotum are more yellowish, the prosternum black, the spine uniform pale green, the meso- and metasterna bright green, the sternum of the abdomen yellowish-green, slightly paler than the thorax, with the basal border of the segments broadly bordered with black and the apical narrowly with fuscous; the whole dorsal surface of the abdomen is black with a mediadorsal series of yellowish-green spots and a triangular spot of the same between the middle and hind coxae; a lateral row of greenish-yellow spots on the first eight abdominal segments, each with a dark arcuate streak above it, opening toward the brownish spiracles.

Length of body, male, 16 mm., female, 26 mm.; antennae, male, 8.5 mm., female, 9 mm.; hind femora, male, 9.25 mm., female, 12 mm.

Twenty-one males, 37 females. Maine (U.S.N.M. [No.724].—Riley collection); Magalloway River, Oxford County, Maine, Sanborn (Museum Comparative Zoology); Speckled Mountain, Oxford County, Maine, 2,000 feet (?), S. I. Smith; same (A. P. Morse); Mount Kearsarge, New Hampshire, 3,250 feet (A. P. Morse); Presidential Range, White Mountains, New Hampshire, 4,000 to 5,400 feet (S. H. Scudder; Museum Comparative Zoology; A. P. Morse); Greylock, Berkshire County, Massachusetts, 3,500 feet (A. P. Morse; S. H. Scudder); Mount Marcy, Adirondacks, New York, 5,400 feet, F. G. Sanborn; Chateaugay Lake, Adirondacks, New York, 2,000 feet, F. C. Bowditch; Sudbury, Ontario, Canada, about 1,000 feet.

Excepting Jackman, Maine (Harvey), the only other place from which it has been reported is "British America" (Bruner), but without further specification Professor Bruner now thinks this was a mistake. Mr. Morse tells me that he has specimens taken on Kataadn, Maine, 5,200 feet.

In the White Mountains I have found this grasshopper from the neighborhood of the snow arch in Tuckermans Ravine (about 4,000 feet) to the base of the rocky slopes on the side of Mount Washington above the Alpine Garden, and at the summit of Mount Madison (5,380 feet) at about the same elevation. I have also taken it at the upper limits of Huntingtons Ravine and about the ledge on the carriage road. It frequents the close branches of the dwarf birch, *Betula nana*, and is rarely or never seen on the ground.

Of the European insects, it is most nearly allied to *Pod. baldensis*, but is a considerably larger insect, with heavier and stouter cerci and slenderer and longer furcula.

2. *PODISMA VARIEGATA*, new species.

(Plate VII, fig. 4.)

Pezotettix glacialis COMSTOCK!, Intr. Ent., 1888, p. 107.

Pallid testaceous with an olivaceous tinge, variegated with dark glistening fuscous or chocolate brown in which also an olivaceous tinge may be detected, pilose. Head pallid olivaceo-testaceous, blotched with olivaceo-fuscous on the genae, and heavily infuscated above, with a broad postocular olivaceo-fuscous band; vertex somewhat tumid, slightly elevated above the pronotum, the interspace between the eyes a little broader than (male) or twice as broad as (female) the first antennal joint; fastigium considerably declivent, straight, and not arcuate, in the male lying below, in the female at, the upper level of the eyes so as not to be wholly seen on a side view, a little sulcate, abruptly and angularly expanded a little anteriorly; frontal costa failing to reach the clypeus, subequal, but faintly contracted at the ocellus and as faintly expanding between the antennae, as broad as (male) or slightly narrower than (female) the interspace between the eyes, sulcate excepting above, sparsely punctate above; eyes rather small, very prominent in the male, but little longer than broad, about as long as (male) or a little shorter than (female) the infraocular portion of the genae; antennae lighter or darker olivaceo-fuscous, distinctly longer in the male than the hind femora. Pronotum subequal, faintly subselliform in the male, expanding feebly posteriorly in the female, the disk dull bronze clivaceous in the female, pallid testaceous with a mediodorsal, irregular but not broad, dark chocolate fuscous stripe and dark transverse sulci in the male, the lateral lobes glistening pale testaceous below, above with a very broad, percurrent, glistening brownish fuscous band, in the female deeply tinged with olivaceous; disk strongly convex, passing insensibly into the vertical lateral lobes; median carina slight, percurrent, equal; front and hind margins truncate, the latter feebly emarginate mesially; prozona quadrate in both sexes, sparsely, feebly, and rather coarsely punctate (particularly in the male and posteriorly), twice (male) or almost twice (female) as long as the obscurely, finely, and not densely punctate metazona. Prosternal spine short, blunt, conical; interspace between mesosternal lobes a little transverse and nearly or quite as broad as the lobes (male) or twice as broad as long, fully as broad as the lobes (female), the metasternal lobes approximate (male) or distant, but much less so than the mesosternal (female). Tegmina wanting. Fore and middle femora somewhat tumid in the male and distinctly shorter than in the female, dark olivaceous; hind femora flavo-testaceous, broadly trifasciate with blackish fuscous, besides a blackish geniculation, the under surface pale or dull coral red; hind tibiae bronze green or olive green, the spines black almost from their base, ten, rarely eleven, in number in the outer series. Abdomen hardly (male) or distinctly (female) compressed, with a distinct median

carina, ferrugineo-testaceous, becoming lighter below, obscurely punctate with fuscous (female) or flavo-testaceous above, flavo-olivaceous below, the sides heavily marked with glistening blackish chocolate (male); sides of the first segment with a distinct tympanum; extremity in the male clavate, considerably recurved, the supraanal plate triangular with subrectangulate apex, the sides scarcely elevated and feebly emarginate in the middle, the median sulcus moderately deep, percurrent, subequal, and moderately broad, raised much above the general surface by the considerable elevation of its bounding walls; furcula consisting of a pair of approximate, short, tapering, black spines, hardly longer than the last dorsal segment; cerci castaneous, black-tipped, suberect, very long and very slender, tapering in the basal fourth, beyond distinctly less than half as broad as the base and subequal, feebly expanding apically solely by the curve of the upper margin, the apex inferiorly angulate, the whole a little longer than the supraanal plate and straight except for being feebly incurved; subgenital plate small, about equally broad and long, its apex a little tumid, the apical margin not elevated, well rounded, entire.

Length of body, male, 16.5 mm., female, 23.5 mm.; antennae, male, 10.5 mm., female, 8.5+ mm.; hind femora, male, 9.25 mm., female, 12.75 mm.

Two males, 1 female. Ithaca, Tomkins County, New York, about 400 feet, November, J. H. Comstock; Enfield Falls, Tompkins County, New York, about 450 feet (H. O. Woodworth). The specimens were taken in each case on the banks of streams.

Since this was written, E. M. Walker has sent me drawings of this species from specimens taken at De Grassi Point on Lake Simcoe, about 50 miles north of Toronto, Canada.

This species differs from the preceding not only in coloring and markings, but in the greater length of the antennae and hind legs, the brevity of the furcula, and the slenderness of the cerci.

3. *PODISMA NUBICOLA*, new species.

(Plate VII, fig. 5.)

Melanoplus monticola BRUNER! MS. (pars).

Cinereo-fuscous. Head varying from testaceous to plumbeous, more or less infuscated, above blackish fuscous in a posteriorly broadening mesial stripe, a supraocular belt and a postocular band, sometimes run together; vertex tumid, considerably elevated above the pronotum, the interspace between the eyes almost (male) or fully (female) twice as broad as the first antennal joint; fastigium moderately declivent, broadly and distinctly sulcate, less deeply in the female than in the male; frontal costa feebly expanding and fading before the clypeus, faintly narrowed above, slightly (male) or distinctly (female) narrower than the interspace between the eyes, sulcate at and below the ocellus (but feebly in the female), heavily punctate throughout; eyes small, faintly promi-

ment in the male, no longer (male) or distinctly shorter (female) than the infraocular portion of the genae; antennae luteous or luteo castaneous, heavily infuscated apically, two-thirds (male) or hardly half (female) as long as the hind femora. Pronotum feebly constricted mesially, cinereo-fuscous more or less infuscated, sometimes punctate with fuscous, pilose, the lateral lobes of the prozona distinctly tumid above and piceous or blackish fuscous, the disk considerably convex, particularly on the prozona, and passing into the subvertical lateral lobes by a well-rounded shoulder, which is distinctly angulate on the metazona only, forming blunt lateral carinae; median carina percurrent, marked in black, distinct throughout but more elevated and longitudinally arched on the metazona and sometimes subobsolete between the sulci; front margin faintly convex, hind margin obtusangulate, the angle well rounded; prozona quadrate, only a little if any longer than the rather sparsely and shallowly punctate metazona. Prosternal spine short, very stout, appressed conical, very blunt; interspace between mesosternal lobes a little broader than long (male) or fully half as broad again as long but narrower than the lobes (female), the metasternal lobes subattinent (male) or about half as distant as the mesosternal lobes (female). Tegmina reaching to about the middle of the hind femora, overlapping, rapidly tapering but apically well rounded, cinereo-fuscous often with a vinous tinge, generally heavily flecked with blackish fuscous, particularly but not exclusively in the discoidal area. Fore and middle femora somewhat tumid in the male; hind femora testaceous or flavo-testaceous, on the upper half obliquely and rather broadly bifasciate with fuscous or blackish fuscous, besides a basal spot of the same and an infuscated or piceous upper genicular lobe, the inferior face flavous; hind tibiae pale red brightening apically, the spines black in their apical half, nine to eleven, usually ten, in number in the outer series. Extremity of male abdomen clavate, somewhat recurved, the supraanal plate triangular with acutangulate apex, nearly plane surface, with a moderately broad and equal median sulcus, gradually fading beyond the middle; furcula consisting of a pair of very slender tapering parallel fingers, extending over the outer sides of the submedian ridges of the supraanal plate by about the length of the last dorsal segment; cerci stout and thick, subequal, hardly tapering blades, about twice as long as broad, nearly straight but faintly arcuate, well rounded apically, very faintly twisted with a feeble sulcation or compression sometimes apparent along the upper outer margin of the apical half; subgenital plate rather small, of about equal length and breadth, the apical margin a little elevated, broadly truncate as seen from behind and entire, a feeble ridge descending from each extremity of the apical margin across the apical face.

Length of body, male, 16 mm., female, 19 mm.; antennae, male, 6.25 mm., female, 5 mm.; tegmina, male, 7.5 mm., female, 8 mm.; hind femora, male, 9.75 mm., female, 10.5 mm.

Ten males, 7 females. Mount Lincoln, Park County, Colorado, above timber, 11-13000 feet, August 13 (S. H. Scudder; L. Bruner). [U.S.N.M. No. 725, male and female.]

Bruner gave the unpublished name of *Melanoplus monticola* both to this species and to *M. monticola*, p. 290. All the specimens seen were taken by myself in 1877.

4. PODISMA STUPEFACTA.

(Plate VII, fig. 6.)

Pezotettix stupefactus SCUDDER!, Ann. Rep. Chief Eng., 1876 (1876), p. 503; Ann. Rep. Geol. Survey 100th mer., 1876 (1876), p. 283.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Cinereo-fuscous. Head light brown or yellowish brown, the upper half and sometimes the whole head mottled rather heavily, on the top of the head very heavily, with brownish fuscous, often becoming blackish in a median band on the top of the head and less distinctly above the upper edges of the eyes; vertex gently tumid, slightly elevated above the pronotum, the interspace between the eyes but little broader than (male) or fully twice as broad as (female) the first antennal joint; fastigium distinctly sulcate, most deeply in the male, with distinct and nearly straight, raised, lateral margins, which pass into the lateral margins of the frontal costa; the latter distinctly punctate next the margins like the whole of the face, nearly equal but slightly narrower above, the surface plane except for a slight, short, narrow sulcation at and below the ocellus; eyes of moderate size, not very prominent, the front margin subtruncate, rather longer (male) or distinctly shorter (female) than the infraocular portion of the genae; antennae brownish yellow, becoming dusky toward the tips, in the female a little more than three-fifths as long as the hind femora. Pronotum nearly plane above, the prozona with scarcely perceptible fullness, and on either side of the median carina, at the principal sulcus, a slight oblique depression; the whole pronotum broadens a little and regularly in passing backward, the posterior margin obtusely and roundly angulate; median carina distinct though slight on the metazona, inconspicuous excepting in front on the prozona, and in the female nearly obsolete; lateral carinae distinct, though not prominent; surface profusely punctate, almost rugulose on the metazona; the color is brownish-yellow, darkest on dorsum, and profusely flecked with darker colors; upper third or half of lateral lobes with a postocular brownish fuliginous belt, confined to the prozona, narrower at the extreme front; transverse sulcations distinct, only seldom, and then but slightly, marked with black. Prosternal spine short and very stout, very blunt, and subcylindrical (male) or conical (female); interspace between mesosternal lobes a little transverse (male) or half as broad again as long but narrower than the lobes (female), the metasternal lobes approximate (female) or only a little more than half as distant as the meso-

sternal lobes (female). Tegmina fully half as long as the abdomen, elongate, subfusiform, the tip roundly pointed, dark brown, more or less variegated with yellowish and blackish, the small spots showing a tendency to a longitudinal arrangement, most of the veins light; wings a little shorter than the tegmina. Fore and middle femora rather tumid in the male; hind femora light yellowish-brown, with a pair of conspicuous, submedian, V-shaped, dark brown or blackish bands externally, crossing the upper surface transversely, the extreme base and tip marked with the same color; hind tibiae yellow, the spines black to their base, 10 in number in the outer series. Abdomen yellowish beneath, mostly reddish-brown above, deepening into black, the extremity clavate and somewhat upturned in the male, the supraanal plate hastate, strongly constricted mesially, with elevated margins and obtusangulate tip, the median sulcus narrow, deep, and extending almost to the tip; furecula consisting of a pair of large, parallel, attingent, tapering, acuminate, flattened fingers, reaching nearly halfway across the supraanal plate; cerci short, very broad, nearly equal, strongly compressed, laminate, the tip broadly rounded, slightly incurved, so that the outer margin is broadly convex, the inner shallowly concave; subgenital plate broad and short, narrowing apically, the apical margin abruptly, slightly, and almost uniformly elevated above the lateral margins and set at right angles with them, feebly notched mesially.

Length of body, male, 17 mm., female, 20.5 mm.; antennae, male, female, 7.5 mm.; tegmina, male, 7.7 mm., female, 6.75 mm.; hind femora, female, 11.5 mm.

One male, 3 females. Taos Peak, Sangre de Cristo Mountains, northern New Mexico, 13,000 feet, Lieutenant W. L. Carpenter (S. H. Scudder; U.S.N.M. [No. 726].—Riley collection); Colorado, "Alpine," August (U.S.N.M. [No. 726].—Riley collection).

5. PODISMA DODGEI.

(Plate VII, fig. 7.)

Caloptenus dodgei THOMAS!, Can. Ent., III (1871), p. 168; Ann. Rep. U. S. Geol. Surv. Terr., V (1872), p. 451, Pl. II, figs. 4, 5, 9.—GLOVER, Ill. N. A. Ent., Orth. (1872), Pl. XI, figs. 4, 5, 9.

Pezotettix dodgei THOMAS!, Rep. U. S. Geol. Surv. Terr., V (1873), p. 153; Proc. Dav. Acad. Sc., I (1876), p. 259.—UHLER, Bull. U. S. Geol. Surv. Terr., III (1877), p. 796.—THOMAS, Ann. Rep. Chief Eng., 1878, p. 1845 (1878).—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59; Bull. Div. Ent. U. S. Dep. Agric., IV (1884), p. 57.—RILEY, Stand. Nat. Hist., II (1884), p. 202.—COCKERELL, Can. Ent., XXII (1890), p. 76.

Pezotettix bohemani STÅL!, Bih. K. Sv. Vet.-Akad. Handl., V (1878), No. 9, p. 15.

Pezotettix marshallii SCUDDER!, Appal., I (1878), p. 263.

Pezotettix aspirans SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 85-86; Cent. Orth. (1879), pp. 74-75.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Vertex gently tumid, slightly elevated above the pronotum, the interspace between the eyes considerably broader than the first antennal

joint, rather broader in the female than in the male; fastigium shallowly sulcate, subequal, the bounding walls low and coarse; frontal costa subequal, expanding at the base, very slightly sulcate above, more sulcate but not deeply below the ocellus, as broad as the interspace between the eyes, sparsely, coarsely, and biserially punctate; antennae about five eighths as long as the hind femora, slightly longer in the male than in the female. Pronotum very short and stout, simple, expanding a little on the metazona; prozona quadrate (male) or transverse (female), of the same length as the metazona; front margin truncate, hind margin gently angulated, more prominently in the female than in the male; median carina distinct but dull and equal on the metazona, obsolete on the prozona; transverse sulci of the prozona unusually distinct, continuous; lateral carinae distinct but rounded; disc punctate, distantly and rather faintly on the prozona, abundantly and rather coarsely but still faintly on the metazona. Prosternal spine short, stout, appressed conical, blunt, in the female subtransverse; interspace between mesosternal lobes fully half as broad again as long (male) or nearly twice as broad as long (female), the metasternal lobes approximate (male) or distant (female). Tegmina short subfusiform, scarcely longer than the pronotum, about twice as long as broad, the extremity produced but rounded, the inner edges not or faintly overlapping. Extremity of male abdomen clavate, considerably recurved, the supraanal plate triangular, perhaps a little longer than broad, the sides straight, the tip rounded, the surface subgibbose; furcula consisting of a pair of minute, triangular, blunt, rather distant teeth; cerci simple, regularly conical, compressed at base, blunt-tipped, considerably shorter than the supraanal plate; subgenital plate sharply upturned and tumid, short-conical, several times longer than broad, the extremity just below the entire apical edge produced to a blunt point.

The general color is blackish griseous, very obscurely mottled with testaceous above, dirty yellow tinged with ferruginous below; antennae pale red at base, much infuscated beyond; a quadrate piceous patch occupies the upper part of the lateral lobes upon the prozona, followed immediately below by a paler tint, and occasionally edged on the lateral carinae with dull testaceous. Tegmina with some of the veins of the dorsal field (for the anterior field is deflected) testaceous. Hind femora testaceous, conspicuously marked with black at base and tip, and by two moderately broad transverse bands, the premedian angulate; hind tibiae pale red, marked with fuscous toward the base, the spines black, ten to twelve, usually ten, in the outer series.

Length of body, male, 14.5 mm., female, 21 mm.; antennae, male and female, 5.5 mm.; tegmina, male, 4 mm., female, 5 mm.; hind femora, male, 8 mm. female, 8.8 mm.

Thirty males, 28 females. Colorado, Morrison, 13,000 feet (S. Henshaw; S. H. Scudder); Colorado, alpine, September (U.S.N.M.—Riley collection); Pikes Peak, Colorado, 12,000 to 13,000 feet, August 24 (S.

H. Scudder; U.S.N.M. [No. 727].—Riley collection); Sierra Blanca, Colorado, 12,000 to 13,000 feet, August 29; Georgetown, Clear Creek County, Colorado, 8,500 to 9,000 feet, July 12–13; North Park, Colorado (L. Bruner); Poudre River, Colorado, June (U.S.N.M.—Riley collection); Beaver Brook, Jefferson County, Colorado, 6,000 feet, July 11; Laramie, Albany County, Wyoming (L. Bruner); Wasatch Mountains near Beaver, Utah, August 1–4, E. Palmer.

It has also been reported from the mountain sides in Clear Creek Canyon, Colorado (Uhler), from Brush Creek, Colorado, 12,000 feet (Cockerell), from Colorado (Stål), and from Montana (Bruner).

I formerly compared this insect to the European *Podisma alpina* var. *montana*, but it should rather be compared to *Podisma pedestris* on account of its much shorter subgenital plate, though in its cerci it is more nearly related to the former; it can not be confounded with either, but is more nearly related to *Podisma pedestris* than to any other American type.

By the kindness of Doctor Aurivillius, of Stockholm, I have received one of the type specimens of Stål's *Pezotettix bohemani*, and been able to compare it with the types of the other nominal species mentioned in the synonymy.

6. PODISMA ASCENSOR, new species.

(Plate VII, fig. 8.)

Pezotettix dodgei SCUDDER!, Bull. U. S. Geol. Surv. Terr., II (1876), p. 261.

Brownish testaceous above, dull testaceous below. Head testaceous, feebly olivaceous, embrowned above; vertex feebly tumid, not elevated above the pronotum, the interspace between the eyes half as broad again (male) or nearly twice as broad (female) as the first antennal joint; fastigium moderately declivent, broadly and very shallowly sulcate; frontal costa percurrent, equal, a little narrower than the interspace between the eyes, feebly sulcate at and a little below the ocellus, faintly and finely biseriately punctate above; eyes of moderate size, not at all prominent, similar in the two sexes, anteriorly truncate, slightly longer, especially in the male, than the infraocular portion of the genae; antennae testaceous, apically infuscated, about two-thirds as long as the hind femora in both sexes. Pronotum feebly and regularly expanding posteriorly, with a more or less broken and irregular piceous postocular band confined to the prozona, the disk broadly convex and passing by a rounded shoulder, nowhere forming distinct lateral carinae, into the anteriorly tumid subvertical lateral lobes; median carina slight, percurrent, subequal but slighter on the prozona than on the metazona; front border truncate, hind border rotundato-obtusangulate; prozona longitudinally (male) or transversely (female) subquadrate, slightly (male) or scarcely (female) longer than the finely punctate metazona. Prosternal spine of moderate length, stout, conical, not very blunt; interspace between mesosternal lobes nearly twice as broad as long, but

narrower than the lobes in both sexes, the metasternal lobes approximate (male) or subapproximate (female). Tegmina distinctly (male) or scarcely (female) shorter than the pronotum, lateral, rather widely separated, subovate with rotundato angulate costal margin and subacuminate apex, brownish fuscous. Fore and middle femora no more tumid in the male than in the female; hind femora ferrugineo-testaceous, faintly and angularly bifasciate with fuscous, the under surface flavous, the genicular arc broadly piceous; hind tibiae pale yellowish red, with a fuscous patellar spot, the spines black almost to their base, ten to eleven in number in the outer series. Extremity of male abdomen a little clavate, slightly recurved, the supraanal plate triangular with acutangulate apex, the surface strongly but broadly tectate, the median sulcus broad, moderately deep, with very rounded walls, percurrent but partially interrupted beyond the middle; furcula consisting of a pair of rather slender, tapering and acuminate, parallel, approximate fingers a little longer than the last dorsal segment, overlying the submedian ridges of the supraanal plate; cerci small, simple, substyliform, a little compressed, considerably shorter than the supraanal plate, blunt-tipped or narrowly truncate; subgenital plate small, of about equal length and breadth, the lateral and apical margins in the same plane, entire, as seen from above strongly rounded, subangulate.

Length of body, male, 17 mm., female, 18.5 mm.; antennae, male, 6 mm., female, 6.6 mm.; tegmina, male, 3.1 mm., female, 4.5 mm.; hind femora, male, 9.5 mm., female, 10 mm.

One male, 1 female. American Fork Canyon, Utah, A. S. Packard.

This species is the nearest allied of the American forms to *Podisma pedestris* of Europe, but differs distinctly from it in the structure of the subgenital plate and the slender fore and middle femora of the male.

7. *PODISMA MARSHALLII*.

(Plate VII, fig. 9.)

Pezotettix marshallii THOMAS, Rep. Geogr. Surv. 100th mer., V (1875), pp. 889-890, pl. XLV, fig. 3.—SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), p. 86; Cent. Orth. (1879), p. 75.—BRUNER, Rep. U.S. Ent. Comm., III (1883), p. 59.

Brownish fuscous above, often more or less ferruginous, sordid testaceous beneath. Head fusco- or ferrugineo-olivaceous, more or less infuscated above (the infuscation sometimes confined to a pair of widening streaks), with a broader or narrower piceous postocular band; vertex gently tumid, scarcely or not elevated above the pronotum, the interspace between the eyes twice (male) or nearly thrice (female) as broad as the first antennal joint; fastigium broad, moderately declivent, scarcely sulcate; frontal costa rather prominent, fading before the clypeus, equal, much narrower than the interspace between the eyes, plane, irregularly punctate; eyes of moderate size, slightly prominent in the male, somewhat longer than the infraocular portion of the genae; antennae dark castaneous, becoming blackish fuscous apically, nearly three-fifths (male) or hardly a half (female) as long as the hind femora.

Pronotum subequal, feebly expanding on the metazona, especially in the female, the disk of the prozona often enlivened with the lighter colors of the face, the upper half of the lateral lobes of the prozona occupied by a piceous patch or band, sometimes broken in the female, the disk convex and passing into the vertical lateral lobes by a rounded shoulder, rarely angulate, without forming lateral carinae; median carina weak, percurrent, subequal, but slightly feebler on the prozona than on the metazona; front margin truncate, hind margin broadly rotundate, occasionally feebly angulate in the female; prozona slightly longitudinal (male) or slightly transverse (female), distinctly longer than the finely punctate metazona. Prosternal spine short and stout, scarcely tapering, very blunt, appressed; interspace between mesosternal lobes fully half as broad again as long (male) or about twice as broad as long, barely narrower than the lobes (female), the metasternal lobes approximate (male) or hardly half as distant as the mesosternal lobes (female). Tegmina about as long as the pronotum, moderately distant, elliptical, about twice as long as broad, apically subacuminate, fusco-ferruginous. Fore and middle femora considerably tumid in the male; hind femora moderately stout, testaceous often tinged with ferruginous, very obliquely bifasciate with fuscous, generally interrupted on the outer half of the upper face, the under face flavous, verging on orange, the geniculation more or less infuscated; hind tibiae dull greenish, a little paler next the base, with a fuscous patellar spot, the spines black almost to their base, eight to eleven, usually nine, in number in the outer series. Extremity of male abdomen clavate, somewhat recurved, the supraanal plate long hastate with expanded base, roundly angulate sides and rectangulate apex, the lateral margins considerably elevated, the median sulcus deep and conspicuous between high and sharp walls, terminating apically in a cochlearate depression; furcula consisting of a pair of slender, tapering, acuminate, divergent fingers hardly a fifth as long as the supraanal plate; cerci rather broad, gently tapering in the basal half, beyond equal, apically rounded, nearly straight except for being gently incurved, less than three times as long as the middle breadth; subgenital plate short and very broad, the lateral and apical margins in nearly the same plane, rotundato-angulate as seen from above, entire.

Length of body, male, 19 mm., female, 20 mm.; antennae, male, 6 mm., female, 5.5 mm.; tegmina, male, 4 mm., female, 5.5 mm.; hind femora, male, 10.5 mm., female, 11.5 mm.

Ten males, eleven females. Mount Lincoln, Colorado, 11,000 to 13,000 feet, August 13 (S. H. Scudder; [U.S.N.M. No. 728]). It has also been reported from the "mountains of southern Colorado" by Thomas; and by myself, but erroneously, from Sierra Blanca, Colorado, and northern New Mexico; for in different papers I have formerly referred to this species what are here described as *Melanoplus altitudinum* and *Podisma dodgei*. The present species has a close general resemblance to *Melanoplus indigenus*, extending to the abdominal appendages of the male.

8. *PODISMA OREGONENSIS*.

(Plate VII, fig. 10.)

Pezotettix oregonensis THOMAS, Rep. Geogr. Expl. 100th mer., V (1875), pp. 888, 889.

Of rather large size for this genus, blackish fuscous more or less ferruginous, sordid testaceous below. Head sordid olivaceous, much suffused or sprinkled with fuscous, above wholly or almost wholly infuscated, with a broad piceous postocular band; vertex gently tumid, feebly elevated above the pronotum, the interspace between the eyes nearly (male) or distinctly more than (female) twice as broad as the first antennal joint; fastigium rather steeply declivent, shallowly and broadly (male) or scarcely (female) sulcate; frontal costa fading just before the clypeus, equal, slightly narrower than the interspace between the eyes, faintly depressed at the ocellus, nowhere sulcate, rather sparsely punctate throughout, biserially and more heavily above; eyes moderately large, not prominent, anteriorly subtruncate, a little (male) or scarcely (female) longer than the infraocular portion of the genae; antennae rufous, sometimes feebly infuscated apically, fully two-thirds (male) or a little more than half (female) as long as the hind femora. Pronotum subequal, slightly enlarging posteriorly on the posterior half, the sides with a broad postocular piceous band confined to the prozona, less conspicuous in the female than in the male and often broken, the disk rather broadly convex and passing into the inferiorly vertical lateral lobes by a well rounded shoulder, occasionally showing a blunt angulation; median carina distinct on the metazona, generally very feeble on the prozona and often subobsolete between the sulci; front margin truncate, hind margin very broadly convex, occasionally subangulate; prozona longitudinal (male) or quadrate (female), about a third (male) or at most a fourth (female) longer than the densely punctate metazona. Prosternal spine rather large and stout, conical or subconical, bluntly pointed; interspace between mesosternal lobes nearly (male) or fully (female) half as broad again as long, narrower than the lobes; metasternal lobes subattinent (male) or moderately approximate (female). Tegmina about as long as the pronotum, subattinent, ovate, apically bluntly acuminate, at most twice as long as broad, ferrugineo-fuscous. Fore and middle femora considerably tumid in the male; hind femora rather long, not very slender, testaceous, more or less but generally much and confusedly infuscated, not infrequently distinctly and obliquely bifasciate with fuscous, the lower face and lower half of inner face flavous, the geniculation more or less infuscated; hind tibiae sordid pale olivaceous, with a fuscous patellar annulus, the spines black nearly from the base, eleven to twelve, rarely ten, in number in the outer series. Extremity of male abdomen considerably clavate, much recurved, the supraanal plate subtriangular with rectangulate apex, the lateral margins strongly elevated in the basal half, the median sulcus moderately deep, fading beyond the middle of the plate, bounded by rather broad

walls; furcula consisting of a pair of parallel or feebly divergent, flattened, slender, tapering, bluntly acuminate fingers nearly half as long as the supraanal plate; cerci subequal compressed laminae, a little more than twice as long as broad, nearly straight but feebly arcuate and feebly incurved, not so long as the supraanal plate, well rounded apically, sometimes feebly dimpled apically on the exterior surface; subgenital plate of equal length and breadth, broadly subconical, the apical margin slightly elevated and subtuberculate.

Length of body, male, 17 mm., female, 24 mm.; antennæ, male, 6.75 mm., female, 6.25 mm.; tegmina, male, 4.75 mm., female, 5 mm.; hind femora, male, 10 mm., female, 11.75 mm.

Fourteen males, 21 females. Idaho (U.S.N.M.—Riley collection); Henry Lake, Idaho, August (same; L. Bruner); Yellowstone, Montana (U.S.N.M.—Riley collection); Fort McLeod, Alberta, August (same; L. Bruner.) It was originally described by Thomas from Oregon.

Thomas's text refers to an illustration on a plate, but another species was there substituted for it. His types do not appear to exist, but I think there can be little doubt that this is his species, his description agreeing exceptionally well and certainly applying to no other insect I have seen. I am also drawn to this conclusion by notes taken many years ago upon examination of his types.

ANALYTICAL KEY TO THE OLD WORLD SPECIES OF PODISMA.

A¹. Subgenital plate of male normal, as seen from above at least as long as broad, apically narrowing (Podisma, s. s.).

b¹. Tegmina absent.

c¹. Sides of first abdominal segment with no distinct tympanum.

d¹. Disk of pronotum smooth, at least on prozona.

e¹. Hind tibiae red; lobes of male furcula very distant; cerci very short, styliform, acuminate; subgenital plate not prolonged beyond its apical margin 9. *pedemontana* (p. 112).

e². Hind tibiae lutescent; lobes of male furcula attingent; cerci moderately long, subcompressed, slightly dilated apically; subgenital plate prolonged as a tubercle beyond its apical margin 10. *cobellii* (p. 113).

d². Disk of pronotum rugulose throughout.

e¹. Hind femora pallid beneath; hind tibiae rufescent... 11. *costae* (p. 113).

e². Hind femora red or reddish beneath; hind tibiae sordid blue.

f¹. Pronotum of female enlarging but little posteriorly; lobes of male furcula stout though small, rounded; subgenital plate as broad as long, the apical margin broadly rounded, with a feeble, indistinct, and blunt tubercle 12. *parnassica* (p. 113).

f². Pronotum of female enlarging posteriorly rapidly and considerably; lobes of male furcula slight and minute, elongate; subgenital plate much longer than broad, the apical margin angulate, with a small but distinct and slightly elevated tubercle 13. *pyrenaica* (p. 114).

c². Sides of first abdominal segment with a distinct tympanum.

d¹. Hind tibiae flavo-olivaceous; lateral halves of last dorsal segment of male widely separated; cerci tapering almost regularly throughout, equal for a short distance beyond the middle; subgenital plate elongate, its apical margin subangulate as seen from above 14. *salamandra* (p. 114).

- d.* Hind tibiae reddish; lateral halves of last dorsal segment of male narrowly separated; cerci enlarging slightly beyond the middle; subgenital plate short, its apical margin broadly rounded as seen from above. 15. *baldensis* (p. 114).
- b.* Tegmina present, abbreviate; sides of first abdominal segment with a distinct tympanum.
- c.* Interspace between mesosternal lobes of male quadrate or faintly longer than broad; abdomen of male not clavate, the cerci bent abruptly inward at right angles beyond the middle, the furcula obsolete. . . . 16. *dairisama* (p. 114).
- e.* Interspace between mesosternal lobes of male broader, generally much broader than long; abdomen of male distinctly clavate, the cerci gently incurved throughout or straight, the furcula more or less though feebly developed.
- d.* Eyes of male very prominent; posterior margin of pronotum truncate; tegmina linear or sublinear, lateral; cerci of male decurved or apically enlarged, as well as incurved.
- e.* Hind margin of pronotum distinctly emarginate; interspace between mesosternal lobes of male twice as broad as long; hind tibiae greenish; furcula of male composed of a pair of attingent projecting black points; cerci regularly tapering, acuminate, incurved, and decurved; ovipositor of female elongate and slender, the upper valves straight. 17. *schmidtii* (p. 115).
- e.* Hind margin of pronotum feebly emarginate; interspace between mesosternal lobes of male only a little broader than long; hind tibiae yellow; furcula of male composed of a pair of scarcely projecting distant lobules; cerci at first tapering, then enlarging feebly, apically well rounded; ovipositor of female rather short and stout, the upper valves normally falcate. 18. *feberi* (p. 115).
- d.* Eyes of male only moderately prominent; posterior margin of pronotum rounded or obtusangulate; tegmina broad elliptical or simply abbreviate; cerci of male simple, tapering throughout, straight or merely incurved.
- e.* Pronotum with the transverse sulci deeply impressed, the hind margin rounded; hind tibiae blue or partly flavescens; subgenital plate of male greatly produced, extending beyond the tip of the supraanal plate by fully the length of the latter, and narrowly acutangulate as seen from above; cerci regularly compressed-conical.
- f.* Hind tibiae cyaneous; cerci of male short and moderately stout, shorter than the hind arolia; tip of subgenital plate bluntly rounded. 19. *pedestris* (p. 116).
- f.* Hind tibiae sordid violaceous at base, apically flavescens; cerci of male moderately long, slender, longer than the hind arolia; tip of subgenital plate acuminate. 20. *alpina* (p. 116).
- e.* Pronotum with the transverse sulci slightly impressed, the hind margin obtusangulate; hind tibiae red; subgenital plate of male little produced, extending beyond the supraanal plate by much less than the length of the latter, strongly rounded as seen from above; cerci laminate, subequal, bluntly rounded at tip. 21. *frigida* (p. 117).
- A.* Subgenital plate of male, as seen from above, much broader than long, apically broadened, the lateral walls excessively tumid (*Eupodisma*) . . . 22. *primnoa* (p. 117.)

9. PODISMA PEDEMONTANA.

(Plate VIII, fig. 1.)

Pezotettix pedemontanus BRUNNER, Prodr. Eur. Orth. (1882), p. 230.

For a figure of the abdominal appendages of this species, which I have not seen, I am indebted to Herr Josef Redtenbacher through Hofrath Brunner von Wattenwyl.

Susa, Piedmont, Italy.

10. *PODISMA COBELLII*.

(Plate VIII, fig. 2.)

Pezotettix cobellii KRAUSS, Verh. Zool.-Bot. Ges. Wien, XXXIII (1883), pp. 222, 223, fig. 2.*Pezotettix salamandra* COBELLI, Ort. Gen. Trent. (1883), p. 15.

Hofrath Brunner von Wattenwyl has kindly loaned me a pair of this little known species for study and illustration.

Mountains about Roveredo, Tyrol:—Cima Posta, Monte Pasubio, 6,000 to 7,000 feet, and somewhat lower; Sette Albi.

11. *PODISMA COSTAE*.*Pezotettix costae* TARGIONI TOZETTI, Bull. Soc. Ent. Ital., XIII (1881), p. 185.—BRUNNER, Prodr. Eur. Orth. (1882), p. 229.

I have not seen this species, and introduce it in the table only by aid of the characters assigned by Brunner.

Monte Morrone, Abruzzo, Italy.

12. *PODISMA PARNASSICA*, new species.

(Plate VIII, fig. 3.)

Pezotettix parnassicus BRUNNER!, MS.

Very dark bronze green, beneath dull testaceous (male), or ferrugineo-testaceous, beneath dull flavous (female), the lower margins of the lateral lobes of the color of the under surface, the abdomen with a slender dorsal testaceous stripe. Antennae as long as the head and pronotum together. Frontal costa scarcely depressed at the ocellus, fading before the clypeus. Pronotum short, subcylindrical (male) or feebly expanding posteriorly (female), pretty uniformly and sparsely rugoso-punctate, slightly more finely on the metazona than on the prozona; prozona transverse, nearly twice as long as the metazona, its transverse sulci inconspicuous; posterior margin of pronotum truncate, the median carina subobsolete, lateral carinae wanting. Meso- and metanota, especially in the male, and the dorsum of the basal abdominal segments, in the male only, punctate. Prosternal spine blunt conical; interspace between mesosternal lobes quadrate (male) or strongly transverse, fully as broad as the lobes (female), the metasternal lobes subattingent (male) or distant, the interspace broader than the frontal costa (female). Tegmina wanting. Hind femora olivaceo-testaceous, rufous beneath in the female; hind tibiae lutescent (male) or pale green (female), the spines black-tipped, eight to nine in number in the outer series. Sides of first abdominal segment with no tympanum; extremity of male abdomen not clavate nor recurved, the supraanal plate triangular with a median sulcus in the basal half and a broad depression apically; furcula consisting of a pair of rather distant, hardly elongate, rounded lobes no longer than the last dorsal segment; cerci

small, styliform, shorter than the supraanal plate; subgenital plate small, slightly longer than broad, the apical margin thickened and sub-tuberculate.

Length of body, male, 15 mm., female, 21 mm.; antennae, male, 5.5 mm., female, 7.5 mm.; pronotum, male, 3 mm., female, 4.4 mm.; hind femora, male, 7.25 mm., female, 10 mm.

One male, 1 female. Mount Parnassus, Greece; through the kind communication of Hofrath Brunner von Wattenwyl.

13. PODISMA PYRENAEA.

(Plate VIII, fig. 4.)

Pezotettix pyrenaea FISCHER, Orth. Eur. (1853), p. 373, pl. xv, figs. 22*, 22* a.

Pezotettix pyrenaeus BRUNNER, Prodr. Eur. Orth. (1882), p. 229.

For an opportunity of studying this species I am indebted to M. de Bormans.

Pic du Midi, Pyrénées, France, 9,540 feet.

14. PODISMA SALAMANDRA.

(Plate VIII, fig. 5.)

Pezotettix salamandra FISCHER, Orth. Eur. (1853), pp. 372-373, pl. xv, fig. 22, 22 a b c.—BRUNNER, Prodr. Eur. Orth. (1882), pp. 228-229.

In the mountainous region north and east of the Adriatic, Goritz and Adelsberg, Illyria, the Draga Thal near Fiume, Istria and Josephsthal, Croatia. It is found on bushes like our *P. glacialis*.

15. PODISMA BALDENSIS.

(Plate VIII, fig. 6.)

Pezotettix baldensis KRAUSS, Verh. Zool.-Bot. Ges. Wien, XXX (1883), pp. 220-222, fig. 1.

Pezotettix salamandra GRABER, *ibid.*, XVII (1867), p. 271.

For an opportunity of examining and figuring this species I am indebted to Hofrath Brunner von Wattenwyl.

Monte Baldo, southern Tyrol, 5,000 feet.

16. PODISMA DAIRISAMA, new species.

(Plate VIII, fig. 7.)

Dark olive green, beneath dull flavous. Frontal costa deeply sulcate, subpercurrent, equal. Pronotum subcylindrical, the hind margin subtruncate, minutely emarginate; prozona quadrate, finely and sparsely punctate; metazona rather densely punctate, hardly more than half as long as the prozona; median carina obsolete, lateral carinae wholly wanting; transverse sulci of prozona feebly impressed; lateral lobes concolorous with disk. Prosternal spine conical, subacute; interspace between mesosternal lobes faintly longitudinal (male) or transverse,

almost as broad as the lobes (female), the inner margins of the lobes strongly rounded, the metasternal lobes subattinent (male) or distant by nearly the breadth of the frontal costa (female). Tegmina lateral, elliptical, more than twice as long as broad, no longer than the prozona, ferrugineo-testaceous. Hind femora fusco-olivaceous, sanguineous beneath; hind tibiae feebly valgate, green, the spines black-tipped, nine to ten in number in the outer series. Abdomen lighter in the male than in the female, in the former with a pair of subdorsal, longitudinal, oval, basal, flavous spots on segments three to eight, sides of first segment with a distinct tympanum, the extremity hardly clavate or recurved in the male, the supraanal plate blunt triangular, tectate, with broad, regularly narrowing, percurrent median sulcus; furcula wanting, the lateral halves of the last dorsal segment rather distant; cerci moderately slender, rather regularly tapering, blunt-tipped, abruptly bent inward and upward beyond the middle; subgenital plate equally broad and long, conical, ending in a blunt tubercle prolonged beyond the apical margin. Valves of ovipositor rather long, nearly straight, the upper pair sinuate above, with serratulate margins.

Length of body, male, 24 mm., female, 31.5 mm.; antennae, male, 8 mm.; pronotum, male, 5.5 mm., female, 6.5 mm.; tegmina, male, 3 mm., female, 4 mm.; hind femora, male, 11 mm., female, 14 mm.

One male, 1 female. Japan (U.S.N.M. [No. 729], through L. Bruner).

17. *PODISMA SCHMIDTII*.

(Plate VIII, fig. 9.)

Podisma schmidtii FIEBER, Lotos, III (June, 1853), pp. 119-120.

Pezotettix mendax FISCHER, Orth. Eur. (Nov., 1853), pp. 371-372, pl. xv, figs. 23, 23 ab.—BRUNNER, Prodr. Eur. Orth. (1882), pp. 227-228.

The publication of Fieber's species dates from 1853 (Lotos) and not from 1854 (Synopsis), and antedates by several months the description of Fischer, whose name has been hitherto accepted; for Fieber's species was published in the June number of Lotos, and the preface to Fischer's work is dated November.

This species occurs, according to Brunner von Wattenwyl, on hazel stalks and bramble bushes.

Austrian Alps, especially the southern side, from Transylvania westward to southern Tyrol and the Swiss canton Ticino; and in the mountainous region bordering the upper extremity of the Adriatic, eastward.

18. *PODISMA FIEBERI*, new name.

(Plate VIII, fig. 8.)

Pezotettix schmidtii BRUNNER, Verh. Zool.-Bot. Ges. Wien, XI (1861), p. 306, pl. XVI, figs. 23 A B; Prodr. Eur. Orth. (1882), p. 225.

As Brunner points out, this is not the *Podisma schmidtii* of Fieber (1853); but he nevertheless retains Fieber's name for it, because it was first described by himself under that name, under the supposition that

it was Fieber's species, and because Fieber's *schmidtii* and Fischer's *mendax* are the same. By the ordinary rules of nomenclature, the name *schmidtii*, having been applied to one species of the genus could not subsequently be applied to another, even if the first were a synonym; but it is doubly incorrect here, since *schmidtii* of Fieber has the priority over *mendax* of Fischer. It is therefore necessary to give the present species a new name.

This species is found on leafy bushes.

From Carniola eastward to Servia, southern Hungary, and Transylvania.

19. PODISMA PEDESTRIS.

(Plate VIII, fig. 10.)

Gryllus pedestris LINNÆUS, Syst. Nat., Ed. X (1758), p. 433.

Acrydium pedestre OLIVIER, Encycl. Méth., VI (1791), p. 232.

Podisma pedestris LATREILLE, Cuv. Règne Anim., V (1829), p. 188.

Pezotettix pedestris BURMEISTER, Germ. Zeitschr. Ent., II (1840), p. 51.—

FISCHER, Orth. Eur. (1854), pp. 369-371, pl. xv, figs. 17, 17⁺, 18, 18a.—

BRUNNER, Prodr. Eur. Orth. (1882), pp. 226-227.

Acrydium apterum DEGEER, Mém., III (1773), p. 474, pl. xxiii, figs. 8, 9.

In northern Europe, in Finland, southern Sweden, and Holstein; then again farther south in the high alps of Switzerland, at the Wengern alp and the Rhone glacier, and in the mountains of southern Bavaria and the Tyrol; farther east it comes down to the hill country and occurs from Carinthia eastward to the Volga. South of the alps it is found in southeastern France, southern Tyrol, and Sardinia. It has been incorrectly reported from England.

20. PODISMA ALPINA.

(Plate IX, fig. 1.)

Gryllus alpinus KOLLAR, Beitr. Landesk. Oesterr., III (1833), p. 83.

Podisma alpina FIEBER, Lotos, III (1853), pp. 119.

Pezotettix alpina FISCHER, Orth. Eur. (1853), pp. 368-369, pl. xv, figs. 19, 20.

Pezotettix alpinus BRUNNER, Prodr. Eur. Orth. (1882), pp. 224-225, pl. vii, fig. 53.

Aeridium pulchellum HERRICH-SCHAEFFER, Nomencl. Ins., II (1840), Orth., 8, 19.

Podisma frigidum FISCHER, Jahresb. Mann. ver. Naturk., XV (1849), pp. 38-39.

Podisma subalpinum FISCHER, *ibid.*, XVI (1850), p. 27.

Occurs in two forms: *alpina*, with tegmina separate and lateral, found in the higher mountains; and a larger, *collina*, with tegmina overlapping, half as long as the abdomen.

P. a. alpina occurs in all the higher mountains of central Europe as far east as the borders of Servia. I found it extremely abundant in the alpine pastures about Villars sur Bex, Canton de Vaud, Switzerland. *P. a. collina* is found from Carniola and the forest of Vienna through southern Hungary to Transylvania.

21. PODISMA FRIGIDA.

(Plate IX, fig. 2.)

Gryllus frigidus BOHEMAN, Övers. K. Sv. Vet.-Akad. Forh. (1846), p. 80.*Podisma frigidum* VON BORCK, Skand. Rätv. Ins. Nat. Hist. (1848), pp. 90-92, pl. III, fig. 2.*Pezotettix frigida* FISCHER, Orth. Eur. (1853), pp. 366-368, pl. xv, fig. 21.*Pezotettix (Melanoplus) frigidus* STÅL, Rec. Orth., I (1873), p. 79.*Pezotettix frigidus* BRUNNER, Prodr. Eur. Orth. (1882), pp. 223-224.*Pezotettix alpicola* FISCHER, Stett. Ent. Zeit., XIII (1852), p. 21.

Occurs in Lapland and Norway; and again in the high alps of Switzerland and the Tyrol.

22. PODISMA (EUPODISMA) PRIMNOA.

(Plate IX, fig. 3.)

Podisma primnoa FISCHER DE WALDHEIM, Orth. Russ. (1846), p. 248.*Primnoa viridis* MOTSCHULSKY, MS., *ibid.*

On account of the extraordinary development of the subgenital plate of the male of this largest of Podismae, I have proposed for it the subgeneric name of Eupodisma.

Fischer de Waldheim describes it from Verkhni-Udinsk, Transbaicalia, Siberia. Specimens in my collection were collected by Parsehine at the same place in June, at Samonoffsk in June, at Khabarowki and Tscherhjava on the Amur in May and August, and in the Desert of Khorinskaya in Transbaicalia.

22. PARATYLOTROPIDIA.

(Παρά, beside; Tylotropidia, a genus of Eupreocnemes.)

Paratylotropidia BRUNNER, Rév. Syst. Orth. (1893), p. 147.

Body moderately stout, somewhat compressed, without noticeable pilosity, the excessively brief and fine hairs being exceedingly scattered. Head large by being protuberant, not broader than the pronotum, the face moderately oblique and the genae feebly tumescent; vertex broadly arched, not elevated above the pronotum; fastigium very broad, tumid, feebly declivent, anteriorly rounded; eyes rather long oval, fully half as long again as broad, especially in the female, anteriorly subtruncate, separated above by an exceptionally wide interval, almost or quite twice as wide as the rather broad frontal costa; antennae slender, about as long (in the female at least) as the head and pronotum together. Pronotum long, compressed, subequal, narrowed above anteriorly, the disk nearly plane but the prozona slightly tumid, with percurrent and equal median carina, distinct, percurrent, equal and feebly arcuate lateral carinae, the transverse sulci feebly incised, the hind margin produced, but very obtusangulate, the metazona flaring only in the female and then almost imperceptibly. Prosternal spine

not stout, conico-cylindrical; meso- and metastethia together much longer than broad in both sexes, the latter narrowing rapidly behind, so that the portion behind the lobes, more than twice as broad as long, is scarcely more than half as broad as the metastethium; interspace between mesosternal lobes much longer than broad in both sexes and much narrower than the lobes themselves, the metasternal lobes more (male) or less (female) approximate, the interspace in the female scarcely so broad as, in the male much narrower than, the frontal costa. Tegmina abbreviate, overlapping, acuminate. Hind femora very long, the inferior genicular lobe subpallid, uniform, the hind tibiae with eight to twelve spines in the outer series. Sides of the first abdominal segment with a distinct tympanum. Subgenital plate of male with no apical tubercle, its lateral margins ampliate, basally rectangulate; cerci lamellate, subpyriform, tapering strongly and unequally, the apex produced, subacuminate and incurved. Abdomen of female regularly tapering, the ovipositor normally exerted, the valves nearly straight with acute but smooth costae.

The genus is represented by a single species found in the western Mississippi valley. When published by Brunner, no species was described or even named, but the species here given is the one upon which the genus was founded and is therefore the type.

PARATYLOTROPIDIA BRUNNERI, new species.

(Plate IX, figs. 4, 5.)

Warm brownish ferruginous, approaching castaneous, inclining to flavous below, marked with pale flavous. Head protuberant, flavous, faintly and sparsely punctate with fuscous, above with an anteriorly tapering, broad, ferrugineo-fuscous or olivaceo-fuscous band, the genae behind the eyes more or less distinctly infuscated; vertex feebly tumid, not elevated above the pronotum, the interspace between the eyes exceptionally broad, being nearly four times as broad as the basal joint of the antennae; fastigium very feebly declivent, plane or tumid, scarcely expanding anteriorly, its lateral margins not in the least elevated, well rounded, its anterior margin well rounded as seen from above; frontal costa fading just before the clypeus, faintly enlarging from above downward, above about (male) or fully (female) half as wide as the interspace between the eyes, feebly sulcate at the ocellus, coarsely and sparsely punctate throughout; eyes not very large nor prominent, about as long as the infraocular portion of the genae; antennae luteo-testaceous, apically infuscated, in the female about two-thirds as long as the hind femora. Pronotum elongate, compressed, subequal but feebly enlarging backward on the upper portion of the anterior section of the prozona, beyond it equal, the disk very broadly subtectate, passing by abrupt angles, forming distinct and continuous feebly and oppositely arcuate lateral carinae facing inward, into the vertical lateral lobes, which above are very steeply and convexly declivent; whole

pronotum unicolorous except that the lower portions of the lateral lobes become gradually flavescent and the lateral carinae are conspicuously flavous; median carina percurrent, equal, blunt, longitudinally arcuate on the prozona; front margin subtruncate, hind margin very obtusangulate, both delicately margined; prozona very longitudinal, being more than (male) or almost (female) half as long again as broad, very coarsely and sparsely punctate, half as long again as the finely ruguloso-punctate metazona. Prosternal spine rather long, conico-cylindrical, erect, blunt; interspace between mesosternal lobes twice as long as broad (male) or fully half as long again as broad (female), the metasternal lobes approximate (male) or moderately distant (female). Tegmina subovate, very broad, very rapidly tapering especially by the oblique excision of the costal margin and the strong apical arcuation of the inner margin, subacuminate, a little longer than the pronotum, overlapping, brownish castaneous, the ulnar vein broadly marked with pale flavous edged anteriorly with blackish fuscous. Fore and middle femora somewhat enlarged in the male, rufo-flavous; hind femora flavo-testaceous, the outer face and the geniculation more or less deeply infuscated especially above, without fasciation or maculation of any kind; hind tibiae rather deep red or fusco-violaceous, the spines pallid with black tips, eight to eleven in number in the outer series. Extremity of male abdomen clavate but very feebly enlarged, very strongly recurved, the supraanal plate pretty regularly triangular, as long as broad, the apex acutangulate, the margins feebly and broadly elevated, the median sulcus not very deep, terminating with its bordering ridges in the center of the plate; furcula?; cerci very broad and somewhat tumid at base, forming a compressed and slightly tortuous cone, tapering rapidly and somewhat regularly, but with the slender tip a little produced, curved slightly inward and downward, bluntly pointed, reaching the tip of the supraanal plate; infracercal plates very broad, suddenly narrowing just beyond the base but easily visible outside the cerci nearly the whole length of the latter, slightly produced apically to attain the tip of the supraanal plate; subgenital plate tumid, very broad at apex, partly by the retrocession of the preceding ventral segment, distinctly broader than long, the lateral and apical margins together feebly arcuate so that the apex is slightly elevated, the apical margin as seen from above acutangulate, entire.

Length of body, male, 29.5 mm., female, 39.5 mm.; antennae, female, 12.5 mm.; pronotum, male, 7.5 mm., female, 9.75 mm.; tegmina, male, 9 mm., female, 11.15 mm.; hind femora, male, 16 mm., female, 18.5 mm.

One male, 1 female. Dakota (L. Bruner); Dallas, Texas, Boll (U.S.N.M. [No. 730.])—Riley collection.

The single male (from Dakota) is slightly mutilated, preventing a description of certain parts. I was at first inclined to regard this as distinct from Brunner's species, of which he favored me with a description and figure (hitherto unpublished), on account of the representation

of the lateral carinae of the pronotum in his figure as arcuate in an opposite sense to that here described; but his description agrees so perfectly with the other characteristics of the specimens before me that I regard this as an accident. Nevertheless, I append hereto the description furnished by him, with the sketch sent me, which he kindly permits me to publish (see Plate IX, fig. 5).

PARATYLOTROPIDIA sp.

Colore castaneo. Pronotum disco deplanato, carina media pereurrente, necnon utrinque carina longitudinali flava delineato. Elytra abbreviata, acuminata, fascia flava secundum venam ulnarem ornata. Femora postica carina superiore acuta instructa, superne flava. Tibiae posticae fusco-violaceae, spinulis albis, apice nigris, in utroque margine numero 10 ad 12. Lamina supraanalis ♂ triangularis, acuminata, plana. Cerci ♂ deplanata, basi latissimi, apice acuminati. Lamina subgenitalis ♂ elongata, ultra apicem laminae supraanalis valde prominula. Ovipositor valvulis acute costatis sed haud denticulatis.

	♂	♀
	mm.	mm.
Long. corp.	30	38
pron.	8	10
elytr.	9	12
fem. post.	16.5	20

Patria: Dallas, Texas.

Brunner, 1895.

23. MELANOPLUS.

(Μέλαις, black; ὄπλα, armor.)

Melanoplus STÅL, Rec. Orth., I (1873), p. 79.

Body moderately stout, rarely slender, generally feebly compressed, more or less but generally feebly pilose. Head moderately, rarely not at all, prominent, generally but little if any longer than the prozona, unless the latter (as rarely) is distinctly transverse; face almost vertical or a little oblique, its angle with the fastigium rarely less than 75°; vertex gently tumid; eyes rounded oval, never more generally less than half as long again as broad, the anterior margin subtruncate or feebly convex, separated above rather or very narrowly, at most but little farther apart than the width of the equal or subequal frontal costa; fastigium more or less sometimes very declivent, passing insensibly into the frontal costa, always more or less sulcate or with elevated lateral margins, generally more deeply sulcate in the male than in the female; frontal costa moderately prominent, generally sulcate below, usually more or less punctate; antennae slender, of variable length, but never very short, never longer than the hind femora, and rarely if ever more than twice as long as the pronotum, even when this is subtruncate posteriorly. Pronotum generally subcompressed, rarely or never twice as long as the average breadth, generally only half as long again as the average breadth even in the male, the metazona generally more or less flaring, its disk plane and densely punctate, while that of the prozona

is more or less, generally slightly, convex, is rarely at all flaring in front or only in the very slightest degree, at most faintly punctate and generally distinctly longer than the metazona; front margin generally truncate or subtruncate, hind margin obtusangulate to a greater or less degree, rarely subtruncate; median carina always distinct on the metazona, generally much less so on the prozona, often subobsolete between the sulci and never wholly wanting; lateral carinae typically obsolete, but often indicated by a distinctly abrupt though rounded shoulder, rarely becoming carinate; lateral lobes vertical or subvertical, especially below, often feebly tumid above on the prozona, and generally marked by a piceous postocular band, crossing either the prozona alone or the whole pronotum, not infrequently broken or maculate. Prosteral spine variable, but always prominent; meso- and metastethia together distinctly longer than broad in both sexes; interspace between mesosternal lobes generally longer or much longer than broad, never¹ in the least broader than long, even when the sides of the interspace are very divergent posteriorly (male) or generally quadrate but more variable than in the other sex, sometimes as narrow as there but more frequently subtransverse, occasionally in brachypterous forms distinctly transverse, as a general rule wider than in the other sex (female), in both always distinctly, generally much, narrower than the lobes themselves, except in the few instances² where it is distinctly transverse in the female; metasternal lobes generally attingent or subattingent, rarely only approximate (male), or generally approximate or subapproximate, the interspace between them generally narrower than the frontal costa (female); metasternum rapidly narrowing posteriorly, so that the portion behind the lobes is not, or is hardly more than, half the greatest width of the metasternum, but is more than twice as broad as long. Tegmina always present, but either abbreviate and then lateral, attingent, or overlapping, sometimes shorter and sometimes longer than, but generally nearly the length of, the pronotum and usually more or less acuminate apically; or they are fully developed and then usually about attain or a little surpass the tips of the hind femora, tapering more or less but very gradually and apically well rounded, at a distance from the apex equal to the breadth of the tegmina distinctly narrower than the metazona, the intercalaries and cross-veins of the discoidal area (except in the macropterous forms of the dimorphic species, *M. dawsoni* and *M. marginatus*) relatively numerous at least in the apical fourth and usually throughout, the venation in general sharp and clearly defined, the humeral vein straight and only apically arcuate, nearly always terminating either on the apical margin or only a short distance before it, running for some distance almost exactly parallel to the costal margin or merging insensibly into it. the

¹ In two species, *M. montanus* and *M. borealis*, it is feebly transverse, but much narrower than the lobes, and is similar in the two sexes.

² These are *M. artemisiae*, *M. militaris*, and *M. altitudinum*.

area intercalata always, even in macropterous forms of dimorphic species, extending somewhat, generally considerably, beyond the middle of the tegmina. Hind femora moderately long and slender, the inferior genicular lobe with at least a darker basal spot or transverse band, the hind tibiae with a variable number of spines (generally nine to fourteen) in the outer series, by rare exception eight only. Abdomen more or less compressed, the sides of the first segment with a distinct tympanum, the extremity in the male more or less sometimes strongly clavate, usually considerably recurved, the subgenital plate of variable form, but always with the lateral margins ampliate at the base and with no distinct apical tubercle, though not infrequently apically produced or subtuberculate and frequently tumescent; cerci exceedingly variable in form, often enlarging apically, always lamellate excepting (the lakinus series—three species) where they are basally globose, never styliform, rarely (the puer series—two species) in the least substyliform, generally incurved and of about the length of the supraanal plate; furcula usually developed and to a very variable extent, and with variable form; pallium rarely exerted; ovipositor of female generally fully exerted.

The type of the genus is *Acridium femur-rubrum* De Geer.

The number of species of *Melanoplus* is so exceedingly great that I have endeavored to display their relationships in part by separating them into groups. Noticing how seldom the characteristic parts of the male abdomen agreed in the short-winged and long-winged forms, notwithstanding that one would look for their close agreement, I have first divided them in the following table into those which are fully equipped with ample organs of flight and those in which these organs are more or less undeveloped, and then have subdivided each according to other characteristics, endeavoring thus to bring into close contiguity those which appeared to be most nearly allied. I was not a little surprised to find in how few instances it was possible to combine the brachypterous and macropterous species in any one of these groups. Even in most of these, and especially in the dawsoni series (itself somewhat heterogeneous on either side), the collocation is rather forced. The groups into which I have divided the macropterous forms are far more natural than those of the brachypterous species, and the portion of the table relating to the former is therefore much more satisfactory than the other. I have more than once completely remodeled that relating to the brachypterous species, but with no greater success than in that now presented.

Much to my surprise, I find but a couple of species in this genus (*M. dawsoni*, *M. marginatus*) in which there is complete dimorphism shown in the full development on the one hand and extreme abbreviation on the other of the organs of flight. In other species, especially in *M. fasciatus* and *M. extremus*, there is considerable variability, but nowhere else is it carried to this extreme. It is, however, found in *Dendrotettix*,

Phoetaliotes, and *Oedaleonotus*, each of which is represented by a single species. I have treated this matter more fully in the Introduction.

The present genus, so richly endowed with species, is naturally very widely distributed, though so far as known it is completely confined to the continent of North America, and even does not occur, so far as reported,¹ south of Mexico. Within this region it is as widespread as all the other genera combined. It extends from the arctic circle in Alaska and on the Mackenzie River, and from northern Labrador and perhaps southern Greenland on the north, to the extremity of Florida and southern Mexico on the south, and from the Atlantic to the Pacific. It is, however; far richer in species in the west than in the east. Only seventeen of the one hundred and thirty-one species are found exclusively east of the Mississippi River, though four other eastern species barely cross it; while in the Rocky Mountain region and west of it, and there only, forty-nine species are known, while thirty-two others are found only west of the Mississippi River and seven western species barely cross it to the east; six species, as stated in our introduction, range from Atlantic to Pacific; one occurs only north of our national boundaries in Labrador, while nineteen others inhabit Canada; twelve are found only in Mexico, with ten others which it possesses in common with the United States.

These figures show the western preponderance of the species better than any summary of the twenty-eight groups into which I have divided the genus, which, besides being rather unequal in the number of contained species, often show an extremely wide distribution or more than one center of distribution, in the latter case indicating, perhaps, the imperfection of the grouping. Still, leaving out the five groups, each of which contains one or more transcontinental species, it will be noted that there are three others which compass the continent—the *maucus* (five species), *plebejus* (five species), and *robustus* (five species) series. Of the twenty remaining, one-half, viz, the *flabellifer* (six species), *bowditchi* (six species), *glaucipes* (two species), *utahensis* (three species), *devastator* (eight species), *aridus* (three species), *rusticus* (seven species), *borckii* (six species), *cinereus* (six species), and *packardii* (five species) series—extend westward to the Pacific; while only five—the *impudicus* (one species), *dawsoni* (seven species), *puer* (two species), *inornatus* (three species), and *punctulatus* (two species) series—reach eastward to the Atlantic coast; and the remaining five—the *lakinus* (three species), *indigenus* (one species), *alleni* (two species), *angustipennis* (four species), and *texanus* (five species) series—are found exclusively, or almost exclusively, west of the Mississippi River.

One-half of the series are represented in Mexico, showing rather

¹ One species, *M. borealis*, is reported, *in litt.*, by Brunner to occur at Valdivia, Chile; as its only other known localities are in the arctic regions, I am inclined to doubt the correctness of the determination, and presume the material to be insufficient.

exceptional diversity for its twenty-two species, while ten series are represented in the twenty species hitherto found in Canada. Nearly all the series have a large latitudinal distribution, the most limited in this respect being:—in the north, the *utahensis* series (three species), from Washington and Alberta to Utah and Colorado, and the *indigenus* series (one species), confined to Idaho; and in the south the *lakinus* series (three species), from Nebraska to central Mexico, the *impudicus* series (one species), found only in Georgia and Mississippi, the *aridus* series (three species), from Arizona to Jalisco, the *puer* series (two species), found in Texas and Florida, and the *inornatus* series (three species), occurring in Illinois, Indiana, North Carolina, and northern Mexico.

ANALYTICAL KEY TO THE SPECIES OF MELANOPLUS.¹

A¹. Tegmina conspicuously shorter than the abdomen, often no longer than pronotum; furcula almost always developed feebly, generally no longer than the last dorsal segment from which it arises.

b¹. Cerci of male expanding from the base outward and bullate, abruptly tapering and bent inward at tip; subgenital plate of male abruptly elevated apically (1. *Lakinus* series).

e¹. Interval between mesosternal lobes of male nearly twice as long as broad;² of female fully half as broad again as long 1. *marculentus* (p. 139).

e². Interval between mesosternal lobes of male distinctly less than twice as long as broad; of female barely broader or not broader than long.

d¹. Hind femora heavily bifasciate above and on the outer face; hind tibiae blue throughout 2. *lakinus* (p. 141).

d². Hind femora with feeble signs of bifasciation above only, if at all; hind tibiae pale red, apically infuscated 3. *sonorae* (p. 143).

b². Cerci of male tapering in the basal half, usually from the very base, sometimes throughout, usually laminate; subgenital plate of male of variable elevation apically.

c¹. Cerci of male beyond the middle either equal or tapering, sometimes simply styliform throughout, the tip usually more or less pointed but sometimes broad or truncate; metasternal lobes of male attingent or subattingent.³

d¹. Cerci of male very broad and short, not more than twice as long as the middle breadth, and broadly rounded at apex (2. *Flabellifer* series).

e¹. Tegmina about half as long as the abdomen and much longer than pronotum; cerci of male not longitudinally sulcate apically.

f¹. Interval between mesosternal lobes of male twice as broad posteriorly as anteriorly, the inner margins of the lobes regularly divergent; interval in female longer than broad; cerci of male but little longer than broad.

7. *discolor* (p. 149).

f². Interval between mesosternal lobes of male of nearly equal breadth in front and behind, the inner margins of the lobes convex; interval in female transverse; cerci of male nearly twice as long as broad.

8. *simplex* (p. 150).

¹By permission of the Assistant Secretary, this key has been issued in advance in the Proceedings of the American Philosophical Society, XXXVI, No. 154.

²This interval is of various shapes in different species,—cuneiform, elepsydral, or rectangular, but for the purposes of this table the middle breadth is always taken.

³The cerci are faintly enlarged apically in *M. meridionalis* and *M. walshii*, which come under this division. See also the note under the alternate category.

- e*². Tegmina shorter than the pronotum; cerci of male deeply sulcate longitudinally at apex and incurved 9. *rileyanus* (p. 151).
- d*². Cerci of male more elongate, at least twice, generally much more than twice, as long as middle breadth, ordinarily more or less acuminate at apex.
- e*¹. Cerci of male irregularly tapering or scarcely tapering at all, compressed, in no sense styliform.
- f*¹. Subgenital plate of male short and broad, its apical breadth equal to or surpassing the length of its lateral margin.¹
- g*¹. Cerci of male long and very slender, in the middle not one-half the width of the frontal costa; last dorsal segment of male with a pair of strongly oblique submedian sulci outside the furcula;² subgenital plate not elevated apically (3. *Aridus* series).
- h*¹. Hind margin of pronotum truncato-emarginate; disk of metazona fully twice as broad as long; tegmina relatively slender, widely distant.
- i*¹. Disk of prozona coarsely and uniformly punctate; cerci of male apically enlarged and inferiorly acuminate at apex.
37. *humphreysii* (p. 206).
- i*². Disk of prozona coarsely punctate only along anterior margin; cerci of male apically equal, rounded at tip... 38. *nitidus* (p. 207).
- h*². Hind margin of pronotum obtusangulate but subtruncate; disk of metazona less than twice as broad as long; tegmina relatively broad, approximate, at least in the male..... 39. *aridus* (p. 209).
- g*². Cerci of male long and broad throughout, subequal, broader than the frontal costa; last dorsal segment of male with no oblique sulci outside the furcula; subgenital plate apically elevated (10. *Indigenes* series).
40. *indigenes* (p. 211).
- g*³. Cerci of male short or not very long, and broad or moderately slender, in the middle nearly as broad as if not broader than the frontal costa; last dorsal segment of male with no oblique sulci outside the furcula; subgenital plate not elevated apically (11. *Mancus* series).
- h*¹. Prozona, at least in male, much longer than broad, the disk of the whole pronotum more than twice as long as the middle breadth, the median carina percurrent, equal; interval between mesosternal lobes of male twice as long as broad..... 41. *scudderi* (p. 212).
- h*². Prozona, even in male, transverse, subquadrate or slightly longitudinal, the disk of the whole pronotum less than twice as long as middle breadth, the median carina often subobsolete between the sulci; interval between the mesosternal lobes of male not more than half as long again as broad.
- i*¹. Cerci of male rather stout, subequal.
- j*¹. Abdomen of male strongly recurved; forks of furcula divergent, distinctly longer than the last dorsal segment; subgenital plate with no apical tubercle..... 42. *gillettei* (p. 215).
- j*². Abdomen of male scarcely recurved; forks of furcula parallel, minute, hardly as long as the last dorsal segment; subgenital plate with a slight apical tubercle..... 43. *artemisiac* (p. 217).

¹Care should be taken not to include in the apical breadth any part of the membranous integument connecting it with the preceding ventral segment. For simplicity's sake, the length of the plate is here considered its extent parallel to the lateral margin (or that margin itself) as seen from the side; its breadth, what would be its length along the ventral line were it regarded as one of the abdominal segments.

²This has not been seen, but is only inferred, in *M. humphreysii*.

- i*². Cerci rather slender, especially on apical half, of unequal width.
- j*¹. Tegmina shorter than the pronotum, broadly rounded or subangulate at apex; cerci long and rather slender, nearly straight as seen laterally..... 44. *maucus* (p. 218).
- j*². Tegmina as long as or longer than the pronotum, apically acuminate; cerci short and not very slender, rather strongly bent-arcuate as seen laterally..... 45. *canceri* (p. 219).
- f*² Subgenital plate of male distinctly narrower than long, often narrowing apically.
- g*¹. Cerci of male tapering but little, generally rather stout, or if slender then tapering almost not at all in apical half, which is never less than half as broad as the base and is blunt-tipped, rarely, as in *M. juvenus*, angulate below.
- h*¹. Interval between mesosternal lobes of male at least half as long again as broad, sometimes fully twice as long; hind tibiae usually blue or green (12. *Dawsoni* series).
- i*¹. Cerci of male apically turned sharply inward at right angles or even less 46. *reflexus* (p. 221).
- i*². Cerci of male straight or gently incurved, sometimes curved more strongly at apex but not bent abruptly at right angles.
- j*¹. Lateral margins of subgenital plate of male, as seen from above, regularly convergent nearly to the tip; furcula developed only as slightly swollen lobes..... 47. *meridionalis* (p. 223).
- j*². Lateral margins of subgenital plate of male, as seen from above, basally subparallel, apically rather broadly rounded; furcula developed as a pair of projecting spines or fingers.
- k*¹. Tegmina much shorter than the pronotum, widely separated; interval between mesosternal lobes of female distinctly transverse, as broad as the lobes; subgenital plate of male with distinct though minute apical tubercle..... 48. *militaris* (p. 224).
- k*². Tegmina longer than the pronotum, overlapping; interval between mesosternal lobes of female quadrate; subgenital plate of male with minute apical tubercle or none.
- l*¹. Subgenital plate of male not pyramidal, nor elevated apically except by a minute apical tubercle; furcula minute, overlying the supraanal plate by a less distance than the length of the last dorsal segment; cerci bent roundly inward at the apex..... 49. *nigrescens* (p. 225).
- l*². Subgenital plate of male subpyramidal, broadly and roundly elevated at apex; furcula well developed, reaching middle of the supraanal plate; cerci very feebly incurved apically..... 50. *dawsoni* (p. 227).
- h*². Interval between mesosternal lobes of male subquadrate, often gradually widening posteriorly; hind tibiae usually red (13. *Rusticus* series).
- i*¹. Apical margin of subgenital plate of male more or less elevated or tuberculate or both, generally well rounded as seen from above, never transverse.
- j*¹. Tegmina attingent or overlapping; cerci of male apically rounded; furcula distinctly developed; subgenital plate relatively long, subequal in breadth.
- k*¹. Interspace between the eyes of male broader than the first antennal joint; cerci of male with arcuate upper margin; subgenital plate apically elevated to a greater or less degree, but never conspicuously.

- l*¹. Prosternal spine transverse, apically truncate or subtruncate; interval between mesosternal lobes of female slightly transverse; subgenital plate of male moderately narrow.
53. *montanus* (p. 232).
- l*². Prosternal spine subconical, bluntly pointed; interval between mesosternal lobes of female broadly transverse, sometimes as broad as the lobes.
- m*¹. Interval between mesosternal lobes of female narrower than the lobes; cerci of male subequal throughout.
- n*¹. Prozona but little longer than the metazona; hind tibiae uniform in color beyond the patellar spot; tegmina transversely convex, so that the dorsal and lateral fields are not distinguished from each other by any angle; costal margin of same regularly arcuate.
54. *washingtonianus* (p. 233).
- n*². Prozona much longer than the metazona; hind tibiae with a broad pallid subbasal annulation; dorsal and lateral fields of tegmina set in distinct planes; costal margin of same angulato-arcuate. 55. *walshii* (p. 235).
- m*². Interval between mesosternal lobes of female fully as broad as the lobes; cerci of male scarcely half as broad in the apical half as at base. 56. *altitudinum* (p. 236).
- k*². Interspace between the eyes of male no broader than the first antennal joint; anal cerci of male with nearly straight upper margin; subgenital plate not apically elevated, though furnished with a backward directed tubercle formed by the angulation of the margin 57. *gracilipes* (p. 238).
- j*². Tegmina lateral, widely separated; cerci of male apically truncate; furcula obsolescent; subgenital plate relatively short, of unequal breadth. 58. *geniculatus* (p. 239).
- i*². Apical margin of subgenital plate of male neither elevated nor tuberculate, the margins as seen from above quadrate, apically transverse. 59. *rusticus* (p. 240).
- g*². Cerci of male tapering distinctly and abruptly, the apical less or almost less, generally very much less, than half as broad as the basal portion and more or less acuminate (14. Borekii series).
- h*¹. Subgenital plate of male more or less elevated posteriorly, but with no distinct apical tubercle.
- i*¹. Posterior margin of pronotum not mesially emarginate; tegmina attinent or approximate.
- j*¹. Interval between mesosternal lobes of female strongly transverse; lateral carinae of pronotum rounded so as to be subobsolete; postocular piceous band generally distinct, complete, percurrent 60. *pacificus* (p. 241).
- j*². Interval between mesosternal lobes of female subquadrate or feebly transverse; lateral carinae of pronotum distinct; postocular piceous band generally obsolete or wholly wanting, and even when distinct wholly confined to the prozona. 61. *borekii* (p. 243).
- i*². Posterior margin of pronotum mesially emarginate; tegmina distant, lateral.
- j*¹. Color testaceous with feeble or no postocular dark belt.
62. *tennipennis* (p. 244).
- j*². Color dark fuscous with distinct and broad postocular band, at least in the male 63. *missionum* (p. 246).
- h*². Subgenital plate of male distinctly tuberculate at tip.

- i¹. Tegmina more or less widely separated, rarely attingent; interval between mesosternal lobes of male twice or nearly twice as long again as broad; cerci not finely acuminate at tip.
64. *fuscipes* (p. 247).
- i². Tegmina attingent; interval between mesosternal lobes of male only slightly longer than broad; cerci tapering, rather regular, subfalcate, finely acuminate at tip..... 65. *scitulus* (p. 249).
- e². Cerci of male feebly compressed, substyliform, tapering almost uniformly throughout, apically acuminate (15. Puer series).
- f¹. Tegmina attingent; subgenital plate of male short and broad, its apical breadth surpassing the length of its lateral margin, not elevated apically.
66. *flabellatus* (p. 251).
- f². Tegmina distant; subgenital plate of male distinctly narrower than long, elevated apically..... 67. *puer* (p. 252).
- e². Cerci of male more or less expanded apically, so as to be broader at some point beyond the middle than at the middle, spatulate or subspatulate; metasternal lobes of male separated by a variable interval.¹
- d¹. Interval between mesosternal lobes of male quadrate or subquadrate, rarely (*M. amplexens*) half as long again as broad; metasternal lobes of male of variable width.
- e¹. Subgenital plate of male distinctly narrower than long, often narrowing apically.
- f¹. Lateral margins of subgenital plate of male apically meeting more or less acutely and furnished here with a conical erect tubercle (16. Inornatus series).
- g¹. Interval between mesosternal lobes of female slightly longer than broad; anal cerci of male broadly expanded apically; apical tubercle of subgenital plate of male blunt..... 68. *inornatus* (p. 254).
- g². Interval between mesosternal lobes of female distinctly transverse;² anal cerci of male very feebly expanded apically; apical tubercle of subgenital plate acute.
- h¹. Hind femora fasciate; apical half of male cerci moderately broad, the narrowest part more than half as broad as the base; lobes of furcula short..... 69. *viridipes* (p. 255).
- h². Hind femora not fasciate; apical half of male cerci very slender, the narrowest part not more than a third as broad as the base; lobes of furcula long..... 70. *decorus* (p. 257).
- f². Lateral margins of subgenital plate of male meeting with a rounded curve, which if apically elevated does not form a conical tubercle (17. Fasciatus series).
- g¹. Cerci of male strongly incurved and conspicuously enlarged apically.
- h¹. Cerci of male very slender, in the middle not one-third as broad as at base, the apical lobe feebly bifid; furcula developed as slender spines about a fourth the length of the supraanal plate.
71. *attenuatus* (p. 259).
- h². Cerci of male stout, in the middle more than half as broad as at base, the apical lobe single; furcula developed as mere denticulations.
72. *amplexens* (p. 260).
- g². Cerci of male at most gently if at all incurved, and feebly if at all enlarged apically.
- h¹. Metasternal lobes of male subattingent; tegmina shorter than the pronotum; anal cerci of male straight as seen laterally or slightly upcurved apically.

¹The cerci are barely enlarged apically in *M. viridipes*, which comes under this division. See, also, the note under the alternate category.

²The female of *M. decorus* is not known.

β. Cerci of male rounded at tip; furcula scarcely protruding beyond the hind margin of the last dorsal segment; apical margin of the subgenital plate slightly elevated above the lateral margins.

β¹. Supraanal plate of male suddenly contracted before the tip; anal cerci regularly incurved throughout; subgenital plate very broad at base:..... 73. *saltator* (p. 251).

β². Supraanal plate of male regularly triangular; anal cerci slightly twisted as well as incurved; subgenital plate narrow at base.

74. *rotundipennis* (p. 263).

γ. Cerci of male truncate at tip; lobes of furcula long; apical margin of subgenital plate in no way elevated above the lateral margins.

75. *obovatipennis* (p. 264).

δ. Metasternal lobes of male only approximate; tegmina as long as or much longer than the pronotum; anal cerci of male slightly decurved apically, or at least inferiorly angulate at apex.

δ¹. Tegmina not much longer than the pronotum; cerci of male delicate, tapering considerably in apical half; subgenital plate only slightly elevated posteriorly, no broader there than at base.

76. *jurencus* (p. 266).

δ². Tegmina more than half as long as the abdomen; cerci of male coarse and stout, tapering but little in basal half; subgenital plate strongly elevated posteriorly and there very broad.

77. *fasciatus* (p. 267).

ε. Subgenital plate of male short and broad, its apical breadth equal to or surpassing the length of its lateral margin,—see previous note (18. *Alleni* series).

ε¹. Tegmina twice as long as pronotum; cerci of male relatively long and narrow; male cerci fully three times as long as broad. 79. *alleni* (p. 273).

ε². Tegmina of about the length of the pronotum; cerci of male broad and relatively short; male cerci not more than twice as long as broad.

80. *snowii* (p. 274).

ζ. Interval between mesosternal lobes of male nearly or quite twice, sometimes more than twice, as long as broad; metasternal lobes of male attingent or subattingent.

ζ¹. Subgenital plate of male short and broad, its apical breadth equal to or surpassing the length of its lateral margin,—see previous note (23. *Texanus* series).

ζ¹. Tegmina widely separated, lateral; interval between mesosternal lobes of male more than twice as long as broad; furcula consisting of a pair of exceptionally broad and short plates 101. *dumicola* (p. 318).

ζ². Tegmina subattingent, attingent, or overlapping; interval between mesosternal lobes of male less, generally much less, than twice as long as broad; furcula consisting of a pair of approximate pointed denticulations.

ζ¹. Subgenital plate of male ending in a conical tubercle.

102. *variabilis* (p. 319).

ζ². Subgenital plate of male with no pointed tubercle.

η¹. Lobes of furcula longer than broad; extremity of subgenital plate of male elevated, but not noticeably recurved; interval between mesosternal lobes of male hardly more than half as long again as broad.

η¹. Apex of male cerci angulate below 103. *lepidus* (p. 321).

η². Apex of male cerci equally rounded above and below.

104. *blatchleyi* (p. 322).

*h*². Lobes of furcula broader than long; extremity of subgenital plate of male elevated and considerably recurved; interval between mesosternal lobes of male nearly or quite twice as long as broad.

105. *texanus* (p. 324).

*e*². Subgenital plate of male distinctly narrower than long, often narrowing apically (24. *Plebejus* series).

*f*¹. Hind margin of pronotum distinctly though obtusely angulate; interval between mesosternal lobes of female at least half as long again as broad; apical portion of anal cerci of male distinctly and sharply sulcate exteriorly..... 106. *plebejus* (p. 326).

*f*². Hind margin of pronotum rarely angulate, sometimes emarginate; interval between mesosternal lobes of female (where known) subquadrate; apical portion of anal cerci of male exteriorly tumid or plane.

*g*¹. Posterior margin of pronotum distinctly emarginate in the middle; tegmina widely separated; cerci of male elongate, surpassing the supraanal plate; subgenital plate broader at base than apically, its apical margin regularly rounded and even 107. *gracilis* (p. 327).

*g*². Posterior margin of pronotum obtusely angulated or rounded truncate, with at most but feeblest sign of any emargination; tegmina attinent or overlapping; cerci of male relatively brief, not surpassing the supraanal plate; subgenital plate not broader at base than apically, its apical margin angulate or tuberculate.

*h*¹. Tegmina shorter than pronotum; posterior margin of pronotum rounded truncate with feeblest signs of mesial emargination; cerci of male curved slightly upward; subgenital plate ending in a blunt rather coarse tubercle..... 108. *inops* (p. 329).

*h*². Tegmina longer than pronotum; posterior margin of pronotum distinctly though very obtusely angulate; cerci of male curved feebly downward; subgenital plate ending in a delicate pointed tubercle.

109. *marginatus* (p. 330).

*A*². Tegmina nearly or quite as long as, or longer than, the abdomen; furcula usually well developed, generally at least a quarter as long as the supraanal plate, but sometimes obsolete.

*b*¹. Cerci of male rapidly expanding from the base toward the middle, as a whole broad and short, flabellate, rarely twice as long as broad, not expanded apically (2. *Flabellifer* series).

*c*¹. Cerci of male twice as broad in broadest as in narrowest portion.

*d*¹. Subgenital plate of male with a distinct though minute independent¹ apical tubercle 4. *occidentalis* (p. 145).

*d*². Subgenital plate of male with only an obscure trace of apical tubercle.

5. *cuneatus* (p. 147).

*e*². Cerci of male with no striking inequality in breadth.. 6. *flabellifer* (p. 148).

*b*². Cerci of male tapering from the very base toward the middle, rarely equal in basal portion,² generally long and slender and rarely as little as twice as long as broad.

*c*¹. Cerci of male beyond the middle either equal or tapering, the tip usually slender or acuminate, never bifurcate (in *M. ater* it enlarges feebly).

*d*¹. Furcula of male developed as large flattened lobes, about half as long as the supraanal plate and exceptionally broad, but apically narrowed by the considerable excision of their inner side; subgenital plate not elevated apically above the lateral margins (3. *Bowditchi* series).

¹ That is, not formed by the culmination of the more or less pyramidal form of the subgenital plate.

² In rare instances it expands slightly from the extreme base, but it is then greatly expanded apically.

*e*¹. Body, tegmina, and legs almost wholly green, the hind femora not banded.

*f*¹. Sides of the disk of the prozona with a distinct narrow yellow stripe, extending to the upper margin of the eyes; passage of the disk of the pronotum into the lateral lobes more gradual than in the alternate category; hind tibiae green; antennae apically infuscated. . . . 10. *herbaceus* (p. 153).

*f*². Disk of pronotum and summit of head uniform in coloration, the former passing into the lateral lobes with a more distinct angle than in the alternate category; hind tibiae blue; antennae uniform.

11. *flavescens* (p. 155).

*e*². Body, tegmina, and legs brown or testaceous, the hind femora generally banded with dark colors.

*f*¹. Forks of the male furcula more or less obliquely or transversely truncate at tip and given an oppositely hooked appearance by the rounded excision of the inner margin; hind femora generally distinctly banded.

*g*¹. Highly variegated, the lateral lobes of pronotum conspicuously marked with an unequal bright flavous stripe next the lateral carinae; male cerci very feebly expanded and externally sulcate apically.

12. *pictus* (p. 156).

*g*². Rather uniform in coloring, the lateral lobes with no bright stripe; male cerci in no way expanded apically and externally tumid rather than sulcate.

*h*¹. Lateral lobes of prozona with a broad and usually distinct piceous band above; tegmina generally distinctly flecked along the middle line. 13. *bowditchi* (p. 157).

*h*². Lateral lobes of prozona with a narrow or no distinct band above; tegmina very obscurely flecked, if at all, along the middle line.

14. *flavidus* (p. 158).

*f*². Forks of the male furcula rounded symmetrically at tip, the inner margin scarcely more excised than the outer, so that the forks are straight and not oppositely hooked; bands of hind femora scarcely perceptible.

15. *elongatus* (p. 160).

*d*². Furcula of male variously developed, rarely at all unusually broad and flattened, and then either not apically emarginate on the inner side, or the subgenital plate is considerably elevated apically, or both.

*e*¹. Subgenital plate of male almost or quite as broad as the marginal length, its apical margin generally notched; cerci broad and nearly equally broad throughout (except sometimes narrowed by the oblique excision of the lower side of the apical half), the basal half scarcely tapering, the whole rarely more than twice and never thrice as long as the middle breadth (except in a few cases, and then the apical margin of the subgenital plate is mesially notched), very broadly rounded at apex.

*f*¹. Apical margin of subgenital plate of male not mesially notched; mesosternum of male variable.

*g*¹. Apical margin of subgenital plate of male but slightly elevated above the lateral margins and moderately prolonged posteriorly; mesosternum of male in front of lobes flat (4. *Glaucipes* series).

*h*¹. Prozona of male longer than its posterior breadth; lateral carinae more pronounced on prozona than on metazona; interval between mesosternal lobes of male twice as long as broad; hind tibiae blue.

16. *glaucipes* (p. 161).

*h*². Prozona of male transverse; lateral carinae more pronounced on metazona than on prozona; interval between mesosternal lobes of male subquadrate; hind tibiae red 17. *kennicottii* (p. 163).

*g*². Apical margin of subgenital plate of male conspicuously elevated above the lateral margins and greatly prolonged posteriorly; mesoster-

num of male in front of lobes with a central swelling, forming a blunt tubercle (5. *Utahensis* series).

*h*¹. Apical margin of subgenital plate of male entire; ¹lobes of furcula not exceptionally broad; subgenital plate greatly but not excessively prolonged

*i*¹. Interval between mesosternal lobes of male more than twice as long as broad; of female a little longer than broad; male cerci more than twice as long as broad; apical margin of subgenital plate of male, as seen from behind, subtruncate..... 18. *bruneri* (p. 164).

*i*². Interval between mesosternal lobes of male much less than twice as long as broad; of female transverse; male cerci less than twice as long as broad; apical margin of subgenital plate of male, as seen from behind, rounded..... 19. *excelsus* (p. 166).

*h*². Apical margin of subgenital plate of male deeply notched on either side of the middle; lobes of furcula exceptionally broad, subequal throughout; subgenital plate excessively prolonged.

20. *utahensis* (p. 167).

*f*². Apical margin of subgenital plate of male mesially notched; mesosternum of male in front of lobes with a central swelling, forming a blunt tubercle (6. *Spretus* series).

*g*¹. Tegmina extending beyond hind femora, if at all, by not more than the length of the pronotum, generally by much less than that; prozona of male quadrate or very feebly transverse; cerci of male generally almost or quite twice as long as broad.

*h*¹. Cerci of male regularly subfalciform, both margins being uniformly and distinctly curved rather than bent, and more than twice as long as median breadth..... 21. *alaskanus* (p. 169).

*h*². Cerci of male nearly straight as viewed laterally, or slightly bent upward in apical half, rather than curved.

*i*¹. Cerci of male distinctly more than twice as long as median breadth, the apical half subequal but narrower than the basal half.

*j*¹. Hind tibiae normally pale glaucous; when red, pale red.

*k*¹. Larger, robust; median carina usually as distinct between the sulci as on the anterior portion of the prozona.

22. *affinis* (p. 171).

*k*². Smaller, slender; median carina usually obsolete or subobsolete between the sulci..... 23. *intermedius* (p. 172).

*j*². Hind tibiae bright red..... 24. *bilitoratus* (p. 174).

*i*². Cerci of male not more than twice as long as median breadth, the apical half not only narrower than the basal half, but itself tapering throughout, obliquely truncate beneath; hind tibiae usually red.

*j*¹. Tegmina brief, not nearly reaching the tips of the hind femora; apical margin of subgenital plate of male greatly elevated.

25. *defectus* (p. 177).

*j*². Tegmina reaching, generally considerably surpassing, the tips of the hind femora; apical margin of subgenital plate of male moderately elevated..... 26. *atlanis* (p. 178).

*g*². Tegmina extending beyond hind femora by the length of the pronotum or nearly as much, often by the length of the head and pronotum combined; prozona of male generally strongly transverse; cerci of male not more than half as long again as broad..... 27. *spretus* (p. 184).

¹ It is occasionally fissured mesially (perhaps in drying) but not properly notched or bilobed.

e³. Breadth of subgenital plate of male variable, but generally narrower than long, its apical margin usually entire; cerci rarely less than four times as long as middle breadth (when less, at least three times as long, and then the apical margin of the subgenital plate is entire), generally slender, excepting sometimes at extreme base when there is great disparity in width between the basal and apical halves, the basal half generally tapering considerably, the apical half often much narrower than the basal, rarely showing any excision of the lower margin, the apex narrowly rounded or bluntly pointed.

f¹. Subgenital plate of male as broad or nearly as broad at apex as at base, generally elevated apically and often notched (generally narrowly); cerci usually narrowing but little on basal half, the apical half equal and symmetrical, bluntly rounded (rarely truncate or angulate) apically.

g¹. Apical margin of subgenital plate of male notched with greater or less distinctness; cerci slender, narrower than the frontal costa, subequal, straight or only gently incurved (7. *Devastator* series).

h¹. Small species, with tegmina not surpassing the hind femora in either sex; interval between mesosternal lobes of male distinctly less than twice as broad as long.

i¹. Cerci of male narrowed rather than broadened apically.

j¹. External surface of male cerci apically dimpled; furcula with the tapering portion relatively broad, distinctly flattened, almost reaching the middle of the supraanal plate.

k¹. Prozona of male longitudinal; fingers of furcula parallel; cerci bent inward apically..... 28. *diminutus* (p. 190).

k². Prozona of male quadrate; fingers of furcula divergent; cerci gently incurved throughout.... 29. *consanguineus* (p. 192).

j². External surface of male cerci sulcate through apical third or more; furcula with the tapering portion very slender, not flattened, not nearly reaching the middle of the supraanal plate.

30. *sierranus* (p. 193).

i². Cerci of male feebly enlarged apically rather than narrowed.

31. *ater* (p. 194).

h². Medium-sized species, with tegmina almost always surpassing the hind femora in the male and usually in both sexes; interval between mesosternal lobes of male fully twice, generally more than twice, as long as broad.

i¹. Tegmina more or less, generally distinctly and profusely, maculate.

j¹. Lateral lobes of prozona with a generally distinct black band, rarely broken and then by no conspicuous pale oblique stripe.

32. *devastator* (p. 196).

j². Lateral lobes of prozona with a distinct black band, always broken by a conspicuous more or less arcuate oblique pale stripe.

33. *virgatus* (p. 199).

i². Tegmina immaculate or with the feeblest possible sign of maculation.

j¹. Whole body, including tegmina, very light colored, having a bleached appearance with no dark markings, except (and very rarely) dusky clouds on hind femora..... 34. *uniformis* (p. 201).

j². Whole body, including tegmina, moderately dark, the lateral lobes with a darker stripe and the hind femora distinctly though not conspicuously bifasciate..... 35. *angelicus* (p. 202).

g². Apical margin of subgenital plate of male entire; cerci either broad (broader than the frontal costa or fully as broad as it) and subequal; or else very unequal, tapering rapidly at the base and generally arcuate; hind tibiae usually red.

- h*¹. Supraanal plate regularly triangular with straight margins; subgenital plate with a postmarginal tubercle at apex (8. Impudicus series) 36. *impudicus* (p. 204).
- h*². Supraanal plate with sides more or less irregular or sinuate by lateral compression or by the depression of the apical half of the plate; subgenital plate with no postmarginal tubercle though sometimes with the margin itself apically thickened.
- i*¹. Interval between mesosternal lobes of male distinctly longer, generally much longer, than broad and much narrower than the lobes; metasternal lobes attinent or subattinent in the male (12. Dawsoni series).
- j*¹. Subgenital plate of male broad, at least as broad as long; cerci incurved feebly and gently or not at all; hind tibiae red. 50. *dawsoni* (p. 227).
- j*². Subgenital plate of male rather narrow, narrower than long, although short; cerci abruptly incurved apically; hind tibiae yellow.
- k*¹. Tegmina only attaining the tip of the hind femora; supraanal plate of male suddenly depressed in apical half; furcula slightly developed, shorter than last dorsal segment. 51. *gladstoni* (p. 229).
- k*². Tegmina considerably surpassing the tip of the hind femora; supraanal plate of male not apically depressed; furcula well developed, about one-third as long as the supraanal plate. 52. *palmeri* (p. 230).
- i*². Interval between mesosternal lobes of male quadrate, almost or a little transverse and but little narrower than the lobes; metasternal lobes of male only approximate (17. Fasciatus series).
- j*¹. Cerci no slenderer or hardly slenderer on apical than on basal half, far surpassing the supraanal plate; furcula very slight, not so long as last dorsal segment 77. *fasciatus* (p. 267).
- j*². Cerci much slenderer on apical than on basal half, shorter than the supraanal plate; furcula long and slender, reaching the middle of the supraanal plate 78. *borealis* (p. 270).
- f*². Subgenital plate of male conspicuously narrower at apex than at base (generally only half as wide), rarely at all elevated at apex above the lateral margins and never notched¹; cerci always distinctly narrowing on basal half, the upper angle of the apex prolonged and often subacuminate (19. Femur-rubrum series).
- g*¹. Distal half of male cerci much less than half as broad as the extreme base; interval between mesosternal lobes of male nearly or quite twice as long as broad; tegmina usually surpassing the hind femora.
- h*¹. Pronotum marked above with light carinal streaks on a dark ground; tegmina dark olivaceous green 81. *plumbeus* (p. 276).
- h*². Pronotum uniform in coloring above; tegmina dark fuscous.
- i*¹. Furcula not reaching or scarcely reaching the middle of the supraanal plate 82. *femur-rubrum* (p. 278).
- i*². Furcula extending considerably beyond the middle of the supraanal plate 83. *propinquus* (p. 285).
- g*². Distal half of male cerci distinctly more than half as broad as the extreme base; interval between mesosternal lobes of male scarcely if at all longer than broad; tegmina usually falling far short of the tips of the hind femora.

¹Except in *M. monticola*, where it is very broadly and shallowly notched by the tubercular elevation of the lateral extremities of the apical margin.

*h*¹. Apical margin of subgenital plate not elevated where it joins the lateral margins, so that it is straight as seen from behind.

84. *extremus* (p. 287).

*h*². Apical margin of subgenital plate elevated to form a tubercle where it joins the lateral margins, so that it is broadly notched as seen from behind.....

85. *monticola* (p. 290).

*c*². Cerci of male more or less expanded apically, so as to be broader at some point beyond the middle than at the middle, spatulate or subspatulate or apically bifurcate.

*d*¹. Cerci of male simply spatulate or subspatulate, at most moderately broad, apically entire and no broader than at base; furcula always developed as distinct denticulations, generally as long or very long ones.

*e*¹. Furcula of male long and prominent, the projecting portion much longer than the last dorsal segment from which it springs, generally more than a third as long as the supraanal plate.

*f*¹. Subgenital plate of male only moderately broad at apex, distinctly narrower than long, never in the least notched and rarely, and then but slightly, elevated apically; furcula rarely (and then but little) less, usually more, than half as long as the supraanal plate; hind tibiae green or blue, rarely (*M. complanatipes*) reddish yellow (20. *Cinereus* series).

*g*¹. Furcula of male only moderately broad at base, tapering uniformly, not more than half as long as the supraanal plate; cerci uniformly incurved throughout, not nearly reaching the tip of the supraanal plate; the latter abruptly and strongly contracted shortly before its tip.

*h*¹. Prozona of male quadrate or transverse; apical margin of subgenital plate of male, as seen from above, well rounded.

86. *bispinosus* (p. 292).

*h*². Prozona of male a little longer than its basal breadth; apical margin of subgenital plate of male, as seen from above, rounded angulate.....

87. *terminalis* (p. 293).

*g*². Furcula of male unusually broad at base, usually tapering unequally, the narrowing beginning beyond the base and leaving a portion of the apex equal and very slender, the whole considerably more than half the length of the supraanal plate; cerci bent suddenly inward before the tip and at the tip reassuming, at least in part, the original course, reaching the tip of the supraanal plate; the latter with no abrupt pre-apical constriction.

*h*¹. The distal twist of the male cerci conspicuous and involving the apical half of the same.

*i*¹. Furcula of male narrowing uniformly or almost uniformly throughout; hind margin of pronotum very obtusangulate; disk of pronotum dotted obscurely if at all with fuscous.....

88. *cyanipes* (p. 295).

*i*². Furcula of male with a considerable part of the apical portion equal and very slender; hind margin of pronotum only a little obtusangulate; disk of pronotum generally distinctly dotted with fuscous.....

89. *cinereus* (p. 296).

*h*². The distal twist of the male cerci inconspicuous, involving only the extreme tip.

*i*¹. Tegmina long and very slender, far surpassing the hind femora, without distinct spots; hind femora strongly compressed; hind tibiae reddish yellow.....

90. *complanatipes* (p. 298).

*i*². Tegmina of normal width and but little surpassing the hind femora, maculate along the discoidal area; hind femora normal; hind tibiae glaucous.....

91. *canonicus* (p. 300).

*f*². Subgenital plate of male very broad apically, nearly or quite as broad as long, apically generally notched, though very feebly; furcula rarely (and then but little) more than a third the length of the supraanal plate; hind tibiae usually red, but sometimes blue or green (21. *Angustipennis* series).

*g*¹. Hind tibiae red.

*h*¹. Prozona of male subquadrate; tegmina very slender, subequal, scarcely expanded on the costa; furcula of male with straight subparallel forks 92. *comptus* (p. 302).

*h*². Prozona of male distinctly longitudinal, much longer than its basal breadth; tegmina of ordinary breadth and costal expansion, tapering; furcula of male with arcuate, strongly divergent forks.

93. *coccineipes* (p. 303).

*g*². Hind tibiae glaucous.

*h*¹. Furcula of male not more than a third as long as the supraanal plate; tegmina lightly maculate or immaculate.

94. *angustipennis* (p. 305).

*h*². Furcula of male more than a third as long as the supraanal plate; tegmina usually heavily maculate..... 95. *impiger* (p. 306).

*e*². Furcula of male slight, the projecting portion not longer or scarcely longer than the last dorsal segment from which it springs.

*f*¹. Subgenital plate of male broad, throughout broader than the extreme base of the cerci; apical portion of supraanal plate suddenly depressed just beyond the middle; cerci moderately broad, not much narrowed in the middle, more or less suddenly bent inward near tip, exteriorly sulcate at apex (22. Packardii series).

*g*¹. Interval between mesosternal lobes of male nearly or quite twice as long as broad.

*h*¹. Median carina of pronotum obsolete or almost obsolete on the prozona, distinct but low on the metazona; extremity of male cerci nearly plane exteriorly or merely depressed within the margin; forks of furcula conspicuously divergent.

*i*¹. Prozona ordinarily with a broad median dark stripe, made more conspicuous by the much lighter colors on either side, or else light-brownish testaceous; antennae of male but little more than three-fourths as long as the hind femora; hind tibiae blue or red.

96. *packardii* (p. 309).

*i*². Prozona with uniform dingy coloring on disk; antennae of male almost as long as the hind femora; hind tibiae red. 97. *foedus* (p. 311).

*h*². Median carina of pronotum tolerably distinct on the prozona, at least anteriorly, distinct and moderately high on the metazona; extremity of male cerci deeply sulcate exteriorly or else tumid; forks of furcula parallel or only slightly divergent.

*i*¹. Larger species; narrowest part of interval between mesosternal lobes of male narrower than the narrowest part of frontal costa; sides of head and prozona rarely with any black band; interval between mesosternal lobes of female strongly transverse; hind femora red beneath; hind tibiae stout..... 98. *corpulentus* (p. 313).

*i*². Smaller species; narrowest part of interval between mesosternal lobes of male equal to the narrowest part of frontal costa; sides of head and prozona with a black band; interval between mesosternal lobes of female subquadrate; hind femora yellow beneath; hind tibiae slender..... 99. *conspersus* (p. 315).

*g*². Interval between mesosternal lobes of male subquadrate.

100. *compactus* (p. 316).

*f*². Subgenital plate of male very narrow and narrower apically than the extreme base of the cerci; supraanal plate on the same general plane throughout; cerci slender and much narrowed in the middle, gradually incurved, exteriorly tumid at apex (24. *Plebejus* series).

*g*¹. Subgenital plate of male, as seen from above, apically angulate and tuberculate..... 109. *marginatus* (p. 330).

*g*². Subgenital plate of male, as seen from above, apically well rounded and simple..... 110. *paroxyoides* (p. 331).

*d*². Cerci of male apically bifurcate, or with an inferior submedian process or abrupt angulation, or else expanded so as to be distinctly, generally much, broader apically than at the extreme base; furcula wanting or minute, rarely (*M. arizonae*) a fourth as long as the supraanal plate.

*e*¹. Size small or medium; cerci of male always bifurcate or with an inferior submedian process or abrupt angulation; supraanal plate pretty regularly triangular, with straight or feebly convex lateral margins; furcula usually distinctly developed, rarely (*M. collinus*) wanting; prosternal spine usually short (25. *Collinus* series).

*f*¹. Lower fork of bifurcation of male cerci much longer than the upper; apical margin of subgenital plate narrowly, abruptly, and considerably elevated.

*g*¹. Small species; interval between mesosternal lobes of male more than twice as long as broad; of female quadrate; median portion of male cerci cylindrical, not compressed..... 111. *alpinus* (p. 333).

*g*². Very small species; interval between mesosternal lobes of male half as long again as broad; of female transverse; median portion of male cerci compressed..... 112. *infantilis* (p. 335).

*f*². Upper fork of bifurcation of male cerci longer than the lower, which is sometimes merely an inferior median or postmedian process; apical margin of subgenital plate elevated, if at all, only broadly, gradually, and a little.

*g*¹. Furcula of male distinctly present; apical margin of subgenital plate distinctly elevated more or less above the lateral margins.

*h*¹. Furcula of male consisting of slender spines, longer than the last dorsal segment; base of lateral margins of subgenital plates incurved.

*i*¹. Furcula of male less than a fourth as long as the supraanal plate; apical half of cerci bent upward from the basal course.

*j*¹. Prozona of male subquadrate; supraanal plate with the apical and basal portions in one plane; subgenital plate of equal or subequal breadth beyond the middle..... 113. *minor* (p. 337).

*j*¹. Prozona of male distinctly longitudinal; supraanal plate with the apical portion distinctly elevated above the median; subgenital plate distinctly narrowing beyond the middle.

114. *confusus* (p. 339).

*i*². Furcula of male half as long as the supraanal plate; anal cerci incurved but otherwise straight..... 115. *arizonae* (p. 340).

*h*². Furcula of male consisting of brief triangular lobes; base of lateral margins of subgenital plate not incurved.

*i*¹. Interval between mesosternal lobes of male twice as long as broad; upper fork of cerci scarcely bent upward above the trend of the basal stem.

*j*¹. Upper fork of male cerci much shorter than the stem; subgenital plate shorter than broad..... 116. *keeleri* (p. 341).

*j*². Upper fork of male cerci nearly as long as the stem; subgenital plate of equal length and breadth..... 117. *deletor* (p. 343).

*i*². Interval between mesosternal lobes of male scarcely longer than broad; upper fork of cerci bent distinctly upward.

118. *luridus* (p. 344).

*g*². Furcula of male absent; apical margin of subgenital plate not elevated above the lateral margins 119. *collinus* (p. 346).
*e*². Size medium or large; cerci of male rarely bifurcate or with an inferior process (and then the insect is of large size, which it never is in the alternate category, and the supraanal plate is distinctly shield-shaped, the apical half tapering with much greater rapidity than the basal; or the furcula is absent; or the interval between the mesosternal lobes of the male is three times as long as broad, which it never is in the alternate category); supraanal plate of variable shape; furcula either absent or very minutely developed; prosternal spine usually long.

*f*¹. Interval between mesosternal lobes of male nearly, fully, or much more than twice as long as broad; of female generally longer than broad, rarely quadrate; prosternal spine generally long; tegmina usually clear, or with a marked distinction in color between the dorsal and lateral areas, or with the angle between the two marked by a conspicuous light-colored stripe; head less prominent and with less prominent eyes in the male than in the alternate category, the front margin of the pronotum in no way flaring to receive the head.

*g*¹. Furcula of male entirely absent, or present only as a minute point or bead; hind tibiae usually yellow, but sometimes red (26. *Robustus* series).

*h*¹. Tegmina fully equal to or surpassing the hind femora; hind tibiae yellow.

*i*¹. Cerci of male boot-shaped, the apical foot as long as the basal leg, the apical margin deeply emarginate below; markings of the outer face of hind femora so run together as to be more longitudinal than transverse..... 120. *differentialis* (p. 349).

*i*². Cerci of male apically expanded only a little more above than below, the apical margin regularly or almost regularly convex; markings of outer face of hind femora transverse.

121. *robustus* (p. 354).

*h*². Tegmina somewhat abbreviated, not reaching the extremity of the hind femora; hind tibiae red or reddish yellow.

*l*¹. Apical margin of male cerci convex or angulate-convex.

*j*¹. Tegmina distinctly and considerably spotted with fuscous on the lateral face; cerci of male nearly equal on proximal half, the apical margin convex..... 122. *viola* (p. 355).

*j*². Tegmina almost uniformly fuscous on lateral face; cerci of male distinctly tapering on proximal half, the apical margin broadly angulate..... 123. *clypeatus* (p. 357).

*i*². Male cerci apically forked, the apical border being deeply emarginate..... 124. *furcatus* (p. 358).

*g*². Furcula of male distinctly present, though always very small, angulate, the angle rarely produced; hind tibiae never yellow, usually red, rarely purplish and yellow at tip (27. *Bivittatus* series).

*h*¹. Interval between mesosternal lobes of male distinctly more than twice as long as broad; pronotum with conspicuous light-colored lateral stripes on the disk, their outer margin at the position of lateral carinae.

*i*¹. Cerci of male very much more expanded apically above than below, the apical border slightly emarginate below.

*j*¹. Hind tibiae clear red throughout..... 125. *femoratus* (p. 360).

*j*². Hind tibiae purplish basally, yellow, rarely reddish, apically.

126. *bivittatus* (p. 363).

*i*². Cerci of male apically expanded but little more above than below; the apical border convex, with no emargination below.....

127. *thomasi* (p. 368).

*h*². Interval between mesosternal lobes of male a little less than twice as long as broad; pronotum unicolorous on disk, any lateral stripes being confined to the position of lateral carinae.

*i*¹. Prozona of male feebly longitudinal; apical margin of subgenital plate considerably elevated and truncate; furcula formed of apically rectangular lobes. 128. *yarrowii* (p. 369).

*i*². Prozona of male distinctly longitudinal; apical margin of subgenital plate considerably prolonged and subtuberculate; furcula formed of rounded lobes with a slight prolongation.

129. *olivaceus* (p. 370).

*f*². Interval between mesosternal lobes of male subquadrate; of female transverse; prosternal spine short; tegmina maculate with roundish fuscous spots; eyes of male and head prominent, the front margin of the pronotum flaring to receive the head (28. *Punctulatus* series).

*g*¹. Of large size; furcula present as a pair of very small denticulations; apical margin of male cerci broadly convex, feebly emarginate on the lower half. 130. *arboreus* (p. 372).

*g*². Of medium size; furcula wanting; apical margin of male cerci angulato-convex with no inferior emargination. 131. *punctulatus* (p. 374).

1. LAKINUS SERIES.

In this small and compact group the prozona of the male is longitudinal, and the interspace between the mesosternal lobes in the same sex longer than broad, sometimes twice as long as broad. The antennae are rather short. The tegmina are but little longer than the pronotum, overlapping, and apically acuminate. The hind tibiae are glaucous (or pale red) with nine to twelve (normally ten) spines in the outer series.

The supraanal plate is subtriangular, with rather plane surface, except for the rather prominent ridges bordering and forming between them the median sulcus; the furcula consists of a pair of pointed slender teeth but little longer than the last dorsal segment; the cerci are very peculiar, enlarging and bullate beyond the base, but with angular margins, sulcate inferiorly, compressed but longitudinally convex exteriorly, abruptly narrowing beyond the middle and incurved, ending in a superior, short, flattened finger directed toward the tip of the supraanal plate; the subgenital plate is very short and apically very broad, subconical, with a strongly and abruptly elevated though laterally brief apical margin.

The three species belonging here are rather bulky insects, rather above the medium size for the genus, and they range from southwestern Nebraska and Colorado to central Mexico.

1. MELANOPLUS MARCULENTUS, new species.

(Plate X, fig. 1.)

Pezotettix marculentus BRUNER!, MS.

Brownish fuscous, often more or less testaceous. Head brownish testaceous, tending to flavous above, where there is a rather broad posteriorly enlarging median streak and a broad submedian brownish

piceous band; vertex somewhat tumid, barely elevated above the pronotum, the interspace between the eyes nearly (male) or much more than (female) twice as broad as the first antennal joint; fastigium distinctly sulcate, with elevated rounded margins; frontal costa fading just before the clypeus at least in the male, slightly narrowed above, as broad as the interspace between the eyes (or barely narrower in the female), slightly sulcate excepting above, punctate throughout; eyes of moderate size, slightly prominent in the male, barely longer (male) or barely shorter (female) than the infraocular portion of the genae; antennae rufous, sometimes a little infuscated apically, two-thirds (male) or less than three-fifths (female) as long as the hind femora. Pronotum slightly (male) or distinctly (female) enlarging from in front posteriorly, the disk rounded subrectiform, passing by a distinct but rounded angle into the gently tumid subvertical lateral lobes, often with feeble subflavous lateral stripes next the lateral carinae, the upper half of the lateral lobes of the prozona occupied by a more or less distinct blackish (sometimes piceous) belt, sometimes followed below by luteous flecks; median carina percurrent but less distinct on the prozona than on the metazona, generally subobsolete between the sulci in the male; front margin faintly convex, hind margin very broadly obtusangulate, sometimes rotundato-obtusangulate; prozona distinctly longitudinal (male) or faintly longitudinal or quadrate (female), fully a third (male) or but little (female) longer than the finely punctate metazona. Prosternal spine moderately long, appressed conical, rather bluntly pointed, a little retrorse; interspace between mesosternal lobes from half as long again as broad to twice as broad with divergent sides (male) or transverse but much narrower than the lobes (female), the metasternal lobes subattinent (male) or approximate (female). Tegmina ovate lanceolate, apically acuminate, overlapping, somewhat longer than the pronotum, brownish fuscous, generally with a narrow median line of alternating blackish and flavous dots or dashes; wings pale flavous, sublinear, aborted. Fore and middle femora considerably tumid in the male; hind femora testaceous, more or less suffused either with ferruginous or olivaceous, the outer face often infuscated, especially in the upper half, the upper face and especially its inner half bimaculate with blackish fuscous, which sometimes invades the flavo-testaceous inner face, the lower face more or less rufous or ferruginous, the genicular arc piceous; hind tibiae glaucous, the spines pallid at base, black apically, nine to twelve (usually ten) in number in the outer series. Extremity of male abdomen clavate but apically conical, much recurved, the supraanal plate triangular, with feebly convex sides, bluntly acutangulate apex, and surface nearly plane except for the rather high, percurrent but apically obsolescent, submedian ridges bounding the moderately narrow median sulcus; furcula consisting of a pair of small and short, subparallel, tapering, pointed fingers or spines lying on the outer side of

the submedian ridges of the supraanal plate, and projecting over it by a little more than the length of the last dorsal segment; cerci bullate, strongly incurved, exteriorly flattened but a little convex longitudinally, at first enlarging and swelling, the inferior margin bent roundly at a right angle in the middle (before which the margin itself is transversely abruptly rectangulate, beyond it acutangulate, so that the lower face is sulcate), then suddenly contracted, with the upper portion produced as a short, tapering, bluntly pointed, compressed finger, which does not reach the tip of the supraanal plate; subgenital plate very much broader than long, subconical, the apical margin abruptly and greatly elevated, thickened and well rounded.

Length of body, male, 17 mm., female, 22.5 mm.; antennae, male, 7 mm., female, 7.25 mm.; tegmina, male, 6 mm., female, 7.25 mm.; hind femora, male, 10.5 mm., female, 13.5 mm.

Thirty-two males, 42 females. Montelovez, Coahuila, Mexico, September 20, E. Palmer; Sierra Nola, Tamaulipas, Mexico, December 3-6, E. Palmer; Sierra de San Miguelito, and mountains twelve leagues east of San Luis Potosi, Mexico, E. Palmer; San Luis Potosi, Mexico, October, E. Palmer, E. Barroeta; Bledos, San Luis Potosi, Mexico, October 1, E. Palmer; Zacatecas, Mexico, November (L. Bruner); Aguas Calientes, Mexico, November (L. Bruner).

2. MELANOPLUS LAKINUS.

(Plate X, fig. 2.)

Pezotettix lakinus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 79-80; Cent. Orth. (1879), pp. 68-69.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59; Bull. Washb. Coll., I (1885), p. 136; Publ. Nebr. Acad. Sc., III (1893), p. 27.

Vertex of the head gently tumid, scarcely elevated above the pronotum, the interspace between the eyes half as broad again as the first antennal joint; fastigium broad, shallow, flat, expanding in front, the bounding walls low and thick; frontal costa moderate, slightly expanded at the ocellus, sulcate almost throughout, only the summit flat, about as broad as the interspace between the eyes; eyes rather small, not prominent, about as long as the infraocular portion of the genae; antennae about three-fourths (male) or about two-thirds (female) as long as the hind femora. Pronotum short, especially in the female, but simple, expanding slightly posteriorly, either half of the lateral lobes of the prozona slightly and independently tumid in the male; front border truncate, hind border very little angulated and rounded; median carina slight but distinct, equal; lateral carinae well marked, forming a nearly square shoulder, especially on the hinder portion of the prozona; prozona longitudinal (male) or subquadrate (female), slightly (male) or scarcely (female) longer than the finely punctate metazona. Prosternal spine moderately long, a little shorter in the female than in the male,

conical, feebly appressed, slightly retrorse; interspace between mesosternal lobes half as long again as broad (male) or subquadrate (female), the metasternal lobes attingent (male) or approximate (female.) Tegmina abbreviate, overlapping, lanceolate, sharply pointed, longer than the pronotum, fully twice as long as broad, their inner and costal margins about equally convex. Extremity of male abdomen a little clavate, considerably recurved, bluntly conical, the supraanal plate triangular, as long as broad, the sides nearly straight, the tip rounded; furcula consisting of a pair of rather distant processes, broad at base, with a slight tapering pointed projection, the whole very small; cerci very tumid, spherico-triangular at base, carinate on the posterior outer margin, with a slight, equal, and blunt-tipped finger, shorter than the base, extending inward and upward from the basal swelling: subgenital plate short, considerably broader at apex than long, because the extreme posterior margin is produced to form a rather large rounded elevation nearly as high as broad.

The general color is a brownish griseous, tinged below with yellowish; the antennae are dark and sometimes darker apically; along the top of the head and pronotum is a blackish fuscous rather broad median stripe, sometimes broadening in patches, sometimes obsolete; the upper half of the lateral lobes of the prozona is marked by a broad blackish fuscous belt, which is often separated from the front margin and the frequent extension of the band to the eyes by a narrow yellow line. The tegmina are uniformly griseous, with a slender median line of alternate yellowish and fuscous flecks, often obsolete. The hind femora are lighter or darker testaceous, with two very broad, oblique, blackish purple belts, which do not reach the pale orange under surface; hind tibiae dull glaucous, the spines pale at base, black tipped, ten to eleven, usually ten, in number in the outer series. Sides of abdomen marked with black at base.

Length of body, male, 22 mm., female, 30 mm.; antennae, male, 9 mm., female, 9.5 mm.; tegmina, male and female, 7 mm.; hind femora, male, 12.5 mm., female, 14 mm.

Seven males, 7 females. Between Lincoln, Nebraska, and Denver, Colorado, October 3; Lakin, Kearny County, Kansas, 3,000 feet, September 1; Colorado (C. P. Gillette); Colorado, 5,500 feet, Morrison; Pueblo, Colorado, 4,700 feet, August 30-31; Las Cruces, Donna Ana County, New Mexico, T. D. A. Cockerell.

It is also reported from southwest Nebraska (Bruner).

This species is very closely allied to the last, differing from it in its narrower interspace between the sternal lobes, the oblique bands on the outer face of the hind femora, the more distant forks of the furcula of the male, and the stouter apical process of the subgenital plate; the cerci are much the same.

3. MELANOPLUS SONORAE, new species.

(Plate X, fig. 3.)

Pale testaceous (alcoholic specimens). Head not prominent, uniform in coloring except for a sometimes obsolete median black stripe on summit, and a broad postocular piceous band; vertex feebly tumid, not or slightly elevated above the pronotum, the interspace between the eyes half as broad again (male), or nearly twice as broad (female) as the first antennal joint; fastigium steeply declivent, sulcate throughout, more broadly in the female than in the male; frontal costa percurrent, rather prominent above but shallow below, equal except for a sudden and slight contraction between the antennae,¹ fully as broad as the interspace between the eyes, faintly sulcate at and below the ocellus, finely and faintly punctate throughout; eyes of medium size and prominence, longer, in the male much longer, than the infraocular portion of the genae; antennae testaceous, nearly two-thirds (male) or one-half (female) as long as the hind femora. Pronotum compressed, unusually equal, scarcely or not expanding on the metazona, the disk very uniform, broadly convex, passing by a rounded angle into the inferiorly vertical faintly tumid lateral lobes without forming lateral carinae; a broad piceous belt, sometimes obscured, occupies the upper half of the lateral lobes of the prozona; median carina distinct, percurrent, equal; front margin subtruncate, hind margin very obtusangulate; prozona distinctly (male) or feebly (female) longitudinal, about a fourth longer than the finely punctate metazona, which encroaches upon it mesially by the angularity of the principal sulcus. Prosternal spine rather long, appressed conical, a little retrorse, bluntly pointed; interspace between mesosternal lobes subequal, a little longer than broad (male) or transverse but narrower than the lobes (female). Tegmina abbreviate, ovate-lanceolate, overlapping, from a little longer than the pronotum to a third as long again, apically rather abruptly acuminate, brownish-testaceous, sometimes with feeble signs of a slender line of maculations. Fore and middle femora of the male a little tumid; hind femora slender, testaceous (apparently olivaceo-testaceous), sometimes bimaculate with fuscous on the inner half of the upper face, with black genicular arc; hind tibiae pale red (?), apically infuscated, the spines pallid at base and black beyond, ten to eleven, rarely twelve, in number in the outer series. Extremity of male abdomen clavate, strongly recurved, the supraanal plate triangular but suddenly tapering a little more rapidly just before the rectangulate apex, the margins not in the least elevated, the surface sloping in a concave curve to the summit of the very sharp and rather high submedian ridges inclosing the very deep and rather narrow percurrent median sulcus, whose margins are

¹ In one female specimen this is abnormally extended to nearly the whole supra-ocellar region, narrowing the costa by one-half.

a little contracted in the middle; furcula consisting of a pair of rather distant, moderately slender, scarcely tapering, blunt, dark denticulations, overlying the outer slopes of the submedian ridges of the supra-anal plate, and extending over the plate by only a little more than the length of the last dorsal segment; cerci strongly compressed-bullate just beyond the base, the bullate portion broader than long and exteriorly very strongly and longitudinally convex, beneath sulcate, the whole bullate portion abruptly narrowing and terminating in a compressed, indirected, round-tipped, equal and short finger, falling a little short of the tip of the supraanal plate; subgenital plate short, subconical, and apically very broad by the abrupt rounded production of the apical margin, the process of about equal height and posterior breadth, entire.

Length of body, male, 16 mm., female, 22 mm.; antennae, male, 6.5 mm. (est.), female, 6 mm.; tegmina, male and female, 6 mm.; hind femora, male, 10.25 mm., female, 12 mm.

One male, 4 females. Sonora, Mexico, A. Schott, Mexican Boundary Survey.

This species differs from the preceding two in the uniformity of the pronotum, which does not expand posteriorly, and has a uniformly sharp median carina throughout; it is also lighter bodied and less heavily marked.

2. FLABELLIFER SERIES.

In this series, one of the few which combines macropterous and brachypterous forms, the male prozona is feebly or distinctly longitudinal, occasionally quadrate, the interspace between the mesosternal lobes of the same sex varying from quadrate to half as long again as broad, or somewhat more. The tegmina are either fully developed, though at most but slightly surpassing the hind femora, much and irregularly maculate; or half as long as the abdomen, heavily marked in the discoidal field and subacuminate; or shorter than the pronotum and then apically rounded. The length of the tegmina in each species, however, is fixed. The hind tibiae are blue, with nine to eleven spines in the outer series, or, in some brachypterous forms, red, with ten to thirteen spines in the outer series.

The supraanal plate is triangular, rather longer than broad, with no or slightly developed transverse ridges. The furcula is minute or subobsolete, except in a single instance where it is small. The cerci are broad, often excessively broad and flabellate, enlarging from the base toward the middle, at least in the macropterous forms, rarely as much as twice as long as broad, broadly rounded apically. The subgenital plate is short and broad, sometimes with a slight apical tubercle, the lateral margins straight, the apical margin not elevated, or only in a single instance.

M. rileyanus is the most aberrant form, having very brief tegmina,

the furcula longer than the last dorsal segment, and the lateral margins of the subgenital plate slightly elevated apically.

The species, six in number, are evenly divided between macropterous and brachypterous forms—and this is the only homogeneous series of *Melanoplus* in which they are so—of small or rather small size, and are found only in the district to the west of the Mississippi and mainly in the Cordilleran region. They have not been reported north of the United States, and a single species has been found to extend south of our boundary in northern Mexico; while another species is known only from California and is the only one occurring west of the Sierra Nevada, (the same species, *M. rileyanus*, mentioned above).

4. MELANOPLUS OCCIDENTALIS.

(Plate X, fig. 4.)

Caloptenus occidentalis THOMAS!, Ann. Rep. U. S. Geol. Surv. Terr., V (1872), p. 453, pl. II, fig. 2.—GLOVER, Ill. N. A. Ent., Orth. (1872), pl. XI, fig. 2.—THOMAS!, Rep. U. S. Geol. Surv. Terr., V (1873), p. 161; ? Rep. Geol. Geogr. Surv. 100th mer., V (1875), p. 893; ? Proc. Dav. Acad. Sc., I (1876), p. 261.—SCUDDER, Bull. U. S. Geol. Surv. Terr., II (1876), p. 261.—THOMAS, *ibid.*, IV (1878), p. 484.—BRUNER, Can. Ent., IX (1877), p. 145.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 43.—BRUNER, Bull. Div. Ent. U. S. Dep. Agric., II (1883), p. 9; *ibid.*, III (1883), p. 60.

Melanoplus variolosus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 67-68; Cent. Orth. (1879), pp. 56-57.—BRUNER, Rep. U. S. Ent. Comm., III (1883) p. 61.

Melanoplus occidentalis BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 28.

Of medium or rather small size. Head very slightly elevated, a very little arched; fastigium rather shallow, particularly in the female, the margins in front of the eyes blunt, gently diverging and then converging, but in the female subparallel; interspace between the eyes as broad (male) or half as broad again (female) as the first antennal joint; frontal costa more than usually prominent, about as broad as the interspace between the eyes, scarcely contracted above, scarcely enlarged at the ocellus, at and below which it is somewhat sulcate; eyes rather prominent, anteriorly truncate; antennae somewhat more (male) or slightly less (female) than three-fourths as long as the hind femora. Pronotum enlarging on the metazona, laterally subtumid in an irregular way on the prozona, the metazona faintly punctate; front margin feebly convex, with a feeble median emargination; hind margin roundly obtusangulate; median carina distinct on the metazona, faint on the prozona, obsolete between the sulci; sides of the pronotum hardly shouldered or with very rounded shoulders; transverse sulci of prozona pretty distinct and continuous; prozona longitudinal, a little longer than the metazona (male) or transverse, no longer than the metazona (female). Prosternal spine rather short, appressed conical, broadly rounded at tip, a little retrorse; interspace between mesosternal lobes about half as long again as broad (male) or transverse (female).

Tegmina extending to or a little beyond the tip of the abdomen, slender, scarcely tapering, profusely maculate throughout, as described below. Supraanal plate of male rounded triangular, pointed, fully as broad as long; furcula consisting of minute triangular denticles; cerci flabellate, each consisting of a very broad, upturned lateral lamella, whose anterior edge is gently convex, whose lower is strongly convex only at the expanded base and there thickened, the tip rounded, angular, and the whole half as long again as the extreme width; subgenital plate shallowly scoop-shaped, the apical edge entire, but just below it, at the extremity, a conical tubercle. Basal tooth of the lower valve of the ovipositor of the female sharp, triangular, nearly as long as broad.

The general color is a ferruginous-brown above, mottled strongly with blackish-fuscous, livid-brown below; a blackish-brown median stripe, broadening posteriorly, passes from between the eyes to the back of the head, but seldom continues, and then less deeply, upon the pronotum; the face and genae vary from yellow to testaceous and are seldom blotched by dusky colors, excepting on the genae; the antennae are of a lighter or darker testaceous, and are scarcely infuscated at tip; a more or less broken black patch occupies the upper part of the anterior half of the lateral lobes. The tegmina are dark brownish cinereous, with a slender median yellow stripe, frequently broken by quadrate fuscous or blackish spots, and similar spots are scattered rather distantly all over the tegmina, giving them an unusually speckled appearance; wings hyaline, the veins glaucous, except anteriorly. Hind femora variable, either with oblique pale patches on a dark ground or—and generally—the reverse; hind tibiae glaucous, with black-tipped spines, ten or eleven in number in the outer series.

Length of body, male, 18 mm., female, 25 mm.; antennae, male, 9.5 mm., female, 10.25 mm.; tegmina, male, 16 mm., female, 21 mm.; hind femora, male, 11.5 mm., female, 14 mm.

Sixteen males, 12 females. Yellowstone, Montana (U.S.N.M.—Riley collection); Eastern Wyoming (same); Sweetwater and Cottonwood, Wyoming (same); Cheyenne, Laramie County, Wyoming (same); Douglas, Converse County, Wyoming, Bruner (same); Sidney, Cheyenne County, Nebraska, August (L. Bruner); Fort Robinson, Dawes County, Nebraska, August 22, Bruner (U.S.N.M.—Riley collection); Western Kansas, July (same); Lakin, Kearny County, Kansas, 3,000 feet, September 1; Colorado, 5,500 feet, Morrison; Pueblo, Colorado, 4,700 feet, July 8-9, August 30-31; Garden of the Gods, El Paso County, Colorado; Salida, Chaffee County, Colorado, July 3 (U.S.N.M.—Riley collection); Magdalena, Socorro County, New Mexico (University of Kansas); Fort Wingate, Bernalillo County, New Mexico (U.S.N.M.—Riley collection).

It has also been reported from Bismarck, North Dakota (Bruner), Minnesota (Thomas), Salt Lake, Utah (Seudder), and Spring Lake, Utah (Thomas).

5. MELANOPLUS CUNEATUS, new species.

(Plate X, fig. 5.)

Melanoplus cuneatus BRUNER!, MS.

Brownish testaceous, darker above. Head luteo-testaceous, with the lateral ridges of the fastigium black, the posterior part of the vertex with a median triangular blackish stripe, a broken black edging to the upper posterior part of the eyes and, joining it, a black band behind the eyes; vertex tumid, much elevated above the pronotum, the interspace between the eyes not very broad, about as broad as the basal antennal joint, the fastigium deeply sulcate; frontal costa subequal, rather narrower than the interspace between the eyes, shallowly sulcate excepting above; eyes rather large, prominent, about as long as the infraocular portion of the genae; antennae fulvo-testaceous, about three-fourths as long as the hind femora. Pronotum feebly constricted mesially, expanding almost as much anteriorly as posteriorly, the front margin feebly convex, the hind margin obtusangulate, the lateral lobes lighter colored than the disk, but on the prozona marked above with a broken blackish fuscous band, the impressed middle line of the posterior section black; median carina percurrent, but slighter on the prozona than on the metazona, subobsolete between the sulci, the lateral carinae forming a rounded shoulder on the metazona, obsolete on the prozona. Prosternal spine moderately short, appressed conical, blunt, slightly retrorse; interspace between mesosternal lobes of male half as long again as broad. Tegmina surpassing a little the hind femora, not very slender, subequal, much maculate along the discoidal area but not elsewhere; wings hyaline. Hind femora brownish testaceous, crossed above and externally by two very oblique fuscous bars, which above are premedian and postmedian, the inner and under surfaces pale coralline, the genicular arc black; hind tibiae glaucous with a slender dusky patellar spot, the spines black nearly to the base, nine to ten, usually ten, in number in the outer series. Extremity of male abdomen feebly compressed, not clavate, scarcely upturned, the supraanal plate triangular, either lateral half broadly and shallowly sulcate and separated by sharp but not very high walls from the rather deep and apically narrowing and fading median sulcus; furcula composed of a pair of minute projecting angulations surmounting the ridges of the supraanal plate; cerci bent inwards almost from the base, very broad, broadening mesially by their inferior expansion, the lower margin suddenly bent at the middle, so that the apical half narrows rapidly and has an upward direction, well and rather narrowly rounded, even subangulate, at tip, the whole only half as long again as broad and yet longer than the supraanal plate; subgenital plate exceedingly small and of about equal length and breadth, subconical, with scarcely any trace of an apical tubercle, except that formed by the shape of the plate as a whole.

Length of body, male, 21 mm.; antennae, 9 mm.; tegmina, 16.5 mm.; hind femora, 12 mm.

Three males. Silver City, Grant County, New Mexico, (U.S.N.M.—Riley collection); Fort Grant, Graham County, Arizona (same); and Fort Whipple, Yavapai County, Arizona, Palmer.

6. MELANOPLUS FLABELLIFER.

(Plate X, fig. 6.)

Melanoplus flabellifer SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 68–69; Cent. Orth. (1879), pp. 57–58.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 61; Bull. Washb. Coll., I (1886), p. 200; Publ. Nebr. Acad. Sc., III (1893), p. 28.

Melanoplus occidentalis TOWNSEND!, Ins. Life, VI (1893), p. 31.

Of rather small size. Head scarcely elevated, well arched; interspace between the eyes rather broader than the first joint of the antennae, the fastigium faintly subspatulate, pretty deep, with abrupt but blunt, rounded walls; frontal costa narrower than the interspace between the eyes, slightly contracted above and very slightly just below the ocellus; otherwise scarcely enlarging from above downward, scarcely depressed above the ocellus, strongly sulcate at and below the same; eyes neither large nor very prominent; antennae pale castaneous, paler at base, about three-fourths (male) or less than two-thirds (female) as long as the hind femora. Pronotum rather simple, the metazona expanding somewhat, the unequal halves of the prozona each slightly tumid laterally, and as a whole slightly expanding anteriorly; front margin feebly sinuate, hind margin roundly obtusangulate; median carina nearly obsolete between the sulci, but otherwise nearly equal; transverse sulci of the prozona pretty distinct, the posterior severing the median carina; metazona scarcely punctate; prozona subquadrate, slightly longer than the metazona, or, in the female, sometimes subequal. Prosternal spine short, stout, appressed conical, very blunt tipped, hardly retrorse; interspace between the mesosternal lobes subquadrate, a little longer than broad (male) or transverse (female). Tegmina reaching (female) or slightly surpassing (male) the tip of the hind femora, not very slender, subequal. Supraanal plate of male triangular, bluntly pointed, the sides a little convex, rather longer than broad; furcula formed of distinct, pointed, triangular teeth; cerci large, flabellate, upturned, twice as long as the mean breadth, tapering but little, the extremity broadly rounded; subgenital plate prow-shaped, straight, ending in a blunt conical projection.

The general color is cinereo-plumbeous, the head and pronotum dusky above, with the usual black belt behind the eye, extending over the prozona. Tegmina dark fuscous, especially at base, sprinkled with dusky spots; wings hyaline, sometimes with a feeble bluish tinge, the anterior venation dusky. Hind femora livid brown on the outer face, heavily marked with rufo-fuscous in oblique bands, orange beneath;

hind tibiae rather dark glaucous, the spines black, nine to eleven in number in the outer series.

Length of body, male, 16.5 mm., female, 18 mm.; antennae, male, 7.2 mm., female, 6 mm.; tegmina, male, 13.75 mm., female, 13.5 mm.; hind femora, male, 9.5 mm., female, 9.75 mm.

Nine males, 5 females. Montana (U.S.N.M.—Riley collection); Finney County, Kansas, September, H. W. Menke (University of Kansas); between Smoky Hill, Kansas, and Denver, Colorado, September, L. Agassiz (Museum Comparative Zoology); Colorado Springs, El Paso County, Colorado, August, E. S. Tucker (same); Garden of the Gods, El Paso County, Colorado, October 6; South Park, Colorado, 8–10,000 feet, August 11, 16; Salt Lake Valley, Utah, September (U.S.N.M.—Riley collection); Johnson's Basin, New Mexico, June 22, Townsend (L. Bruner); Zacatecas, Mexico, November (same).

It is also reported by Bruner from Idaho, Wyoming, and western Nebraska.

7. MELANOPLUS DISCOLOR.

(Plate X, fig. 7.)

Pezotettix discolor SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 81–82; Cent. Orth. (1879), pp. 70–71.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 58.

Vertex tumid, considerably elevated above the pronotum; interspace between the eyes half as broad again as the basal antennal joint, the fastigium shallow, indistinct, broad, enlarging apically; frontal costa broad, equal, flat (male) or slightly tumid (female) above, sulcate below; antennae three-fourths (male) or hardly two-thirds (female) as long as the hind femora. Pronotum simple, scarcely enlarging on the metazona, the front border straight, the hind border roundly and broadly angulate; median carina distinct though rather slight, equal; lateral carinae scarcely perceptible; metazona faintly punctate; prozona slightly longitudinal (male) or quadrate (female), about a fourth longer than the metazona. Prosternal spine moderately long, cylindrical, blunt, erect; interspace between mesosternal lobes twice (male) or almost twice (female) as long as broad; metasternal lobes attingent (male) or approximate (female). Tegmina a little longer than head and pronotum together, tapering, the dorsal and lateral fields angularly separate. Supraanal plate of male triangular, longer than broad, pointed, the sides straight; furcula consisting of a pair of approximate, small, triangular teeth, the tips a little produced; cerci forming on each side a broad, semicircular, rounded flap, the upper side concave, the lower convex, the tip rounded, the whole in one plane; subgenital plate conical, longer than broad, the tip compressed.

The general color is a yellowish or cinereous brown above, a paler brownish yellow below. The antennae are pale red, infuscated apically; a very broad, straight, piceous belt, slightly larger behind than in front, extends from behind the eyes across the prozona, its upper edge

at the lateral carinae; an oblique cuneiform yellow dash, the apex in front and above, follows the ridge of the metathoracic episterna, margined on either side by an equal piceous belt. The dorsal field of the tegmina is of the same color as the disk of the pronotum, or occasionally a little paler, while the lateral field is nearly always much darker brown, the discoidal area marked by dashes of blackish fuscous, which occasionally suffuses nearly the whole of the lateral field. The hind femora are twice barred with blackish above, and have more or less blackish fuscous on their outer face; while the under portion of the femora is yellowish, and the hind tibiae red with black-tipped spines, twelve, rarely thirteen, in number in the outer series.

Length of body, male, 19 mm., female, 25 mm.; antennae, male, 9 mm., female, 18.5 mm.; tegmina, male, 8 mm., female, 9.5 mm.; hind femora, male, 12 mm., female, 13.5 mm.

Three males, 6 females. Dallas, Texas, J. Boll.

8. MELANOPLUS SIMPLEX, new species.

(Plate X, fig. 8.)

Ashen brown, darker above, sometimes darker throughout, with a postocular piceous band. Head not at all prominent, luteo-testaceous with a feeble olivaceous tinge, the summit with a pair of submedian triangular stripes posteriorly; vertex tumid, elevated above the pronotum, the interspace between the eyes not very narrow, slightly broader than the first antennal joint; fastigium strongly declivent, broadly sulcate anteriorly, more deeply in the male than in the female; frontal costa as broad as the interspace between the eyes, equal, faintly depressed at the ocellus, seriatly punctate at the sides; eyes rather large, rather prominent in the male, a little longer than the infraocular portion of the genae; antennae dark ferruginous, about two-thirds as long as the hind femora, of similar relative length in the two sexes. Pronotum short, subequal, scarcely enlarging posteriorly, slightly darker on the disk than on the lateral lobes and more or less feebly punctate or blotched with fuscous, the lateral lobes with a broad, equal, piceous band, extending from behind the eyes across the upper part of the prozona; front margin feebly convex, hind margin broadly angulate; the median carina sharper on the metazona than on the prozona but hardly more prominent, the disk separated from the slightly tumid lateral lobes by a blunt angle, but without distinct lateral carinae; prozona in both sexes slightly longitudinal, about a fourth longer than the feebly punctate metazona. Prosternal spine rather long, not slender, and erect, cylindrical and very blunt (male) or conical but not acuminate (female); interspace between mesosternal lobes somewhat longer than broad (male) or distinctly transverse (female), the metasternal lobes attingent over a short space (male) or approximate (female). Tegmina slightly or considerably longer than the head and

pronotum together, sublanceolate, subacuminate, brownish fuscous, the discoidal area sometimes with feebly alternating darker and lighter dashes. Hind femora externally varying from fusco-olivaceous to fusco-testaceous, the lower and inner faces flavous, the latter as well as the inner half of the upper face barred at base and before and beyond the middle with fuscous or blackish fuscous, the outer half of the upper face more or less infuscated throughout, the genicular arc black; hind tibiae red, the spines black only on their apical half, eleven or twelve in number in the outer series. Extremity of male abdomen slightly clavate, much upturned, the supraanal plate triangular with straight sides and acute apex, the rather broad, deep, median sulcus bounded by very high, sharp walls; furcula consisting of a pair of minute, acute denticulations overlying the ridges of the supraanal plate; cerci broad, arcuate, especially by the curvature of the lower margin, tapering only in the apical half, well rounded apically, much less than twice as long as broad, but nearly as long as the supraanal plate, hardly incurved, the apical portion feebly sulcate exteriorly; infracercal plates large, basally nearly as broad as the cerci, rapidly narrowing and extending slightly beyond the supraanal plate; subgenital plate broad and rather short, the lateral margins straight, apically acutely rounded, neither prolonged nor elevated.

Length of body, male, 14 mm., female, 20 mm.; antennae, male, 6.5 mm., female, 7.5 mm.; tegmina, male, 5 mm., female, 8.25 mm.; hind femora, male, 9 mm., female, 11 mm.

Two males, 1 female. Colorado, 5,500 feet, Morrison (S. Heushaw; S. H. Scudder).

9. MELANOPLUS RILEYANUS (new species).

(Plate X, fig. 9.)

Pezotettix rileyanus McNEILL!, MS.

Dark brownish testaceous, with a broad, lateral piceous stripe. Head rather prominent, dark testaceous, sometimes with a feeble olivaceous tinge, much flecked and punctate with fuscous, above much infuscated; vertex somewhat tumid, distinctly elevated above the pronotum, the interspace between the eyes rather narrow, narrower than the first antennal joint (male) or rather broad, distinctly broader than that joint (female), the fastigium with slight, raised, rounded ridges next the eyes, but otherwise scarcely sulcate (female) or distinctly sulcate throughout (male); frontal costa moderately broad, fully as broad as (male) or rather narrower than (female) the interspace between the eyes, subequal, strongly punctate throughout, feebly sulcate at and below the ocellus; eyes large and moderately prominent, distinctly longer than the infra-ocular portion of the genae; antennae luteo-testaceous, nearly (male) or but little more than half (female) as long as the hind femora. Pronotum

rather short and subequal, faintly constricted mesially, more or less faintly punctate with fuscous above, the lateral lobes with a broad piceous belt crossing the prozona above, and sometimes continued across the metazona, but usually obsolete or subobsolete there, sometimes fading, sometimes sharply defined below, the lower portion of the lobes usually lighter colored than elsewhere, repeating the color of the genae; front margin subfruncate, hind margin very broadly rotundato-angulate, in some females with no sign of angulation but very broadly convex; median carina percurrent but generally feebler on the prozona; lateral carinae marked by a distinct though rounded angle; prozona distinctly longitudinal (male) or subquadrate (female), one-fourth to one-third longer than the closely punctate metazona. Prosternal spine short (female) or very short (male), conical, erect; interspace between the mesosternal lobes nearly twice as long as broad (male) or slightly longer than broad (female). Tegmina ovate, well rounded, much less than twice as long as broad, rather shorter than the pronotum, brownish fuscous, generally cinereous in the anal field. Hind femora fusco-ferruginous or fusco-testaceous, twice banded rather obliquely with black, which is confluent on the lower half of the outer face, so as to leave above a large basal and median patch of the lighter color; the lower face is reddish, and the genicular arc fuscous; hind tibiae glaucous, often mottled or suffused with luteous toward the base, and generally with a basal annulus of the same, the spines black in their apical half, ten to twelve in number in the outer series. Extremity of male abdomen oblong clavate, well rounded, well upturned, the supraanal plate triangular with slightly convex sides and rectangulate apex, the median sulcus slender, not very deep, and percurrent, bounded by sharp but not very high walls; furcula consisting of a pair of elongate, slender, parallel, straight denticulations or fingers as long as the last dorsal segment, resting outside the ridges of the supraanal plate; cerci enlarging slightly at the base, then gradually enlarging in the basal half, beyond equal, apically well rounded, the whole forming a broad, much incurved and slightly torqueate plate, whose apical half is so deeply sulcate that its longitudinal halves are nearly at right angles; infracercal plates concealed; subgenital plate broad, fully as broad as long, the lateral margins abruptly elevated a little apically, but not prolonged posteriorly, the apical margin strongly rounded, entire.

Length of body, male, 17 mm., female, 20 mm.; antennae, male, 9 mm., female, 6 mm.; tegmina, male, 3 mm., female, 4.25 mm.; hind femora, male, 10 mm., female, 11 mm.

Six males, 17 females. Yuba County, California (L. Bruner); Mountains near Lake Tahoe, Placer County, California, October, Henshaw, Wheeler's expedition, 1876; Kern County, California, October (U.S. N.M.); Kern County, California, Coquillett (U.S.N.M.—Riley collection); Los Angeles County, California, May, September, Coquillett (same).

3. BOWDITCHI SERIES.

In this series the male prozona is slightly longitudinal, and the interspace between the mesosternal lobes exceptionally narrow, being more than twice, in the male, several times, as long as broad, while the metasternal lobes are attingent over considerable space in the male, approximate in the female. The tegmina, especially those of the male, are rarely, and then but little, maculate, always fully developed and surpassing the hind femora; the hind tibiae are green or blue, with nine to eleven, usually ten, spines in the outer series. The antennae are of very unequal length in the two sexes.

The supraanal plate is more or less clypeate, the apex always well angulate, and the median sulcus almost or quite obsolete; the most striking feature is the furcula, which consists of a pair of long, very broad, parallel, depressed plates, reaching about to the middle of the supraanal plate and at base largely concealing it, apically narrowed partly or wholly by their interior rounded emargination; the cerci are small, the apical portion subequal, nearly straight, and about half as broad as the base; the subgenital plate is somewhat narrower than long, subequal, apically extended slightly but not elevated, the lateral margins straight and on a line with the upper side of the last abdominal segments, the apical margin well rounded as seen from above and entire.

The species, six in number, are of medium or rather large size and are found almost altogether in the southwest; only one is known east of the Mississippi, and that only in the neighborhood of the main stream.

10. MELANOPLUS HERBACEUS.

(Plate X, fig. 10.)

Melanoplus herbaceus BRUNER!, Bull. Div. Ent. U. S. Dep. Agric., XXVIII (1893), pp. 25-26, fig. 13ab.—TOWNSEND, Ins. Life, VI (1893), p. 31.—BRUNER, Rep. St. Hort. Soc. Nebr., 1894, p. 163 (1894).

Grass green, more or less obscured with brownish olivaceous, almost the only markings being a broad dark green band extending from behind the eye across the prozona, directly beneath which the lateral lobes are often spotted with flavous; and, less frequently, a dusky green dorsal band from the posterior end of the fastigium across the prozona, occupying most of the disk and leaving between it and the lateral band only a narrow greenish flavous stripe on the lateral carinae. Head feebly prominent, the vertex gently tumid, the interspace between the eyes moderately broad, as broad as the frontal costa; the fastigium gently declivent and deeply and broadly sulcate; frontal costa percurrent, equal, sulcate throughout, deeply excepting above; eyes rather large, rather prominent, very much longer than broad; antennae a little longer than (male) or about two-thirds as

long as (female) the hind femora, ferruginous, more or less infuscated apically. Pronotum subequal on the prozona, the metazona expanding gently, the front margin subtruncate, the hind margin obtusely angulate, the angle well rounded, the disk gently convex, passing insensibly into the lateral lobes, the median carina slight on the metazona, indicated only by a pallid line on the prozona, the metazona closely and delicately punctate, the prozona a little longitudinal (male) or quadrate (female), slightly longer than the metazona. Prosternal spine long, conical, erect, blunt, a little shorter in the female than in the male; sternum sparsely punctate, the interval between the mesosternal lobes considerably more than twice (male) or fully twice (female) as long as broad, the metasternal lobes attingent over a considerable space (male) or approximate (female). Tegmina slender, gently tapering, well rounded at tip, surpassing considerably the tips of the hind femora, without markings; wings ample, pellucid, the veins and cross veins glaucous, more and more infuscated apically. Femora green, or more or less infuscated or embrowned, the hind pair rarely having the upper face infuscated with feeble, never distinct, fuscous clouds, the genicular arc more or less testaceous above; hind tibiae very faintly incurved, green becoming feebly flavescent apically, the spines rather short, pallid green, briefly black tipped, ten in number in the outer series. Extremity of the male abdomen subclavate, upturned, the supraanal plate subclypeate, narrowing gently in the basal, rapidly in the apical half, slightly constricted in the middle of the basal half, the apex rectangular, the sides broadly and considerably elevated, the rest of the surface plane with a scarcely perceptible median sulcus, except apically where it is slight; furcula consisting of a pair of very large, broad, depressed plates, originating at the base of the last dorsal segment and reaching almost to the middle of the supraanal plate, subequal and attingent for half their length, beyond with their inner margin roundly excised, the apex obliquely and broadly truncate, so that the inner apical angle is acute; cerci rather small, rapidly narrowing on the basal half by the declivence of the upper margin, beyond equal, compressed-cylindrical, blunt tipped, straight, distinctly shorter than the supraanal plate and not greatly surpassing the last ventral segment; subgenital plate moderately narrow, subequal, the lateral margin straight, the apex not in the least elevated and but feebly prolonged, strongly rounded as viewed from above.

Length of body, male, 23 mm., female, 28.5 mm.; antennae, male, 13 mm., female, 9.5 mm.; tegmina, male, 21 mm., female 23.5 mm.; hind femora, male, 12 mm., female, 14.3 mm.

Seven males, eight females. El Paso, Texas, November (U.S.N.M.—Riley collection; L. Bruner); Albuquerque, Bernalillo County, New Mexico, August, Snow (University of Kansas); Las Cruces, Donna Ana County, New Mexico, October, ovipositing, T. D. A. Cockerell; Fort Grant, Graham County, Arizona (U.S.N.M.—Riley collection).

Bruner states that it also occurs "across the line in Mexican territory for some distance," and that it is confined to river bottoms, where it feeds on low vegetation, but is rarely seen on the ground.

II. MELANOPLUS FLAVESCENS, new species.

(Plate XI, fig. 1.)

Uniform pale flavous tinged with green, the upper part of the lateral lobes with a broad olivaceous band, extending from the eyes across the prozona and feebly marking the lateral carinae of the metazona. Head uniform in coloring and, except for the band mentioned, as light above as below; vertex gently tumid, the interspace between the eyes moderate, scarcely narrower than the frontal costa, the fastigium descending with the curvature of the vertex, rather deeply and broadly sulcate throughout; frontal costa prominent above, moderately broad, equal, percurrent, deeply sulcate excepting above but with rounded margins, above seriatly punctate at the sides; eyes rather large and rather prominent; antennae almost as long as the hind femora (male), the first two joints flavous, the rest salmon red. Pronotum subequal, feebly enlarging at the metazona, the front margin feebly convex, the hind margin obtusely angulate, the angle rounded, the disk gently convex on the prozona with no lateral carinae, on the metazona plane with obscure rounded lateral carinae, the median carina distinct though slight on the metazona, wanting in front; prozona distinctly longitudinal, smooth, a third longer than the closely punctate metazona. Prosternal spine rather long, regularly conical, erect, blunt tipped; interspace between mesosternal lobes of male very slender, many times longer than broad, the metasternal lobes attingent over a wide space. Tegmina slender, very feebly tapering, well rounded apically, surpassing considerably the hind femora, greenish-yellow at base, nearly pellucid on apical half, without markings; wings pellucid with a scarcely perceptible glaucous tinge, the veins and cross veins fusco-glaucous. Fore and middle femora flavous with a tinge of olivaceous; hind femora golden yellow on the outer face, growing pallid below; elsewhere flavous with a distinct fulvous tinge on lower and inner sides, the genicular arc testaceous, stained with fuscous; hind tibiae glaucous, pallid at extreme base, the spines pallid on basal, black on apical half, ten in number in the outer series. Extremity of male abdomen feebly clavate, upturned, the supraanal plate obscurely clypeate, the lateral margins raised considerably throughout, pinched just before the middle and just before the tip, and so somewhat torqueate, the median sulcus only apparent and then slight in apical half; furecula consisting of a pair of large, broad, strongly depressed, longitudinally arcuate plates, which, measuring from the base of the last dorsal segment, are about twice as long as broad, in the basal half attingent, in their apical half strongly and roundly excised interiorly, apically obliquely and broadly truncate, terminating acutely at the inner hinder angle, and hardly reaching the

middle of the supraanal plate; cerci rather small, tapering in the basal three-fifths, gently and equally above and below, beyond equal, less than half as broad as the base, exteriorly sulcate apically, the tip blunt and not nearly reaching the tip of the supraanal plate; subgenital plate as in *M. herbaceus*.

Length of body, male, 25.5 mm.; antennae, 13? mm.; tegmina, 23 mm.; hind femora, 14 mm.

One male. San Diego, California, Coquillett (U.S.N.M.—Riley collection).

This species is very closely allied to the preceding, from which it differs by its color and pattern, by the differently shaped male cerci and furcula, by the extreme narrowness of the interspace between the mesosternal lobes, and by the less sharply margined frontal costa.

12. MELANOPLUS PICTUS, new species.

(Plate XI, fig. 2.)

Melanoplus pictus BRUNER!, MS.

A little above the medium size, highly variegated in coloring. Head slightly prominent, bright flavous, irregularly and profusely mottled and blotched with blackish fuscous, least and more delicately so above; vertex moderately tumid, raised slightly above the level of the pronotum, the interspace between the eyes narrow, narrower than the first joint of the antennae; fastigium rapidly and roundly declivent, distinctly sulcate throughout; frontal costa rather prominent above, subequal, considerably broader than the interspace between the eyes, just failing to reach the clypeus, distinctly sulcate excepting above, where it is biserially punctate; eyes rather large, long, and prominent, much longer than the infraocular portion of the genae; antennae nearly as long as the hind femora, flavous throughout. Pronotum subequal, enlarging a little on the metazona, the sides of the prozona a little tumid independently on each zone, the disk pilose, gently convex, passing by a rounded shoulder into the inferiorly vertical lateral lobes, the median carina distinct on the metazona, subobsolete on the prozona, obsolete between the sulci; front margin faintly convex with a slight median emargination, hind margin obtusangulate, the angle well rounded; pronotum mostly brownish fuscous, irregularly enlivened by bright flavous, especially on the anterior part of the disk, on the uppermost part of the lateral lobes, and on the lower part of the metazona of the same, the brown deepening in color on the upper third or more of the prozona; prozona slightly longitudinal, scarcely longer than the densely punctate metazona. Prosternal spine rather short, stout, conical, blunt, erect; interspace between mesosternal lobes of male nearly three times as long as broad, the metasternal lobes subattingent. Tegmina long, slender, subequal, far surpassing the hind femora, brownish with a roseate tinge on the basal half, scarcely flecked with

paler maculations along the middle line; wings rather narrow, hyaline, the veins very pale blue, becoming infuscated apically and anteriorly. Legs flavous, banded with fuscous, the hind femora unequally trifasciate with blackish fuscous, the fasciation only distinct above, the outer face more or less olivaceous, the inner face sanguineous, and a postmedian sanguineous patch below, the genicular arc black, and the whole geniculation flecked with fuscous; hind tibiae purplish fuscous, marked with dull flavous between the spines, which are black, becoming pallid basally, flavous interiorly, eleven in number in the outer series. Extremity of male abdomen hardly clavate or recurved, the supraanal plate subclypeate, the margins strongly and roundly bent beyond the middle, the apex slightly produced, subrectangulate, and pointed, the sides strongly and broadly elevated in the proximal half, the median sulcus slight and only perceptible in apical half; furcula consisting of a pair of broad flattened plates slightly more than twice as long as broad, reaching to the middle of the supraanal plate, beyond the middle roundly and obliquely emarginate on the inner side, apically roundly and obliquely truncate exteriorly; cerci moderately broad at base, almost immediately tapering rapidly by the excision of the upper margin, so that the distal three-fourths forms a compressed subequal finger, barely expanding at the tip, the exterior surface slightly impressed or subsulcate apically, the whole straight, except for being slightly bent inward near the middle, failing to reach the tip of the supraanal plate; subgenital plate forming a regular well rounded flaring scoop, the margin nowhere elevated, entire, the plate considerably narrower apically than at base, and much longer than broad.

Length of body, male, 27 mm.; antennae, 12.5 mm.; tegmina, 24 mm.; hind femora, 14 mm.

One male. Bradshaw Mountain, Arizona, June 21 (L. Bruner).

13. MELANOPLUS BOWDITCHI.

(Plate XI, fig. 3.)

Melanoplus bowditchi SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), p. 72; Cent. Orth. (1879), p. 61.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 61; Publ. Nebr. Acad. Sc., III (1893), p. 27.—TOWNSEND, Ins. Life, VI (1893), p. 31.

Of medium size. Head slightly elevated, moderately arched above; interspace between the eyes about half as broad again as the first antennal joint, a little broader in the female than in the male; fastigium rather shallowly sulcate, subspatulate in form, the lateral margins thick and low; frontal costa equal, plane above, sulcate at and below the ocellus; eyes rather large, rather prominent, especially in the male. Pronotum simple, the metazona slightly expanding, punctulate, the median carina slight but distinct upon it, but wholly wanting in front; lateral carinae obsolete; transverse sulci of prozona distinct, subcontinuous across the middle. Tegmina very slender, extending beyond

(male) or fully to (female) the tip of the abdomen. Supraanal plate subquadrate, longer than broad, the lateral margins subparallel on basal half, beyond tapering rapidly, the tip triangularly produced, sharply angulated; plates of furcula stout, depressed, attinent at base, beyond with the inner margins separated at an angle of 45° , the outer margins straight and parallel, the extremity obliquely docked and scarcely incurved, more than half the length of the supraanal plate and nearly three times as long as the basal breadth; anal cerci forming long, slender, straight, compressed fingers, much expanded above at the extreme base, beyond scarcely tapering, bluntly and roundly terminated, directed backward, somewhat upward and a little inward, about as long as the first hind tarsal joint; subgenital plate elongated scoop-shaped, the extremity a little produced, entire; basal tooth of lower valve of ovipositor of female blunt, triangular, large, broader than long.

The general color is a grayish brown, the eyes margined above with dull pale-yellow, the face and genae olivaceous with transverse mottlings of dusky ferruginous; antennae dull pale castaneous; behind the eye a broad piceous belt, sometimes broken, sometimes entire, crosses the prozona on the upper half of the lateral lobes; disk of pronotum brownish yellow, heavily punctate or mottled with fuscous. Tegmina with an obscure median series of alternate dusky and pallid spots; hind femora brownish yellow, more or less tinged with plumbeous, the incisures dusky, with faint indications on upper surface of dusky transverse stripes; hind tibiae bluish green, sometimes dotted with black and with black spines, ten in number in the outer series.

Length of body, male, 23 mm., female, 26 mm.; antennae, male, 10 mm.; tegmina, male and female, 20 mm.; hind femora, male, 13 mm., female, 14 mm.

Four males, 3 females. Lakin, Kearny County, Kansas, 3,000 feet, September 1; Pueblo, Colorado, 4,700 feet, August 30-31; Chaves, Bernalillo County, New Mexico, August 6 (L. Bruner); Las Cruces, Donna Ana County, New Mexico, July 8, T. D. A. Cockerell.

It is also reported by Townsend from Sabinal, Socorro County, and Belen, Valencia County, New Mexico, August 7.

14. MELANOPLUS FLAVIDUS.

(Plate XI, fig. 4.)

Melanoplus flavidus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), p. 74; Cent. Orth. (1879), p. 63.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 61; Bull. Washb. Coll., I (1885), p. 38; *ibid.*, I (1886), p. 200; Publ. Nebr. Acad. Sci., III (1893), p. 27.

Melanoplus cenchri MCNEILL!, Psyche, VI (1891), pp. 74-75.

Moderately large in size. Head rather large, slightly elevated and well arched above; interspace between the eyes nearly (male) or quite (female) half as broad again as the first antennal joint; fastigium shall-

low, broad, subequal, the sides moderately narrow but low (male) or scarcely sulcate (female); frontal costa broad, equal, plane (male) or tumid (female) above, at and below the ocellus broadly and rather deeply sulcate; eyes pretty large but not very prominent. Pronotum with the prozona equal, the metazona expanding and punctato-rugulose; median carina slight but distinct on the metazona, obsolete or subobsolete on the prozona; lateral carinae subobsolete; transverse sulci of prozona slight but distinct, continuous. Tegmina extending a very little way beyond the abdomen, surpassing the hind femora. Supraanal plate regularly clypeate, about as broad as long; plates of the furcula shaped much as in *M. bowditchi*, but thickened at the tip, as long as the cerci or nearly two-thirds as long as the supraanal plate; the cerci have a triangular base and a long, straight, slender, bluntly terminated, equal finger extending backward and upward and inclined inward, starting from the lower posterior portion of the base; it is as long as the terminal joint of the hind tarsi; subgenital plate scoop-shaped, well rounded as viewed from above, the tip scarcely produced, entire.

The general color is greenish yellow, sometimes a little infuscated above, the head frequently mottled with fuscous; antennae uniform yellowish; the usual stripe behind the eye over the upper portion of the lateral lobes of the pronotum is generally reduced to a very narrow dusky stripe next or on the lateral carinae, diminishing in breadth posteriorly; or if it is broader, it sometimes invades the disk rather than the lateral lobes; the disk has a median dusky line and the summit of the head a dusky basal triangle. The tegmina partake of the general lively tone to a less extent, and the paler median stripe, distinct only at base, is seldom flecked intermittently with fuscous; hind femora yellow, the upper half of the outer face dusky, and two oblique dusky patches often occur above; hind tibiae glaucous, the spines white or glaucous, black tipped, ten to eleven in number in the outer series.

Length of body, male, 20.5 mm., female, 22 mm.; antennae, male, 13 mm., female, 9.75 mm.; tegmina, male, 20.5 mm., female, 22 mm.; hind femora, male, 14 mm., female, 15 mm.

Eighteen males, 20 females. Yellowstone, Montana, August (U.S.N.M.—Riley collection); Sidney, Cheyenne County, Nebraska, August (L. Bruner); Moline, Rock Island County, Illinois, August 27, J. McNeill; Denver, Arapahoe County, Colorado, October 5; Morrison, Jefferson County, Colorado, August 9; Colorado Springs, El Paso County, Colorado, August, E. S. Tucker (University of Kansas); Garden of the Gods, El Paso County, Colorado, October 6; Carrizo Springs, Dimmit County, Texas, August, Dr. A. Walgymar (U.S.N.M.—Riley collection); Las Cruces, Donna Ana County, New Mexico, July 8, T. D. A. Cockerell; Tucson, Pima County, Arizona (U.S.N.M.—Riley collection).

It is also reported by Bruner from Barber and Comanche counties, Kansas.

McNeill found it in Illinois only on high sandy ground where the sole vegetation was *Cenchrus*, and the grasshoppers were "colored so nearly like the yellow sand that they were difficult to see when only two or three feet away."

A single specimen from Colorado which apparently belongs here, but is too much injured to determine with certainty, has the hind tibiae pale red.

15. *MELANOPLUS ELONGATUS*, new species.

(Plate XI, fig. 5.)

Long and slender bodied, warm brownish fuscous, sometimes more or less ferruginous, with feeble markings. Head slightly prominent, dull plumbeo-flavous, much obscured with fuscous, especially above and in a band behind the eyes; vertex gently tumid, the interspace between the eyes rather narrow, narrower than (male) or rather broad, broader than (female) the frontal costa; fastigium descending with tolerable rapidity, broadly and deeply (male) or shallowly (female) sulcate throughout; frontal costa moderately broad, equal, deeply sulcate excepting above, where it is seriatly punctate next the margins; eyes tolerably large, not very prominent, rather elongate; antennae slightly shorter than (male) or about two-thirds as long as (female) the hind femora, fulvo-luteous, infuscated apically. Pronotum gently enlarging posteriorly, the front margin subtruncate, the hind margin somewhat obtusely angulate, the angle well rounded, the disk nearly plane, passing by a rounded angle into the inferiorly vertical lateral lobes, the median carina distinct though slight on the metazona, feebly perceptible on the prozona; lateral lobes marked above more or less obscurely with a broad fuscous stripe crossing the prozona, immediately below it sometimes enlivened with paler flecks; prozona feebly longitudinal (male) or feebly transverse (female), but little longer than the closely and finely punctate metazona. Prosternal spine long, erect, conico-cylindrical, blunt tipped; interspace between mesosternal lobes several times longer than broad, especially in the male, the metasternal lobes attingent in part (male) or approximate (female). Tegmina very long and slender, scarcely tapering, well rounded apically, feebly and very minutely flecked, extending far beyond the femoral tips; wings ample, pellucid, the veins and cross-veins blackish fuscous. Femora ferrugineo-testaceous, the hind pair more or less and irregularly clouded with fuscous, sometimes making a feeble, indistinct bifasciate barring, the genicular arc blackish testaceous; hind tibiae feebly incurved, glaucous, apically lutescent, pallid along the line of the spines, which are pallid at base, black apically, and nine to eleven, usually ten, in number in the outer series. Extremity of male abdomen a little clavate, upturned, the supraanal plate subclypeate, with well rounded but feebly sinuate lateral margins, which are broadly and feebly raised, and hardly the least sign of a median sulcus; furcula consisting of a pair of large, very broad, much depressed, parallel plates, attingent at base, tapering and bluntly rounded at tip, reaching the middle of the supraanal plate,

the inner apical angle sometimes feebly asserting itself as in the allied species; cerci slender, not very long, incurved gently and a little upcurved, tapering gently in less than the basal half, beyond cylindrical, blunt tipped, reaching almost to the tip of the supraanal plate; subgenital plate moderately broad, subequal, the lateral margins straight but faintly rising at the apex, which is broadly rounded as seen from above.

Length of body, male, 29.5 mm., female, 30 mm.; antennae, male, 15 mm., female, 9.5 mm.; tegmina, male, 28 mm., female, 26.5 mm.; hind femora, male, 17 mm., female, 15 mm.

Five males, 4 females. Finley County, Kansas, September, H. W. Menke (University of Kansas); Las Cruces, Donna Ana County, New Mexico, July 8, T. D. A. Cockerell; Mexico (Museum Comparative Zoology); Lerdo, Durango, Mexico, November (L. Bruner); Guanajuato, Mexico, A. Dugès (U.S.N.M.—Riley collection); Bledos, San Luis Potosi, Mexico, October, E. Palmer.

This species differs from the two preceding by its slender elongate form, the simplicity of its male furcula, and by its general markings.

4. GLAUCIPES SERIES.

The two species placed together here have comparatively little in common to warrant their combination as a series, and each should perhaps be made the basis of a distinct series if other forms are found allied to one and the other; but falling together by the characters given in our table, I have thought it best for the present to connect them. They have these common characteristics:

The mesosternum in front of the lobes is plane in the male. The more or less maculate tegmina extend only to the tip of the hind femora, and the hind tibiae have from ten to twelve spines in the outer series. The supraanal plate is simple, without elevated sides; the furcula is developed as a pair of minute triangular denticles; the cerci are broad and short, only about twice as long as broad, a little upcurved, and apically broadly rounded, while the subgenital plate is moderately broad, prolonged, and scarcely elevated apically.

The species are of small or medium size; one occurs in Texas and northern Mexico, the other from Montana to Alaska.

16. MELANOPLUS GLAUCIPES.

(Plate XI, fig. 6.)

Caloptenus glaucipes SCUDDER!, Proc. Bost. Soc. Nat. Hist., XVII (1875), pp. 476-477; Ent. Notes, IV (1875), pp. 75-76.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 42.—SCUDDER!, Cent. Orth. (1879), pp. 20-21.

Melanoplus glaucipes SCUDDER!, Can. Ent., XII (1880), p. 75.

Wood-brown. Head and pronotum yellowish brown, heavily flecked with blackish, more heavily and minutely above, giving it a wood-brown

appearance; a broad black band extends from behind the eyes across the upper part of the lateral lobes of the pronotum, broadening on the metazona. Interspace between the eyes moderately narrow, scarcely wider than the first antennal joint; fastigium narrow, with sides broadening a little in front, pretty sharply defined, inclosing a moderately deep sulcus, deepest posteriorly; frontal costa rather broad, nearly equal, fading out below, with a scarcely perceptible sulcus excepting about the ocellus; antennae a little more (male) or much less (female) than three-fourths as long as the hind femora, orange red, paler at base. Pronotum subequal, the disk nearly plane, the front border truncate, the hind border obtusely angulate; median carina very slight, most distinct on the metazona, cut by all the transverse sulci; lateral carinae obsolete; prozona distinctly longitudinal, a third to a fourth longer than the metazona (male) or quadrate, only slightly longer than the metazona (female). Prosternal spine long, conical, bluntly tipped, somewhat retrorse, in the male considerably appressed; interspace between mesosternal lobes about twice as long as broad in both sexes, the metasternal lobes attingent (male) or approximate (female). Tegmina as long as the body, brown, with a few dusky flecks along the central field. Legs darker or lighter brownish yellow, flecked with fuscous, the hind femora bifasciate above with blackish, besides a blackish base and apex; hind tibiae glaucous with a pale annulus at the base, interrupted in the middle by a blackish glaucous ring, the spines pallid at base, black beyond, ten to twelve in number in the outer series. Extremity of male abdomen compressed, hardly clavate, upturned, the supraanal plate triangular with nearly straight sides, the surface sub-tectate, with a very deep and narrow percurrent median sulcus, bounded by sharp ridges; furcula consisting of a pair of basally attingent, minute, triangular denticulations, surmounting the ridges of the supraanal plate; cerci broad at base, scarcely twice as long as broad, sub-reniform, well rounded, but little smaller on the apical half, not so long as the supraanal plate; subgenital plate broader than long, neither elevated nor prolonged apically, but a little compressed, so that the thickened apical margin as seen from above is strongly rounded (the figure was, unfortunately, drawn from a specimen in which the extreme apex was slightly collapsed in drying) and subacuminate, extending far beyond the tip of the supraanal plate.

Length of body, male, 22.5 mm., female, 28 mm.; antennae, male and female, 9.5 mm.; tegmina, male, 16 mm., female, 18.75 mm.; hind femora, male, 12 mm., female, 15.5 mm.

Nine males, 12 females. Dallas, Texas, August 18, Boll (Museum Comparative Zoology; U.S.N.M.—Riley collection; S. H. Scudder); Lerdo, Durango, Mexico (L. Bruer).

17. MELANOPLUS KENNICOTTII.

(Plate XI, fig. 8.)

- Caloptenus bilituratus* SCUDDER!, Daws., Rep. Geol. Rec. 49th par. (1875), p. 343.
Melanoplus kennicottii SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1878), pp. 287, 289, 290; Ent. Notes, VI (1878), pp. 46, 48, 49.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60; Rep. U. S. Ent., 1885 (1886), p. 307.
Melanoplus bilituratus CAULFIELD (pars), Rep. Ent. Soc. Ont., XVIII (1886), p. 171.
Caloptenus (Melanoplus) bilituratus CAULFIELD (pars), Can. Rec. Sc., II (1887), p. 401; (pars), Can. Orth. (1887), p. 13.
Melanoplus modestus BRUNER!, MS.

Brownish testaceous, heavily mottled with fuscous. Head very dark above and in a postocular band; vertex rather tumid, particularly in the male, where it is distinctly elevated above the level of the pronotum; interspace between the eyes rather broad, much broader than, in the female nearly twice as broad as, the basal joint of the antennae; fastigium rapidly declivent, broadly and rather deeply (male) or shallowly (female) sulcate throughout; frontal costa not very broad, slightly narrowed above, narrower than the interspace between the eyes; eyes moderately large and prominent; antennae testaceous, infuscated apically, a little shorter than (male) or less than two-thirds as long as (female) the hind femora. Pronotum short, enlarging a little posteriorly, the front border truncate, the hind border obtusely angulate, the angle rounded, dark testaceous above, more or less heavily mottled with fuscous, the lower portion of the lateral lobes lighter, but the upper part, on the prozona, with a broad piceous band, occasionally broken, especially in the female; median carina percurrent and slight, but feebler on the prozona than on the metazona; disk passing almost insensibly into the lateral lobes on the prozona, but on the metazona with a distinct though rounded angle; prozona feebly (male) or distinctly (female) transverse, scarcely longer than the obscurely punctate metazona. Prosternal spine short, erect, conical, very blunt; interspace between mesosternal lobes only a little longer than broad (male) or decidedly transverse, but narrower than the lobes themselves (female); metasternal lobes narrowly attingent (male) or approximate (female). Tegmina reaching, occasionally in the female surpassing, the tip of the hind femora, moderately narrow, distinctly tapering, brownish fuscous with feeble flecking along the discoidal area; wings moderately broad, hyaline, most of the veins and cross veins blackish fuscous. Hind femora brownish testaceous, more or less obliquely bifasciate with fuscous on the upper half, the genicular arc piceous, the inferior face more or less but slightly fulvous; hind tibiae paler or browner testaceous, the spines black except at base, ten to eleven in number in the outer series. Extremity of male abdomen slightly clavate, upturned, the supraanal plate triangular with nearly straight sides and acutangulate apex, the median sulcus percurrent, not very narrow but mesially

constricted; furcula consisting of a pair of rather distant, minute, slender denticulations, lying outside the ridges bounding the sulcus of the supraanal plate; cerci coarse, punctate, hardly tapering, slightly upcurved, hardly twice as long as broad, the upper apical portion strongly compressed, while the rest is rather tumid, the apex rounded, reaching beyond the supraanal plate; subgenital plate broad and short, neither elevated nor prolonged apically, the apical margin narrowly subtruncate.

Length of body, male, 15 mm., female, 22.5 mm.; antennae, male, 6.5 mm., female, 6 mm.; tegmina, male, 11 mm., female, 13 mm.; hind femora, male, 8 mm., female, 10.5 mm.

Three males, 2 females. Yukon River, Alaska, Kennicott; Souris River, Assiniboia, Dawson; Glendive, Dawson County, Montana (L. Bruner); Custer County, Montana (same).

Bruner states that this insect feeds upon sagebrush, though it is uncertain whether this is the species he refers to in his statement, since the specimens received from him bear another name.

5. UTAHENSIS SERIES.

In this small group the prozona of the male is quadrate or subquadrate, and the interspace between the mesosternal lobes is as in the spretus series; in front of these lobes, also, the mesosternum of the male has a central swelling forming a blunt tubercle. The antennae are rather short and differ but little in the two sexes. The tegmina are fully developed, but rather short, surpassing the hind femora but little if at all, and clear or feebly maculate; the hind tibiae are red, with normally eleven spines in the outer series.

The supraanal plate is rudely clypeate and longer than broad; the furcula well developed, consisting of flattened, parallel, more or less tapering fingers, half as long as the supraanal plate; the cerci are laminate and simple, very broad and short, subequal, broadly rounded apically, a little upcurved; the subgenital plate is peculiar, being exceptionally long and exceptionally broad, exceptionally elevated and prolonged at apex, the apical margin strongly rounded and mesially entire, though in one species laterally notched, an exceedingly exceptional feature.

The species, three in number, vary from a little below the medium to rather large sized. They are found mainly in the Cordilleran region from about latitude 38° northward into Canada.

18. MELANOPLUS BRUNERI, new species.

(Plate XI, fig. 7.)

Melanoplus extremus? BRUNER!, Can. Ent., XVII (1885), p. 18.

Brownish fuscous, often with a ferruginous tint. Head pale olivaceous-testaceous, dark fuscous or ferruginous above, often much infumated or mottled with fuscous below and with a piceous stripe behind the eyes; vertex feebly tumid, scarcely raised above the level of the pronotum;

interspace between the eyes rather broad, as broad as (male) or broader than (female) the first antennal joint; fastigium rapidly descending with a regular curve, broadly and very shallowly sulcate (male) or plane with feebly raised margins between the eyes (female); frontal costa broad, as broad as the interspace between the eyes, equal, or feebly narrower above than below, just failing to reach the clypeal margin, feebly impressed at and sometimes a little below the ocellus, punctate especially at the sides; eyes moderate, as long as the infraocular portion of the genae, not very prominent; antennae varying from fulvo-testaceous to rufous, much infuscated apically, about three-fourths as long as the hind femora, nearly as long in the female as in the male. Pronotum with the front margin transverse, the hind margin obtusely angulate, the angle rounded, the median carina percurrent, but feeble on the prozona, the prozona plano-convex, passing by a well-rounded angle into the subvertical lateral lobes, the disk smooth, quadrate (male) or feebly transverse (female), slightly longer than the finely and densely punctate metazona, the transverse sulci distinct and continuous; the upper two-fifths of the lateral lobes are marked on the prozona by a fuscous or piceous patch, while the lower half is occasionally lighter than the rest of the body. Prosternal spine erect, and moderately long, appressed conical, the tip blunt (male) or short, stout, conico-cylindrical, very blunt (female); interspace between mesosternal lobes more than twice as long as broad (male) or subquadrate (female); metasternal lobes attinent (male) or distant by half the width of the frontal costa (female). Tegmina reaching and generally somewhat surpassing the tips of the hind femora, somewhat but rather delicately maculate in the basal two-thirds of the discoidal area; wings pellucid, rather broad. Hind femora fusco-ferruginous, obliquely blotched externally and above with luteo-testaceous, the lighter parts occurring before and past the middle and as a pregenicular annulus; beneath dull luteous with a tinge of fulvous; genicular are fusco-piceous; inferior genicular lobe pallid or sordid luteous with a basal black bar; hind tibiae pale red, sometimes with a pale greenish yellow tinge, sometimes with a feeble fuscous patellar mark, the spines black excepting at base, ten to twelve, usually eleven, in number in the outer series. Extremity of the male abdomen a little clavate, much upturned, the supraanal plate rather narrow, demi-oval, with rounded sides and scarcely angulate apex, the rather deep median sulcus terminating beyond the middle by the contraction of its rather stout lateral walls, each lateral half of the plate with a short apical ridge in its middle; furcula consisting of a pair of straight, parallel, flattened, rather slender, tapering, pointed, basally attinent fingers, reaching the middle of the supraanal plate; cerci broad, subequal but mesially contracted, compressed, slightly upcurved and incurved laminae, bluntly rounded apically, more than twice as long as broad, shorter than the supraanal plate; infracercal plates broad, obliquely truncate apically, scarcely surpassing the supraanal plate; subgenital plate greatly prolonged and elevated apically, the

apical face depressed so as to give a tendency to the margin to appear bilobed in drying, but the apical margin actually entire, subtruncate.

Length of body, male, 22 mm., female 22.5 mm.; antennae, male, 9.5 mm., female, 8.5 mm.; tegmina, male, 19 mm., female, 18.75 mm.; hind femora, male and female, 12.5 mm.

Twenty-three males, 25 females. Camp Umatilla, Washington, June 26 (Museum Comparative Zoology); Brown's, Colville Valley, Washington, July 24 (same); Loon Lake, Colville Valley, Washington, July 23 (same); Little Spokane, Washington, July 26 (same); Fort McLeod, Alberta, Canada, August (L. Bruner; U.S.N.M.—Riley collection); Banff, Alberta, Ban, June, August (S. Henshaw); Montana (U.S.N.M.—Riley collection); Weeksville, Montana, August 2 (Museum Comparative Zoology); Yellowstone, Montana, August (U.S.N.M.—Riley collection); Gordon, Sheridan County, Nebraska, Bruner (same); South Park, Colorado, 8,000 to 10,000 feet; Florissant, El Paso County, Colorado, August 17-22, 8,000 feet.

Specimens from Colorado and Nebraska are a little smaller than those from further north, and have rather shorter wings. The same is true also of specimens taken at Banff, Alberta, in June.

Bruner also reports it from Helena, Fort Ellis, and the Madison valley, Montana, and Salmon City, Idaho.

19. MELANOPLUS EXCELSUS, new species..

(Plate XI, fig. 9.)

Dull brownish fuscous, the under surface dull luteo-testaceous. Head dark above and in a piceous band behind the eyes, but elsewhere dull flavo-olivaceous, more or less clouded with plumbeous; vertex feebly tumid, raised slightly above the level of the pronotum in the male; interspace between the eyes rather broader than (male) or nearly twice as broad as (male) the basal antennal joint; fastigium plane with a basal transverse impression (female) or broadly and shallowly sulcate throughout (male); frontal costa broad, broader than the interspace between the eyes, feebly narrowing above in the male, scarcely depressed at the ocellus, and sometimes in the male slightly below it, just failing to reach the clypeus, sparsely punctate; eyes moderately long, anteriorly truncate, as long as the infraocular portion of the genae, slightly prominent; antennae less than three-fourths (male) or than two thirds (female) as long as the hind femora, fusco-ferruginous, lighter at base. Pronotum gradually and slightly enlarging posteriorly, with the front margin truncate, the hind margin bluntly obtus-angulate, the brownish fuscous base with a dull flavous tinge, which increases on the lateral lobes except in the upper portion of the prozona, which is mostly piceous, the sulci piceous, followed in the posterior section by a small flavous patch; median carina percurrent, black, sharper and more elevated on the metazona than on the prozona, the prozona plano-convex with broadly rounded lateral carinae, slightly more angulate on the metazona; disk of prozona nearly smooth and quadrate

(male) or feebly transverse (female), no longer than the feebly and finely ruguloso-punctate metazona. Prosternal spine moderately long and slender, conico-cylindrical, blunt (male) or short and stout, appressed conical, very blunt (female); interspace between mesosternal lobes much less than twice as long as broad (male) or transverse (female), the metasternal lobes attingent (male) or approximate (female). Tegmina just reaching as far as the hind femora, rather slender, scarcely tapering, distinctly and quadrately maculate in all but the apical fourth of the discoidal area; wings pellucid, not very broad. Hind femora obliquely marked alternately with blackish fuscous and brownish testaceous, showing most distinctly (and sometimes only) on the upper half, the lower half lighter, beneath red, in the female sometimes paler, the genicular arc piceous; hind tibiae bright red with a fuscous patellar spot, the spines black except at their very base, ten to twelve (usually eleven) in number in the outer series. Extremity of male abdomen clavate, considerably upturned, the supraanal plate narrow, the sides subparallel and broadly upturned over a little more than the basal half, beyond triangular with rectangulate apex, the median sulcus very deep and narrow between high and compressed walls, reaching nearly to the tip, so that each side has between these walls and the elevated margins of the plate a very pronounced sulcation; furcula consisting of a pair of strongly depressed, slender, parallel fingers, equal and scarcely parted in basal half, beyond tapering and bluntly pointed, reaching the middle of the supraanal plate; cerci very broad, subequal in basal half, then bent a little upward and feebly tapering but broadly rounded apically, the whole obliquely vertical, straight and not incurved, less than twice as long as broad, and shorter than the supraanal plate; infracercal plates thickened apically and a little surpassing the supraanal plate, obliquely truncate; subgenital plate greatly prolonged and elevated apically, the apical margin entire, well rounded, in no way truncate.

Length of body, male, 20 mm., female, 22 mm.; antennae, male, 7.5 mm., female, 7 mm.; tegmina, male, 16 mm., female, 15 mm.; hind femora, male, 11.5 mm., female, 13 mm.

Four males, 5 females. Above timber, 11,000 to 13,000 feet, on Mount Lincoln, Park County, Colorado, August 13.

20. MELANOPLUS UTAHENSIS, new species.

(Plate XI, fig. 10.)

Melanoplus utahensis BRUNER!, MS.

Yellowish brown. Head luteous, much clouded with light fusco-olivaceous, the summit and a broad band behind the eyes very dark fusco-olivaceous, separated by a luteous stripe; vertex gently tumid, scarcely elevated above the pronotum, the interspace between the eyes broad, fully as broad as the first antennal joint, the fastigium broadly and shallowly sulcate except at base; frontal costa broad, feebly

narrowed above the ocellus, as broad as the interspace between the eyes, feebly depressed at the ocellus, punctate throughout; eyes rather large, not very prominent, as long as the infraocular portion of the genae; antennae testaceous. Pronotum gently widening posteriorly, the front margin scarcely convex and feebly and roundly emarginate in the middle, the hind margin obtusely angulate, the angle rounded, the median carina distinct and rather sharp on the metazona, feeble on the prozona and obsolete between the sulci; disk of prozona planoconvex, passing almost insensibly but with a broadly rounded angle into the subvertical lateral lobes, the lateral carinae feebly indicated on the metazona; mesial half of the disk of the prozona very dark fusco-olivaceous, bordered on either side by luteous; lateral lobes and metazona luteo-testaceous with an olivaceous tinge, the upper half of the lateral lobes of the prozona occupied by a broad fusco-fuliginous glistening band, failing to reach the anterior border and broader on the posterior than on the anterior section; prozona smooth, quadrate, a very little longer than the closely punctate metazona. Prosternal spine long, slightly appressed cylindrical, blunt-tipped, very feebly retrorse; interspace between mesosternal lobes of male about half as long again as broad, the metasternal lobes attingent. Tegmina scarcely attaining the tips of the hind femora, moderately broad at base, distinctly tapering, the tip narrow and strongly rounded, brownish testaceous without markings; wings pellucid, the main veins testaceous, the others blackish fuscous. Femora yellowish brown, the hind pair much infuscated on the outer face, especially above, the upper surface broadly marked with fuscous near base at tip, and with two other nearly confluent belts between, the inner face feebly and the lower face distinctly reddened; genicular arc black; hind tibiae uniformly red, the spines black nearly to the base, eleven in number in the outer series. Extremity of male abdomen broadly clavate, strongly upturned, the supraanal plate rather long, triangular, with rounded sides, acutangulate apex, the basal two-thirds of the lateral margins broadly elevated, the median sulcus narrow and deep, extending over two-thirds of the plate, bounded by moderate walls; furecula consisting of a pair of very broad, parallel, elongated, strongly flattened pads with rounded tips, almost reaching the middle of the supraanal plate, their outer margins broadly rounded; cerci consisting of coarse and broad, punctate laminae, feebly narrowing in the basal half, beyond a little upturned, equal, very broadly rounded at apex, straight or feebly outcurved apically, not so long as the supraanal plate; infracercal plates visible only at extreme base; subgenital plate enormously produced and elevated (more abruptly elevated than represented in the figure), the apical margin deeply emarginate laterally, and well rounded and entire mesially.

Length of body, male, 27 mm.; tegmina, 18 mm.; hind femora, 14 mm.

One male. Salt Lake, Utah, August 30, L. Bruner (U.S.N.M.—Riley collection).

6. SPRETUS SERIES.

This group is a very homogeneous one and comprises the species of *Melanoplus* which are especially destructive to vegetation by their immense numbers and more or less extended flights, such destructiveness being almost confined to its members. The pronotum of the male is transverse or quadrate or feebly longitudinal, and the interspace between the mesosternal lobes in the same sex varies from a little longer than broad to fully twice as long as broad, the mesosternum in front of the lobes centrally elevated to form a very low and blunt conical tubercle or boss. The tegmina are always fully developed, usually much surpassing the tips of the hind femora (though in one case not nearly reaching them), more or less maculate (only immaculate by individual exception), and the hind tibiae are variably colored, but either red or green (very rarely blue or yellow), and have nine to thirteen spines in the outer series.

The supraanal plate of the male is subtriangular, rather long, with straight or sinuous lateral margins; the furcula consists of a pair of slender, tapering, parallel or divergent, generally feebly depressed fingers, generally extending over the basal fourth of the supraanal plate; the cerci are rather broad and nearly straight and nearly flat lamellae, the apical half narrower than the basal, generally through oblique excision of the lower margin, and usually bent upward a little, rounded or subtruncate at tip and from one and a half to three times as long as broad; the subgenital plate is haustate, about as broad as long, more or less elevated apically and has the apical margin mesially notched.

The species, seven in number, are of a medium or moderately large size and range widely (especially *M. atlantis*, the range of which is almost or quite equal to that of the group), occurring in every part of the United States, from Atlantic to Pacific, excepting most of California and the southernmost of the Atlantic States; members of the group occur also, but apparently in scanty numbers, as far beyond our southern borders as Central Mexico, and on the north, in full abundance, in Canada from ocean to ocean; but this group apparently does not extend so far north as the *femur-rubrum* series, for it is not known from Newfoundland or Labrador, nor about Hudson Bay, though in the west it reaches the Arctic Circle, two of the species occurring in Alaska.

21. MELANOPLUS ALASKANUS, new species.

(Plate XII, fig. 1.)

Slightly above the medium size, ferrugineo-fuscous with testaceous markings. Head pale castaneous, heavily marked above, at least in the male, with black, especially along the margins of the eyes and in a median stripe, besides a broad postocular band; vertex gently tumid,

scarcely elevated above the pronotum, the interspace between the eyes half as broad again (male) or fully twice as broad (female) as the first antennal joint; fastigium somewhat strongly declivent, broadly and rather deeply (male) or shallowly (female) sulcate; frontal costa rather prominent, percurrent, feebly narrowed above, as broad as the interspace between the eyes, finely and irregularly punctate throughout, but more sparingly below than above, sulcate at and a little below the ocellus; eyes moderately large, moderately prominent, longer than the infraocular portion of the genae; antennae rufo-testaceous, about three-fourths (male) or less than three-fifths (female) as long as the hind femora. Pronotum subequal, expanding feebly on the metazona, luteo-castaneous, the metazona and especially its disk rufo-castaneous, the lateral lobes of the prozona with a very broad piceous postocular band; disk of pronotum very broadly convex, passing by a rounded but distinct shoulder, on the metazona forming subdistinct lateral carinae, into the anteriorly tumid vertical lateral lobes; median carina percurrent, but on the prozona rather feeble and uniform; front margin truncate, narrowly submarginate, hind margin obtusangulate; prozona longitudinally quadrate (male) or feebly transverse (female), as long as the feebly ruguloso-punctate metazona. Prosternal spine short, stout, appressed cylindrical, very obtuse; interspace between mesosternal lobes more than twice as long as broad, broadening posteriorly (male) or subquadrate (female). Tegmina somewhat surpassing the tips of the hind femora, moderately broad, distinctly tapering, rufo-fuscous, feebly maculate with black along the middle line. Fore and middle femora of male rather strongly tumid; hind femora pale flavo-testaceous, flecked with black in open transverse fasciations on the upper half, at base, just before, and somewhat behind the middle, the geniculation with the base of the lower genicular lobe black, the outer half of the inferior face roseate; hind tibiae dark or light red with a feeble fuscous patellar spot, the spines black beyond the base, ten to twelve, usually eleven, in number in the outer series. Extremity of male abdomen clavate, strongly recurved, the supraanal plate triangular with rather broad and subclepsydral median sulcus, bounded by not strongly elevated rounded walls; furcula consisting of a pair of rather coarse, parallel, basally attingent, tapering, acuminate, flattened fingers, a third as long as the supraanal plate; cerci subfalcate, tapering more rapidly in basal than in apical half, regularly curved upward, compressed, strongly rounded apically, more than twice as long as median breadth; subgenital plate pyramidal and strongly elevated apically, the apical margin much thickened but notched by a deep mesial contraction, which separates two rounded bosses.

Length of body, male, 22 mm., female, 26 mm.; antennae, male (est.), 9 mm., female, 8 mm.; tegmina, male, 18 mm., female, 20 mm.; hind femora, male, 12.5 mm., female, 14.5 mm.

Two males, 1 female. Alaska, T. C. Mendenhall (U.S.N.M.); Spilmacheen, British Columbia, July 25 (S. Henshaw).

22. MELANOPLUS AFFINIS, new species.

(Plate XII, fig. 2.)

Melanoplus affinis BRUNER!, MS.[Some of the synonymy given under *M. atlantis* almost certainly belongs here.]

Slightly above the medium size, rather robust, griseo-fuscous, testaceous beneath. Head olivaceo-plumbeous, the clypeus and labrum paler, above more or less rufous and marked with fuscous, with a piceous postocular band; vertex gently tumid, slightly elevated above the pronotum, the interspace between the eyes half as broad again (male) or fully twice as broad (female) as the first antennal joint; fastigium very steeply declivent, broadly and considerably (male) or feebly (female) sulcate; frontal costa reaching or almost reaching the clypeus, as broad as the interspace between the eyes, feebly narrowed above at least in the male, irregularly punctate throughout but more densely above than below, feebly sulcate at and slightly below the ocellus; eyes moderately large, not very prominent, much longer than the intraocular portion of the genae; antennae flavo-testaceous, about three-fourths (male) or about two-thirds (female) as long as the hind femora. Pronotum subequal, expanding a little on the metazona, darker above than on the sides, the lateral lobes of the prozona with a more or less distinct, sometimes broken, broad, piceous, postocular band, the disk nearly plane but broadly convex, passing into the subvertical lateral lobes by a well-rounded but distinct shoulder, forming tolerably distinct lateral carinae on the metazona; median carina percurrent, distinctly feebler on the prozona than on the metazona, as distinct between the sulci as in advance of them; front margin very feebly and very narrowly flaring, truncate, hind margin obtusangulate, the angle not much rounded; prozona feebly longitudinal or quadrate (male) or somewhat transverse (female), scarcely if any longer (male) or faintly shorter (female) than the densely but somewhat obscurely punctate metazona. Prosternal spine moderately long, cylindrical, erect, very blunt and faintly appressed in the male, similar but shorter and more conical in the female; interspace between mesosternal lobes twice or more than twice as long as broad (male) or subquadrate (female). Tegmina surpassing considerably the hind femora, moderately narrow, tapering feebly, rufo-fuscous or griseo-fuscous, with a distinct but more or less pronounced median series of fuscous annulations intercalated in basal half between more or less pronounced pallid dashes or spots; wings hyaline, the veins heavily infuscated apically and anteriorly. Fore and middle femora of male moderately tumid; hind femora rufo-testaceous, more or less clouded with fuscous and feebly bifasciate with fuscous above, the lower face and at least the lower half of the inner face roseate, the genicular arc black; hind tibiae pale glaucous, flavescent at apex and with a fuscous patellar spot, the spines black on more than the apical half, eleven, occasionally twelve, in number in the outer series. Extremity of male abdomen

a little clavate, somewhat recurved, the supraanal plate triangular with slightly convex and slightly elevated lateral margins, subrectangulate apex, and a rather narrow and not very deep percurrent median sulcus, bordered by narrow but rather low and rounded walls; furcula consisting of a pair of very slender, feebly divergent, tapering, acuminate spines, scarcely a fourth as long as the supraanal plate; cerci consisting of a feebly tapering, feebly tumid basal half, and a subequal, slenderer, compressed apical half, the latter bent feebly inward and slightly upward, rounded apically, the whole a little more than twice as long as median breadth; subgenital plate with the apical margin feebly elevated, thickened and mesially notched, but not deeply.

Length of body, male, 23 mm., female, 26 mm.; antennae, male, 8.5 mm., female, 9 mm.; tegmina, male, 20 mm., female, 22.5 mm.; hind femora, male, 12.25 mm., female, 14 mm.

Six males, 4 females. Salt Lake Valley, Utah, August 30 (L. Bruner); Fort McKinney, Johnson County, Wyoming, July (same); Olmstead's, near Ellensburg, Kittitas County, Washington, July 14, 15, S. Henshaw (Museum Comparative Zoology); Ellensburg, Kittitas County, Washington, July 14, Henshaw (same); Spokane, Washington, July 21, 22, Henshaw (same); Loon Lake, Colville Valley, Washington, July 25, Henshaw (same); Camp Umatilla, Washington, June 27, Henshaw (same); British Columbia, Crotch (same).

Bruner in an unpublished account of this species gives its habitat as "in the mountains near Ogden, Utah, among the low trees and bushes, at an elevation slightly above the highest of the ancient shore lines of Salt Lake; also among the foothills of the Big Horn Mountains, near Fort McKinney, Wyoming."

In the same manuscript, Bruner compares the present species with *M. atlans*, as follows:

Closely related to *M. atlans* in many respects; from which it is to be distinguished by its somewhat larger size and more robust form, also by its larger head and more prominent eyes. The last ventral segment [subgenital plate] of the male is shorter and the male cerci are narrower than in the typical *atlans*. The color of the hind tibiae is pale glaucous as in *intermedius* instead of red, as is usually the case in typical specimens of *atlans*.

23. MELANOPLUS INTERMEDIUS, new species.

(Plate XII, figs. 3, 4.)

Melanoplus intermedius BRUNER!, MS.

[Some of the synonymy given under *M. atlans* almost certainly belongs here.]

A medium-sized or rather small species, of slender form, brownish fuscous, dull testaceous beneath. Head slightly prominent, rufous or fusco-testaceous, more or less heavily flecked with fuscous above, or wholly infuscated, with a broad piceous or fuscous postocular band; vertex gently tumid, a little (sometimes considerably) elevated above the level of the pronotum, the interspace between the eyes fully half as broad again as the first antennal joint, slightly broader in the female than in

the male; fastigium rather steeply declivent, distinctly (male) or shallowly (female) and broadly sulcate; frontal costa rather prominent, percurrent or almost percurrent, equal, as broad as (female) or slightly broader than (male) the interspace between the eyes, biserially punctate throughout, slightly depressed at and just below the ocellus; eyes moderately large, prominent especially in the male, much longer than the infraocular portion of the genae; antennae fulvous, basally lutescent, four-fifths (male) or less than three-fifths (female) as long as the hind femora. Pronotum subequal but for the gently flaring metazona, more or less infuscated, sometimes punctate or strigose with fuscous, with a generally distinct postocular piceous band on the lateral lobes of the prozona, the disk very broadly convex and passing into the subvertical lateral lobes by a broadly rounded but distinct shoulder, occasionally angulate on the metazona; median carina distinct on the metazona, feeble on the prozona, nearly always (especially in the male) subobsolete between the sulci; front margin truncate or subtruncate, hind margin obtusangulate, the angle little rounded; prozona feebly longitudinal or rarely quadrate (male) or more or less distinctly transverse (female), generally and especially in the male a little longer than the finely punctate metazona. Prosternal spine moderately long, erect, cylindrical, blunt, in the female tapering a little as seen from the front; interspace between mesosternal lobes twice as long as broad (male) or a little longer than broad (female). Tegmina reaching or somewhat surpassing the tips of the hind femora, rather slender, tapering with some distinctness, apically narrow, brownish fuscous, apically fusco-hyaline, the middle third or more of the discoidal area more or less feebly and rather minutely flecked with fuscous; wings moderately broad, hyaline, with blackish fuscous veins. Fore and middle femora of male not very tumid (the middle more than the fore femora), the hind femora flavotestaceous, very obliquely and rather broadly bifasciate with fuscous, which sometimes suffuses nearly the whole upper half, the lower face sometimes very feebly roseate, the genicular arc black, the lower genicular lobe usually pallid throughout; hind tibiae pale glaucous, rarely red, the spines black nearly to their base, ten to twelve in number in the outer series. Extremity of male abdomen feebly clavate, gently recurved, the supraanal plate triangular with feebly convex lateral margins, subrectangulate apex, and a narrow percurrent median sulcus between rather high and sharp walls; furcula consisting of a pair of feebly divergent, slender, tapering and acuminate, slightly depressed spines about a fourth the length of the supraanal plate; cerci rather small, a little more than twice as long as broad, gently tapering and externally a little tumid in the basal half, beyond subequal, compressed or subsulcate, gently upturned, apically subtruncate or broadly rounded; subgenital plate very slightly elevated apically, the margin feebly notched.

Length of body, male, 18 mm., female, 22 mm.; antennae, male, 8.25

mm., female, 6.5 mm.; tegmina, male, 13 mm., female, 13.5 mm.; hind femora, male, 10 mm., female, 11.5 mm.

Fifteen males, 23 females. White River, Rio Blanco County, Colorado, July 24–August 14; Yellowstone, Montana, August (U.S.N.M.—Riley collection; L. Bruner); Yellowstone National Park, September 6–12; Salmon City, Lemhi County, Idaho, August (U.S.N.M.—Riley collection); Washington, Morrison (same.)

Mr. Bruner, in an unpublished account of this species kindly placed in my hands, says that the point in Montana where this species was taken is in the Yellowstone Valley above the mouth of the Big Horn River; and he gives the following points of difference between this species and *M. atlantis*:

In *intermedius* the entire body is more or less covered with rather long fine hairs, the thorax is much longer than in *atlantis*—throwing the base of the posterior femora considerably back of the middle—and in this respect resembling *Pezotettix* [*Melanoplus*] *washingtonianus* Bruner. The male cerci are longer and narrower than in *atlantis*, and are curved slightly inward and upward on the apical half; they are also shallowly grooved from the outside. The last ventral segment [subgenital plate] of the male abdomen is a little shorter than in that species, and the prosternal spine is also much longer, stouter, and more bluntly pointed than there. The general colorization is much the same as in *atlantis* but darker—being dull brown and gray above and dingy beneath; there are no well-defined bands upon the posterior femora, and the tibiae are dull glaucous, more or less tinged with brown, especially on the basal third and near the apex.

It differs from *M. atlantis*, to which it is most nearly allied, in the longer male antennae, the weaker median carina of the pronotum, the more heavily marked hind femora, and its smaller and slenderer form.

24. MELANOPLUS BILITURATUS.

(Plate XII, fig. 5.)

Caloptenus bilituratus WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 679.—

THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 160; Rep. U. S. Ent. Comm., I (1878), p. 43.—PACKARD, *Ibid.*, I (1878) p. [143].—SCUDDER, Proc. Bost. Soc. Nat. Hist., XIX (1878), p. 289; Ent. Notes, VI (1878), p. 48.

Melanoplus bilituratus CAULFIELD (pars), Rep. Ent. Soc. Ont., XVIII (1886), p. 71.

Caloptenus (*Melanoplus*) *bilituratus* CAULFIELD (pars), Can. Rec. Sc., II (1887), p. 401; (pars), Can. Orth. (1887), p. 13.

? *Melanoplus scriptus* COCKERELL, Trans. Am. Ent. Soc., XX (1894), p. 337.

[Some of the synonymy given under *M. atlantis* almost certainly belongs here.]

A little above the medium size, rather robust, griseo-fuscous. Head a little prominent, fusco-testaceous or fusco-plumbeous, generally more or less infuscated above in longitudinal streaks and with a postocular piceous band; vertex somewhat tumid, a little elevated above the pronotum, the interspace between the eyes half as broad again as the first antennal joint, or slightly broader than that in the female; fastigium steeply declivent, sulcate throughout, more deeply in the male than in the female; frontal costa failing to reach the clypeus, slightly narrowed above but fully as broad as the interspace between the eyes, feebly sulcate at and below the ocellus, feebly and more or less biserially punctate throughout; eyes pretty large, rather prominent, distinctly longer

than the infraocular portion of the genae; antennae testaceous, about two-thirds (male) or rather more than three-fifths (female) as long as the hind femora. Pronotum subequal on the prozona, expanding posteriorly on the metazona, darker above than on the sides, but occasionally with pale stripes following the inner margin of the lateral carinae, the lateral lobes with a generally maculate or broken but usually conspicuous piceous postocular band confined to the prozona, the disk plane on the metazona, feebly convex on the prozona, passing abruptly into the vertical lateral lobes by a distinct shoulder, on the metazona forming rather definite lateral carinae; median carina distinct on the metazona, subdud and uniform on the prozona, more nearly obsolete in the female than in the male; front margin truncate, hind margin feebly obtusangulate; prozona quadrate or feebly longitudinal (male) or transversely subquadrate or transverse (female), scarcely or not longer than the densely punctate metazona. Prosternal spine not very stout, stouter in the female than in the male, appressed conical, rather blunt, erect; interspace between mesosternal lobes fully twice as long as broad (male), or subquadrate (female). Tegmina generally surpassing a little, sometimes considerably, the hind femora, moderately slender, tapering but little, well rounded apically, brownish fuscous, variably maculate but generally rather heavily marked along the discoidal area, sometimes sprinkled with fuscous over a large part of the tegmina, rarely reduced to a feeble series of spots along the middle line; wings rather broad, hyaline with fuscous veins. Fore and middle femora somewhat tumid in the male; hind femora testaceous or flavo-testaceous, heavily and obliquely (and more or less distinctly) bifasciate with fuscous or blackish fuscous over the upper and outer faces, the geniculation black, often with an indistinct pregenicular pale flavous annulation, the lower face with a flush of roseate; hind tibiae bright red (by rare exception glaucous) with a more or less distinct fuscous patellar spot, the spines black almost to the base, eleven to thirteen, usually eleven, in number in the outer series. Extremity of male abdomen considerably clavate, well recurved, the supraanal plate long triangular, feebly compressed in the middle, the apex acutangulate, the margins elevated, the median sulcus rather heavy and deep, apically evanescent, its walls stout; furcula consisting of a pair of parallel, tapering, flattened fingers about a third as long as the supraanal plate; cerci nearly three times as long as middle breadth, consisting of a feebly tapering basal portion nearly twice as long as broad, and an apical, slightly inbent and feebly upturned, externally broadly sulcate, subequal portion, well rounded at tip; subgenital plate subpyramidal, with its lateral margins very feebly sinuate, the apical margin rising a little higher and distinctly notched as well as laterally tumid.

Length of body, male, 21 mm., female, 26.5 mm.; antennae, male, 9 mm., female, 8.75 mm.; tegmina, male, 18.5 mm., female, 20 mm.; hind femora, male, 13 mm., female, 14 mm.

Forty-eight males, 71 females. British Columbia, G. W. Taylor (L

Bruner); same, G. R. Crotch; Vancouver Island, British Columbia, H. Edwards (S. H. Scudder; U.S.N.M.—Riley collection); Victoria, Vancouver Island, British Columbia, Packard (same); Gold Stream, Vancouver Island, British Columbia, July 17 (S. Henshaw); Sicamous, British Columbia, July 25 (same); Northwest Boundary Survey, Doctor Kennerly; Washington, Morrison (U. S. N. M.—Riley collection; S. Henshaw); Camp Umatilla, Washington, June 26, Henshaw (Museum Comparative Zoology); Loon Lake, Stevens County, Washington, July 25, Henshaw (same); Brown's, Colville Valley, Washington, July 24, Henshaw (same); Ellensburg, Kittitas County, Washington, July 14, Henshaw (same); Easton, Kittitas County, Washington (U.S.N.M.—Riley collection); Spokane, Washington, July 21, 22, Henshaw (Museum Comparative Zoology); Fort Wallawalla, Washington, Bendire (U. S. N. M.—Riley collection); Wallula, Wallawalla County, Washington, September 1, Packard (same; S. H. Scudder); Morgan's Ferry, Yakima River, Washington, July 1, Henshaw (Museum Comparative Zoology); La. Chapples, Yakima River, Washington, July 16, Henshaw (same); Umatilla, Oregon, July 25, Henshaw (same); Ruby Valley, Elko County, Nevada, R. Ridgway; Camp Halleck, Elko County, Nevada, E. Palmer; Reno, Washoe County, Nevada (U.S.N.M.—Riley collection); Truckee Valley, Nevada, R. Ridgway; Lake Tahoe, Nevada, Packard (U.S.N.M.—Riley collection); Weeksville, Montana, August 2, Henshaw (Museum Comparative Zoology).

This is the species which has been classed, in the National Museum as belonging to Walker's *Caloptenus scriptus*, and is therefore probably the species so named by Cockerell¹ as coming from Colorado. It is, however, not that species, a female specimen of the present species having at my request been compared with the types by Mr. S. Henshaw during a recent visit in London. As compared with this, he finds the true *scriptus* to be "much larger, heavier, and with shorter, heavier, and more clumsy prosternal spine; thoracic carinae, especially the median, sharper and more prominent; cups of upper valves of ovipositor much deeper; lower valves much heavier." He also compared this with the type of Walker's *Caloptenus bilituratus* and found it the same, "agreeing as to front, eyes, thoracic carinae, prosternal spine, and mesosternal lobes."

This species varies somewhat, and runs very close indeed to *M. atlansis*; more so in the northern examples from British Columbia and Washington than in those from Nevada; and were it not for the considerable uniformity of Nevada specimens, in which the male cerci are always relatively long and slender, and their marked distinction from Utah specimens of *M. atlansis*, I should have hesitated to regard the species as distinct from *M. atlansis*, especially in view of the great variation in the latter species. As it is, I have been in much doubt where to place females from British Columbia and Washington, where the two species occur together.

¹Trans. Am. Ent. Soc., XX (1894), p. 337.

25. MELANOPLUS DEFECTUS, new species.

(Plate XII, fig. 6.)

Of medium or a little less than medium size, ferrugineo-flavous. Head not prominent, flavous or ferruginous or a mixture of both, marked above with a double median black line and with a piceous postocular band of varying width; vertex gently tumid, feebly elevated above the pronotum, the interspace between the eyes alike in both sexes, half as broad again as the first antennal joint; fastigium steeply declivent, deeply sulcate; frontal costa failing to reach the clypeus, subequal, as broad as or slightly broader than the interspace between the eyes, sulcate at and below the ocellus, biserially punctate throughout; eyes moderately large, not very prominent, much longer than the infraocular portion of the genae; antennae flavo-luteous, about two-thirds (male) or about three-fifths (female) as long as the hind femora. Pronotum subequal on the prozona, expanding posteriorly on the metazona, darker above than on the sides, the lateral lobes with a broad, broken, and irregular, piceous, postocular band confined to the prozona, the disk nearly plane but feebly convex, passing into the vertical lobes by a distinctly angulated but rounded shoulder nearly forming lateral carinae on the metazona; median carina distinct on the metazona, subobsolete and equal on the prozona; front margin truncate, hind margin obtusangulate, the angle well rounded; prozona feebly transverse in both sexes, scarcely or not longer than the densely punctate metazona. Prosternal spine rather short, feebly conical, very blunt, slightly appressed, suberect, shorter in the female than in the male; interspace between mesosternal lobes nearly twice as long as broad (male) or subquadrate (female). Tegmina slightly abbreviated, scarcely (female) or a little (male) surpassing the middle of the hind femora, of moderate breadth, tapering regularly but not greatly to a rather broadly rounded apex, brownish hyaline, flecked with black at base and along middle of discoidal area; wings similarly developed. Fore and middle femora of male scarcely enlarged; hind femora varying from flavous to ferruginous, the outer face and especially its upper portion more or less and rather uniformly infuscated between the incisures, the inner face trimaculate above, the lower face feebly roseate, the genicular arc and a transverse bar at base of lower genicular lobe black or fuscous; hind tibiae pale red, the spines black beyond the base, ten to twelve in number in the outer series. Extremity of male abdomen clavate, a little recurved, the supraanal plate triangular with acutangulate apex and the lateral margins elevated especially on the basal half, the median sulcus tolerably deep between high and narrow but rounded walls; furcula consisting of a pair of moderately distant, scarcely diverging, tapering, slender spines, a little larger than the last dorsal segment; cerci slightly less than twice as long as median breadth, the basal half feebly tapering, the apical half narrowed by the slight oblique excision

of the inferior margin, strongly compressed or subsulcate, the apex broadly rounded; subgenital plate with its notched and doubly bossed apical margin strongly and abruptly elevated above the lateral margin.

Length of body, male, 18 mm., female, 22 mm.; antennae, male, 6 mm., female, 6.75 mm.; tegmina, male, 10.5 mm., female, 9.5 mm.; hind femora, male, 9.5 mm., female, 11.5 mm.

One male. 1 female. Grand Junction, Mesa County, Colorado, June (L. Bruner).

26. MELANOPLUS ATLANIS.

(Plate XII, fig. 7.)

Caloptenus spretus PACKARD, Amer. Nat., VIII (1874), p. 502; *ibid.*, IX (1875), p. 573.—RILEY, Can. Ent., VII (1875), p. 180.

Caloptenus atlantis RILEY!, Ann. Rep. Ins. Mo., VII (1875), p. 169; *ibid.*, VIII (1876), pp. 113-118, 153.—WHITMAN, Grasshopper (1876), p. 19.—RILEY!, Ann. Rep. Ins. Mo., IX (1877), p. 86; Loc. Plague (1877), pp. 22-24, 27, 198-199.—THOMAS, Rep. Ent. Ill., VII (1878), p. 38; Bull. U. S. Geol. Surv. Terr. IV (1878), p. 500; Ann. Rep. Chief Eng., 1878, 1845 (1878); Rep. U. S. Ent. Comm., I (1878), pp. 49-50, 52.—PACKARD, *ibid.*, I (1878), pp. 135, [140-144].—THOMAS, PACKARD, *ibid.*, I (1878), p. 140.—RILEY, *ibid.*, I (1878), pp. 220, 225, 226, 232, 237, 284, 299, 446, 458, pl. III.—THOMAS, *ibid.*, II (1881), p. 106.—LINTNER, Ins. Clover (1881), p. 5.—RILEY, Bull. U. S. Ent. Comm., VI (1881), pp. 89-90; Amer. Nat., XVII (1883), p. 1073; Rep. U. S. Ent., 1883 (1883), pp. 99, 170-180, pl. II.—PACKARD, Rep. U. S. Ent. Comm., III (1883), pp. 273-277, pls. XX-XXI.—BRUNER, *ibid.*, III (1883), pp. 9, 10, 14, 54.—RILEY, Stand. Nat. Hist., II (1884), p. 194.—COOK, Beal's Grasses N. A., I (1887), p. 373.—CAULFIELD, Can. Rec. Sc., II (1887), pp. 399, 401; Can. Orth. (1887), pp. 11, 14.—WEED, Bull. Ohio Exp. St., Techn. Ser., I (1889), p. 39.—SCHWARZ, Proc. Ent. Soc. Wash., I (1890), p. 213.—HOWARD, Ins. Life, IV (1891), p. 124.—RILEY, Bull. Div. Ent. U. S. Dep. Agric., XXV (1891), pp. 26-27, figs. 4a-c.—MILLIKEN, Ins. Life, VI (1893), pp. 19, 21.

Caloptenus atlantis THOMAS, Bull. Ill. Mus. Nat. Hist., I (1876), p. 68.—RILEY, Amer. Nat., XI (1877), p. 665; *ibid.*, XII (1878), p. 285.—THOMAS, Rep. Ent. Ill., IX (1880), pp. 92, 96, 124.

Caloptenus femur-rubrum PROVANCHER!, Nat. Can., VIII (1876), pp. 109-110, fig. 12; Faune Ent. Can., II (1877), p. 36, fig. 9.

Melanoplus devastator SCUDDER! (pars), Proc. Bost. Soc. Nat. Hist., XIX (1878), pp. 285-286, 287-288; (pars), Ent. Notes, VI (1878), pp. 46-47, 48-49; (pars), Rep. U. S. Ent. Comm., II, app. (1880), p. 24.

Melanoplus atlantis SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1878), p. 286, 287; Ent. Notes, VI (1878), pp. 45, 46.—CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1888), p. 71.—COMSTOCK, Intr. Ent. (1888), pp. 108, 110.

Melanoplus atlantis SCUDDER!, Rep. U. S. Ent. Comm., II, app. (1881), p. 24, pl. XVII, fig. 6.—BRUNER, *ibid.*, III (1883), p. 60; Can. Ent., XVII (1885), p. 17; Bull. Washb. Coll., I (1885), pp. 137-138.—RILEY, Rep. U. S. Ent., 1885 (1886), p. 233, pl. VIII, figs. 7a-c.—BRUNER, *ibid.*, 1885 (1886), pp. 303, 304, 306, 307; Bull. Div. Ent. U. S. Dep. Agric., XIII (1887), p. 11.—FERNALD, Orth. N. E. (1888), pp. 31, 33; Ann. Rep. Mass. Agric. Coll., XXV (1888), pp. 115, 117.—FLETCHER, Ann. Rep. Ent. Soc. Ont., XIX (1889), p. 10; Rep. Exp. Farms Can., 1888 (1889), p. 63.—DAVIS, Ent. Amer., V (1889), p. 81.—MARLATT, Ins. Life, II (1889), pp. 66-70.—SMITH, Cat. Ins. N. J. (1890), p. 413.—BLATCHLEY, Can. Ent., XXIII (1891), p. 98.—BRUNER, *ibid.*, XXIII (1891), p. 192; Ins. Life, III (1891), p. 229; *ibid.*, IV (1891), pp. 21, 146; Rep. Ent. Soc. Ont., XXII (1891), p. 48; Bull. Div. Ent. U. S. Dep. Agric., XXIII (1891), p. 14; Rep. St.

Bd. Agric. Nebr., 1891 (1891), pp. 243, 306.—MCNEILL, Psyche, VI (1891), pp. 73-74.—WEED, Can. Ent., XXIV (1892), p. 278.—BRUNER, Bull. Div. Ent. U. S. Dep. Agric., XXVII (1892), pp. 12-29; *ibid.*, XXVIII (1893), pp. 29-30, figs. 14a-c; *ibid.*, XXX (1893), p. 35; Publ. Nebr. Acad. Sc., III (1893), p. 28; Rep. Nebr. St. Bd. Agric., 1893 (1893), p. 459; Ins. Life, VI (1893), p. 34.—SCUDDER, Psyche, VI (1893), p. 462.—OSBORN, Ins. Life, V (1893), pp. 323-325; *ibid.*, VI (1893), pp. 80-81.—MORSE, Psyche, VII (1894), p. 106.—BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI (1894), p. 306.—BRUNER, Rep. St. Hort. Soc. Nebr., 1894 (1894), p. 163; Bull. Div. Ent. U. S. Dep. Agric., XXXII (1894), p. 12; Nebr. St. Hort. Rep., 1895 (1895), p. 69.—LINTNER, Rep. St. Mus. N. Y., XLVIII (1895), 440-443.

Caloptenus bilituratus BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60.

Pezotettix atlantis HUNT, Misc. Ess. Econ. Ent. Ill. (1886), pp. 120, 126.—GARMAN, Orth. Ky. (1894), pp. 3, 8.

Melanoplus atlantis caeruleipes COCKERELL, Entom., XXII (1889), p. 127.

[Many of these references may belong to species not heretofore distinguished from *M. atlantis*.]

Varying from medium to a little above medium size, dark griseo-fuscous, often tinged more or less heavily with ferruginous. Head a little prominent, olivaceo-testaceous freckled with fuscous, above more or less infuscated, sometimes diffusing the whole, sometimes confined to two divergent longitudinal stripes, with a broad, piceous, postocular band; vertex rather tumid, somewhat elevated above the pronotum, the interspace between the eyes nearly twice as broad as the first antennal joint in both sexes; fastigium steeply declivent, shallowly sulcate, more shallowly in the female than in the male; frontal costa rather prominent, failing to reach the clypeus, feebly narrowed above especially in the male, fully as broad as the interspace between the eyes, slightly sulcate at and below the ocellus, irregularly punctate throughout, above more densely and with a tendency to a biseriata arrangement; eyes moderate, rather prominent particularly in the male, much longer than the infra-ocular portion of the genae; antennae rufo- or luteo-testaceous, about five-sixths (male) or three fifths (female) as long as the hind femora. Pronotum rather short, feebly and angularly constricted in the middle, the broad angulation at the principal sulcus and produced mostly by the posterior expansion of the metazona, more or less infuscated and often also ferruginous above, the lateral lobes with a generally distinct and entire but sometimes broken or maculate, broad, piceous, postocular band, confined to the prozona; disk broadly convex and passing into the vertical lateral lobes somewhat abruptly but with a well-rounded shoulder, simulating but nowhere really forming distinct lateral carinae; median carina distinct and well marked on the metazona, obscure and generally subobsolete on the prozona if not indeed obsolete, particularly between the sulci and in the female; front margin truncate but very narrowly and minutely flaring, hind margin obtusangulate, the angle very slightly rounded; prozona subquadrate—a little variable on either side (male) or distinctly transverse (female), rarely and then feebly longer than the densely punctate metazona. Prosternal spine variable, usually short, conical, a little blunt, slightly appressed, erect (male) or

short appressed subconical, very blunt, erect (female), but sometimes it is very blunt and decidedly appressed in the male, also it is occasionally distinctly transverse, but it usually shows a distinct taper, generally from base to tip; interspace between mesosternal lobes varying from quadrate to half as long again as broad (male) or from quadrate to slightly longer than broad (female). Tegmina usually surpassing considerably the hind femora, occasionally and especially in the female only a little, slender, feebly tapering, brownish fuscous, nearly always flecked lightly with fuscous throughout the discoidal area; wings rather broad, hyaline, the veins mostly testaceous, growing increasingly fuscous toward the margins, the apex sometimes most faintly, scarcely perceptibly, infumate. Thoracic episterna mostly flavo-testaceous in contrast to the fuscous surroundings. Fore and middle femora of male somewhat tumid; hind femora luteo- or flavo-testaceous, obscurely broadly and obliquely bifasciate with fuscous besides the fuscous base, the inner surface mostly flavous, more or less clouded with fuscous, the lower surface externally flushed with roseate, the geniculation mostly fuscous; hind tibiae normally rather bright red, often feebly pallescent at base, with a faint fuscous patellar spot, but not infrequently pale red or pale green or pale yellow, or even dark blue, the spines black beyond the base, nine to twelve in number in the outer series. Extremity of male abdomen a little clavate, a little recurved, the supraanal plate triangular or hastate, feebly compressed just beyond the middle, the lateral margins before that a little elevated, the tip acutangulate, the median sulcus moderately deep, evanescent apically, its bounding ridges rather high and followed apically by a pair of more distant longitudinal ridges of less importance; furcula consisting of a pair of more or less divergent, slight, slender, acuminate spines, less than a third, sometimes only a fourth, the length of the supraanal plate; cerci generally about twice as long as broad, sometimes less than that, rarely exceeding it, composed of a basal, nearly equal, feebly tumid piece, and a strongly compressed, slightly upturned and somewhat inbent apical portion, narrowed by the oblique excision of the inferior margin, the apex well rounded; subgenital plate subpyramidal, with the apical margin a little but rather abruptly elevated, thickened and mesially notched with greater or less, generally considerable, distinctness, the notch followed by a posterior sulcation to some distance.

Length of body, male, 21.5 mm., female, 24 mm.; antennae, male, 10 mm., female, 7.5 mm.; tegmina, male and female, 20 mm.; hind femora, male, 12.5 mm., female, 12.75 mm.

Three hundred and eighty-seven males, 408 females. Halifax, Nova Scotia, H. Piers; Ottawa, Canada (U.S.N.M.—Riley collection); Maine, Packard; Moosehead Lake, Maine; Bar Harbor, Mount Desert Island, Maine (S. Henshaw); White Mountains, New Hampshire, from valleys through forests to highest summits of Mount Washington, Mount Madison, Mount Lafayette—Scudder, Henshaw, Packard, Shurtleff, Morse, Mrs. Slosson (S. H. Scudder; Museum Comparative Zoology,

S. Henshaw; A. P. Morse); Bethlehem, Grafton County, New Hampshire (Henshaw); Shelburne, Coos County, New Hampshire; Mount Kearsarge, New Hampshire, 2,000 feet to 3251 feet (A. P. Morse); Boscawen, Merrimack County, New Hampshire (U.S.N.M.—Riley collection); Sudbury, Rutland County, Vermont; various localities in the vicinity of or belonging to Boston, Massachusetts—Hyde Park, Beverly, Clifton, Milton, Blue Hills, Brookline, Canton, Revere, Chelsea, Malden, Jamaica Plain, Cambridge (S. Henshaw; Museum Comparative Zoology; A. P. Morse; S. H. Scudder); Plum Island, Putnam, and Salem, Essex County, Massachusetts (Museum Comparative Zoology); Warwick, Franklin County, Massachusetts, Miss A. M. Edmonds (same); Springfield, Hampden County, Massachusetts, Allen (same); Williamstown, Berkshire County, Massachusetts; Adams, Berkshire County, Massachusetts (A. P. Morse); Greylock, Massachusetts, 3,500 feet (same); Cape Cod, Massachusetts; Provincetown, Barnstable County, Massachusetts; Nantucket, Massachusetts (S. Henshaw; S. H. Scudder); West Chop, Marthas Vineyard, Massachusetts, Morse (Museum Comparative Zoology); Canaan and South Kent, Litchfield County, Connecticut (A. P. Morse); Sullivan County, New York, Shaler (Museum Comparative Zoology); New Jersey; Pennsylvania; Middle States, Baron Osten Sacken; Washington, D. C. (L. Bruner; U.S.N.M.—Riley collection); Danville, Pittsylvania County, Virginia, Packard (Museum Comparative Zoology); North Carolina (S. Henshaw); Beaufort, Carteret County, North Carolina, Shute (Museum Comparative Zoology); South Carolina (same); Georgia, Jones (same); Rossville, Walker County, Georgia, King (same); Vigo County, Indiana (Blatchley); Detroit, Michigan, H. Gillman; Illinois, Thomas (U.S.N.M.—Riley collection); Chicago, Illinois; Moline, Rock Island County, Illinois, McNeill; southern Illinois (Museum Comparative Zoology; S. H. Scudder); Sudbury, Ontario; Winnipeg, Manitoba, R. Kennicott; Minneapolis, Minnesota (U.S.N.M.—Riley collection); Custer, South Dakota, Bruner (same); Crawford and Greene counties Iowa, Allen; Nebraska, Dodge; Fort Robinson and Chadron, Dawes County, Nebraska, Bruner (U.S.N.M.—Riley collection); Gordon, Sheridan County, Nebraska, Bruner (same); Nebraska City, Otoe County, Nebraska, Hayden; St. Louis, Missouri (U.S.N.M.—Riley collection; S. H. Scudder); Bushberg, Jefferson County, Missouri (U.S.N.M.—Riley collection); New Madrid, Missouri, R. Kennicott; Williamsville, Wayne County, Missouri, S. W. Denton (A. P. Morse); Monticello, Lawrence County, Mississippi, Miss Helen Jennison; Canebreak, Louisiana, on cotton, Comstock (U.S.N.M.—Riley collection); Texas, Belfrage, Lincecum; Dallas, Texas, Boll; Columbus, Colorado County, Texas, on cotton (U.S.N.M.—Riley collection); Orizaba and Aguas Calientes, Mexico (L. Bruner); San Lorenzo, Chihuahua, Mexico, Palmer; Mount Alvarez, San Luis Potosi, Mexico, Palmer; Bledos, San Luis Potosi, Mexico, Palmer; Fort Grant, Graham County, Arizona (U.S.N.M.—Riley collection); 40 miles east of Tucson, Pima County,

Arizona, Palmer; Fort Whipple, Yavapai County, Arizona, Palmer; Arizona, Burrison (Museum Comparative Zoology); Flagstaff, Coconino County, Arizona, Cordley (L. Bruner); Las Cruces, Donna Ana County, New Mexico, Cockerell; Colorado (U.S.N.M.—Riley collection; C. P. Gillette; S. Henshaw); Fruita, Mesa County, Colorado (U.S.N.M.—Riley collection); Beaver Brook, Colorado, 6,000 feet; Salt Lake, Utah, Packard; Salt Lake Valley, Utah, 4,300 feet; American Fork Canyon, Utah, 9,500 feet; Provo, Utah County, Utah; Spring Lake Villa, Utah County, Utah, Palmer; Douglas, Converse County, Wyoming (U.S.N.M.—Riley collection); Evanston, Uinta County, Wyoming, 6,800 feet; Fort McKinney, Johnson County, Wyoming (U.S.N.M.—Riley collection); Yellowstone National Park; Beaver Canyon Road, Idaho; Yellowstone, Montana (U.S.N.M.—Riley collection); Putnam, Custer County, Montana, A. Sloggy (same); Eldorado County, California, 4,000 feet, Gissler; Umatilla, Oregon, Henshaw (Museum Comparative Zoology); The Dalles, Wasco County, Oregon, Henshaw (same); Washington, Morrison (S. Henshaw); Camp Umatilla, Washington, Henshaw (Museum Comparative Zoology); Preston's, Klikitat—Lone Tree, Yakima River—opposite Ellensburg, Yakima River—Olmstead's, near Ellensburg—Nelson's, Yakima River—Yakima City—and Brown's, Colville Valley, Washington, Henshaw (same); British Columbia, Crotch (Museum Comparative Zoology); explorations in Arctic America and Yukon River, Alaska, R. Kennicott; Laggan, Alberta, Bean (S. Henshaw; S. H. Scudder); Banff and Calgary, Alberta, Bean (S. Henshaw); Fort McLeod, Alberta (U.S.N.M.—Riley collection; L. Bruner).

The published accounts add very little to the above range of distribution, except that it is reported from Quebec (Provancher), northern California (Packard), Nevada (Scudder), and south as far as middle Florida—probably by error (Packard).

It is probable, therefore, that it is found in every part of the continuous district of the United States, excepting in the southernmost Atlantic States and most of California, being thus limited very much as *M. femur-rubrum*; it extends also into central Mexico, and north of our boundary is found from Atlantic to Pacific as far at least as latitude 50° (excepting Newfoundland), and on the Pacific side reaches north to the Yukon River and probably the Lower McKenzie.

Next to *M. spretus* this is our most destructive locust, and east of the Mississippi probably the only one ever doing much damage. Its injuries, however, are not for a moment to be compared with those inflicted by *M. spretus*, for, though possessing good powers of flight and on rare occasions known to migrate in swarms, its injuries can only be classed as local, and they are never so serious as those inflicted by *M. spretus*; nevertheless they are by no means slight, and immense destruction of grain is to be laid at its door. Bruner, who has studied this insect over a wide extent of country, says that "while it occurs over . . . an extended territory, it appears to be . . . partial to hilly

or mountainous regions . . . ; it seems also to prefer a wooded or mixed country to the open prairies or plains.”

This is one of the most variable of the Melanopli, and it is sometimes difficult to distinguish from its immediate allies. The above description is drawn up primarily from Eastern examples which came from the region from which the species was originally described. Specimens from the dry plains of the West (especially noted in those from Utah) are decidedly paler and more cinereous in aspect than those from relatively fertile country, and they have often a flavous stripe bordering the eye and continued along the position of the lateral carinae; a similar but not so striking a cinereous hue attaches to those that occur in sandy localities in the Eastern States, as along the sea margin. The exact contrary is shown in Canada just east of the Rocky Mountains, where the specimens are exceedingly dark in color, almost blackish fuscous, with heavy fasciation of the hind femora;¹ but here again a difference of another sort occurs as one passes eastward, specimens from Laggan and Banff almost invariably having relatively long and slender male cerci, while at Calgary all that have been seen (with a very few from the former localities) have male cerci hardly more than half as long again as broad. Specimens from Mexico, however, agree very closely with those from New England.

Specimens with green hind tibiae have been seen by me from the White Mountains, New Hampshire, but not from the summits (except Kearsarge 3,251 feet), from the vicinity of Boston, at Provincetown, and on the island of Nantucket, Massachusetts, from Laggan, Alberta, the Yellowstone region, Montana, Wyoming, Nebraska, Missouri, Colorado, from the Salt Lake valley and American Fork Canyon (9,500 feet), Utah, Texas, and Chihuahua, Mexico. Specimens with dark blue hind tibiae have been seen from Iowa, Colorado, American Fork Canyon, Utah, and Texas. In nearly or quite all these cases specimens with red hind tibiae predominated in the same district.

According to Riley the first mature insects observed one year about St. Louis, Missouri, appeared July 12, and deposited eggs by July 20. The eggs had a quadrilinear arrangement in the pod, hatched in from three to four weeks, and the young took eighty days to reach maturity. He says he has proved that the insect is there double-brooded, though I find no data published by him in support of the statement, and the above facts drawn from his writings militate against it. Bruner, however, agrees with it, saying that in the District of Columbia a second brood appears in the late autumn, composed of smaller and darker individuals. I have seen nothing of the kind in New England.

The points in which the unfledged locusts differ from the same stages in *M. spretus* and *M. femur-rubrum* are explained and figured in the first report of the United States Entomological Commission, in which many other interesting points regarding this species will be found.

¹Specimens from Sudbury, Ontario, are similarly dark.

27. MELANOPLUS SPRETUS.

(Plate XII, fig. 8.)

- Caloptenus spretus* UHLER!, MS. (1863).—[WALSH], Pract. Ent., II (1866), p. 1.—GLOVER, Rep. U. S. Dep. Agric., 1867 (1867), p. 65, fig.—SCUDDER, Proc. Bost. Soc. Nat. Hist., XI (1868), p. 436; *ibid.*, XII (1868), p. 88.—[WALSH, RILEY], Amer. Ent., I (1868), pp. 16, 73, fig. 65; *ibid.*, I (1869), p. 249.—WALSH, Rep. Ins. Ill., I (1868), p. 82.—PACKARD, Guide Ins. (1869), p. 570, fig. 561a.—THOMAS, Amer. Ent., II (1870), p. 81; Proc. Acad. Nat. Sc. Phila., 1870 (1870), p. 78.—WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 678.—GLOVER, Rep. U. S. Dep. Agric., 1870 (1870), p. 76, fig. 31; *ibid.*, 1871 (1871), p. 78, fig. 11.—SCUDDER, Fin. Rep. U. S. Geol. Surv. Nebr. (1871), pp. 250, 252.—THOMAS, Ann. Rep. U. S. Geol. Surv. Terr., II (1871), pp. 265, 281; *ibid.*, V (1872), p. 451.—DODGE, Can. Ent., IV (1872), p. 15.—SMITH, Rep. Conn. Bd. Agric., 1872 (1872), p. 366, fig. 9.—LEBARON, Ann. Rep. Nox. Ins. Ill., II (1872), p. 158.—GLOVER, Ill. N. A. Ins., Orth. (1872), pl. VIII, fig. 1, pl. XIII, fig. 15; Rep. U. S. Dep. Agric., 1872 (1872), p. 121; *ibid.*, 1873 (1873), pp. 125, 136, fig. 8.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 164.—GLOVER, Rep. U. S. Dep. Agric., 1874 (1874), p. 28.—THOMAS, Key Ill. Orth. (1874?), p. 3.—BETHUNE, Can. Ent., VI (1874), p. 185.—SCUDDER, Daws. Rep. Geol. Rec. 49th par. (1875), p. 343.—RILEY, Ann. Rep. Ins. Mo., VII (1875), p. 121, figs. 23-25, 27, 28, 31, 32, maps.—DODGE, Can. Ent., VII (1875), p. 133.—BETHUNE, Ann. Rep. Ent. Soc. Ont., 1874 (1875), pp. 8, 30, figs. 31, 34; *ibid.*, 1875 (1876), p. 45, fig.; Can. Ent., VIII (1876), p. 4.—PUTNAM, Proc. Dav. Acad. Nat. Sc., I (1876), pp. 187, 265.—THOMAS, *ibid.*, I (1876), pp. 260, 265.—CARPENTER, Field and For., I (1876), p. 81.—MERRICK, *ibid.*, II (1876), p. 64.—RILEY et al., Rocky Mt. Loc. (1876), pp. 37-58, figs. 1-4.—WHITMAN, Grasshopper (1876), pp. 1-17, 4 figs.—DAWSON, Can. Nat., n. s., VIII (1876), pp. 119-134.—BROADHEAD, Trans. St. Louis Acad. Sc., III (1876), pp. 345-349.—SCUDDER, Bull. U. S. Geol. Surv. Terr., II (1876), p. 261; Psyche, I (1876), p. 144.—THOMAS, Bull. Ill. Mus. Nat. Hist., I (1876), p. 68.—RILEY, Rep. Ins. Mo., VIII (1876), pp. 57-156, figs. 39a-e; *ibid.*, IX (1877), pp. 57-124, figs. 18-22, map; Amer. Nat., XI (1877), p. 664.—SCUDDER, Ann. Rep. Geogr. Surv. W. 100th mer., 1876 (1877), p. 281 [Ann. Rep. Chief Eng., 1876, p. 501].—BRUNER, Can. Ent., IX (1877), p. 144.—DODGE, Field and For., II (1877), p. 206.—UHLER, Bull. U. S. Geol. Surv. Terr., III (1877), pp. 359, 798.—BESSEY, Bienn. Rep. Iowa Agric. Coll., VII (1877), p. 209.—THOMAS, Rep. Geogr. Surv. W. 100th mer., V (1877), p. 892.—PHILLIPS, Statist. Minn., 1876 (1877), p. 88-112.—WHITMAN, Rep. Rocky Mt. Loc., 1876 (1877), pp. 1-43, map.—THOMAS, Rep. Ent. Ill., VI (1877), pp. 44-56.—RILEY, THOMAS, PACKARD, Bull. U. S. Ent. Comm., II (1877), pp. 1-15, 11 figs., map; *ibid.*, 2d ed. (1877), pp. 1-14, 11 figs., map.—RILEY, Loc. Plague (1877), pp. 1-231, maps 1-3, figs. 2, 3, 6-14.—DAWSON, Can. Nat., n. s., VIII (1877), pp. 207-226; *ibid.*, VIII (1878), pp. 411-417.—THOMAS, Rep. U. S. Ent. Comm., I (1878), pp. 31-52, 114-130, 334-350.—PACKARD, *ibid.*, I (1878), pp. 136-211.—RILEY, *ibid.*, I (1878), pp. 212-257, 279-334, 350-437, 443-459.—RILEY, THOMAS, PACKARD, *ibid.*, I (1878), pp. 10-16, 1-29, 1-294, pl. I, maps 1-3.—THOMAS, Rep. Ent. Ill., VII (1878), pp. 35, 36-38, figs. 4, 6, 8; Bull. U. S. Geol. Surv. Terr., IV (1878), pp. 483, 485.—RILEY, Amer. Nat., XII (1878), p. 283.—PACKARD, *ibid.*, XII (1878), p. 516; *ibid.*, XIII (1879), p. 586.—GIRARD, Traité élém. d'ent., II (1879), p. 248.—THOMAS, Amer. Ent., III (1880), p. 225.—CARPENTER, *ibid.*, III (1880), p. 296.—BOWLES, Can. Ent., XII (1880), pp. 131-133, fig. 19.—ABBÉ, Amer. Nat., XIV (1880), pp. 735-738.—THOMAS, Psyche, III (1880), p. 114; Rep. Ent. Ill., IX (1880), pp. 92, 96, 121-123, figs. 19-21.—PACKARD, RILEY, Rep. U. S. Ent. Comm., II (1881), pp. 1-14.—THOMAS, *ibid.*, II (1881), pp. 14-155.—PACKARD, *ibid.*, II (1881), pp. 156-163, 178-183,

- 223-242, fig. 9, pl. I, figs. 9-15.—MINOT, *ibid.*, II (1881), pp. 183-222, pls. II-VII.—RILEY, *ibid.*, II (1881), pp. 259-322, pl. XVI; *Can. Ent.*, XIII (1881), p. 180.—PACKARD, *Amer. Nat.*, XV (1881), pp. 285-302, 372-379, pls. II-IV, V, figs. 1-3.—HART, *ibid.*, XV (1881), p. 749.—RILEY, *ibid.*, XV (1881), pp. 1007, 1013.—BOWLES, *Ann. Rep. Ent. Soc. Ont.*, 1880 (1881), pp. 28-29.—PACKARD, *Nat. Leis. Hour*, V (1881), No. 4, pp. 4-10, figs.—LINTNER, *Ins. Clover* (1881), p. 5; *Ann. Rep. Ins. N. Y.*, I (1882), p. 7, fig. 3a.—MANN, *Psyche*, III (1883), pp. 379-380.—RILEY, *Bull. Div. Ent. U. S. Dep. Agric.*, II (1883), p. 5.—BRUNER, *ibid.*, II (1883), pp. 7-22, 29.—PACKARD, *Rep. U. S. Ent. Comm.*, III (1883), pp. 3-7, 263-273, 277-279, 346-347, pls. XVI-XIX, maps 1-2.—BRUNER, *ibid.*, III (1883), pp. 8-54.—MARTEY, *ibid.*, III, App. (1883), pp. 50-54.—SAUNDERS, *Ins. Inj. Fruits* (1883), p. 157, figs. 165, 166.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, IV (1884), pp. 51-62.—RILEY, *Stand. Nat. Hist.*, II (1884), pp. 195-201, figs. 274-281; *Rep. U. S. Ent.*, 1884 (1885), p. 323.—BRUNER, *ibid.*, 1884 (1885), pp. 398-399.—CAULFIELD, *Rep. Ent. Soc. Ont.*, XVIII (1886), pp. 65, 67, figs. 19, 21.—RILEY, *Rep. U. S. Ent.*, 1885 (1886), pp. 228-229, pl. VIII, figs. 6a-c.—HANSEN, *Nordam. Vandreg.* [Tidskr. pop. fremst. naturw.], (1886), pp. 1-32.—COOK, *Beal's Grasses N. A.*, I (1887), pp. 373, 396, 409, fig. 156.—CAULFIELD, *Can. Rec. Sc.*, II (1887), pp. 399, 401; *Can. Orth.* (1887), pp. 11, 14.—RILEY, *Ins. Life*, I (1888), pp. 30-31.—PARSONS, *ibid.*, I (1889), p. 380.—WEED, *Bull. Ohio Exp. St., Techn. Ser.*, I (1889), p. 40.—LUGGER, *Rep. Agric. Exp. St. Minn.* (1889), pp. 339-343, figs. 5, 13, 15, 19-22; *Bull. Agric. Exp. St. Minn.*, VIII (1889), pp. 305-349, figs. 1-4, pl. I, map.—LINTNER, *Rep. Ins. N. Y.*, VII (1891), p. 338.—RILEY, *Ins. Life*, III (1891), pp. 183, 438; *Bull. Div. Ent. U. S. Dep. Agric.*, XXV (1891), pp. 9-26, figs. 1-3, map, pl. I, figs. 1-5.—OSBORN, *Goss. Bull. Iowa Exp. St.*, XIV (1891), pp. 174-175.—PIERCE, *Ins. Life*, IV (1891), p. 80.—RILEY, *ibid.*, IV (1892), p. 323.
- Acridium spretis* THOMAS, *Trans. Ill. St. Agric. Soc.*, V (1865), p. 450.
- Pezotettix spretus* STÅL, *Bih. k. Sv. Vet.-Akad. Handl.*, V (1878), No. 9, p. 14.—HUNT, *Misc. Ess. Econ. Ent. Ill.* (1886), pp. 120-122, 126.
- Melanoplus spretus* SCUDDER, *Proc. Bost. Soc. Nat. Hist.*, XIX (1878), p. 287; *Ent. Notes*, VI (1878), p. 46; *Rep. U. S. Ent. Comm.*, II, App. (1881), p. 24.—BRUNER, *ibid.*, III (1883), p. 60.—RILEY, *Ent. Amer.*, I (1885), p. 177.—FLETCHER, *Rep. Ent. Can.*, 1885 (1885), pp. 9-10, fig. 1.—BRUNER, *Bull. Washb. Coll.*, I (1885), p. 138; *ibid.*, I (1886), p. 200; *Rep. U. S. Ent.*, 1885 (1886), pp. 303-307.—CAULFIELD, *Rep. Ent. Soc. Ont.*, XVIII (1886), p. 71.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, XIII (1887), pp. 9-17, 33.—COMSTOCK, *Intr. Ent.* (1888), pp. 108-110, figs. 97a-f.—BRUNER, *Rep. St. Bd. Agric. Nebr.*, 1888 (1888), p. 88, figs. 1-3.—RILEY, *Ins. Life*, II (1889), p. 87.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, XXII (1890), p. 104; *ibid.*, XXIII (1891), p. 14; *Can. Ent.*, XXIII (1891), p. 192; *Ins. Life*, III (1891), p. 229; *ibid.*, IV (1891), pp. 20-21; *Rep. Ent. Soc. Ont.*, XXII (1891), pp. 47-48; *Rep. St. Bd. Agric. Nebr.*, 1891 (1891), pp. 243, 306-307, figs. 81-83.—MCNEILL, *Psyche*, VI (1891), p. 73.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, XXVII (1892), pp. 11-24.—OSBORN, *Proc. Iowa Acad. Sc.*, I, Pt. II (1892), p. 118.—KELLOGG, *Inj. Ins. Kans.* (1892), pp. 22-25, figs. 6a-d, 12a-f, 13a-f.—WEBSTER, *Bull. Ohio Agric. St.* (2), XLV (1892), p. 205, fig. 29.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, XXVIII (1893), pp. 27-29; *ibid.*, XXX (1893), p. 35; *Publ. Nebr. Acad. Sc.*, III (1893), p. 28; *Rep. St. Bd. Agric. Nebr.*, 1893 (1893), pp. 459-460, figs. 99-101.—OSBORN, *Ins. Life*, VI (1893), pp. 80-81.—BRUNER, *Rep. St. Hort. Soc. Nebr.*, 1894 (1894), pp. 163, 205, fig. 69; *ibid.*, 1895 (1895), p. 69.—LINTNER, *Rep. St. Mus. N. Y.*, XLVIII (1895), p. 441, fig. 18.
- Melanoplus spretus caeruleipes* COCKERELL, *Entom.*, XXII (1889), p. 127.

Of large size, but of slender form, light griseo-fuscous, more or less cinereous, and often tinged to a greater or less degree with ferruginous.

Head somewhat prominent, light fusco-olivaceous, with a broad, piceous, postocular band, and above more or less infuscated or dulled in color, often with a pair of longitudinal fuscous stripes; vertex rather tumid, raised considerably above the level of the pronotum, the interspace between the eyes half as broad again (male) or fully twice as broad (female) as the first antennal joint; fastigium steeply declivent, rather deeply (male) or shallowly (female) sulcate throughout; frontal costa moderately prominent, distinctly failing to reach the clypeus, slightly narrowed above, especially in the male, about as broad as the interspace between the eyes, feebly and broadly sulcate at and below the ocellus, feebly punctate, above biserially; eyes not very large nor very prominent, not more so in the male than in the female (unusual in *Melanoplus*), slightly shorter than the infraocular portion of the genae; antennae testaceous, nearly two-thirds as long as the hind femora in both sexes, scarcely relatively shorter in the female than in the male. Pronotum very short, equal on the prozona, expanding somewhat on the metazona, light brownish fuscous, often ferruginous, the lateral lobes with a much broken and maculate postocular piceous or dark fuscous band confined to the prozona, the disk broadly convex, passing into the vertical lateral lobes by a rounded angle forming a blunt shoulder on the metazona and posterior section of the prozona only; median carina distinct and antero-posteriorly convex on the metazona, feeble and often subobsolete on the prozona; front margin truncate, hind margin feebly obtusangulate, the angle sometimes rounded; prozona distinctly transverse, more so in the female than in the male, shorter (particularly in the female) than the finely and very feebly punctate metazona. Prosternal spine rather long, appressed, feebly conical, very blunt, erect, shorter in the female than in the male; interspace between mesosternal lobes from half as long again to twice as long as broad (male) or quadrate (female). Tegmina exceptionally long, far surpassing the hind femora, not very narrow, subequal, brownish testaceous, heavily flecked with blackish fuscous, usually through the discoidal area but sometimes confined to the middle line; wings ample, hyaline, the veins mostly fuscous, but testaceous next the costal margin. Fore and middle femora only a little tumid in the male; hind femora testaceo-ferruginous clouded with fuscous above, particularly in broad basal, premedian and postmedian patches, the geniculation mostly blackish fuscous, the lower genicular lobe pallid testaceous with a basal blackish bar, the inferior surface, especially externally, flushed with roseate; hind tibiae bright red throughout, the spines black almost to the very base, ten to eleven, rarely twelve, in number in the outer series. Extremity of male abdomen a little clavate, somewhat recurved, the supraanal plate triangular or subhastate, faintly compressed just beyond the middle, the margins feebly elevated on basal half, the apex subacutangulate, the median carina percurrent and rather deep, between rather high and sharp ridges; furcula consisting of a pair of slight, tapering and acuminate, flattened, more or less divergent spines, about

a fourth as long as the supraanal plate; cerci forming nearly flat plates, about half as long again as broad, lying in a nearly uniform subvertical plane, generally slightly curved or bent upward, the apical half slightly more compressed than the basal and narrowed by a considerable oblique excision of the inferior margin, the tip broadly rounded or subtruncate; subgenital plate roundly subpyramidal, the apical margin with moderate abruptness, somewhat elevated, thickened, and mesially notched distinctly.

Length of body, male, 25 mm., female, 28 mm.; antennae, male, 9 mm., female, 8.75 mm.; tegmina, male, 26.5 mm., female, 27.5 mm.; hind femora, male and female, 14 mm.

Two hundred and seventy-six males, 439 females. I refrain from giving in detail the localities from which I have seen specimens, both on account of their number and because, from the irregular distribution of the insect in different years, such details would have little value without dates, which are not always accessible; farther on, however, I give all that are of special interest.

The name of this species is to be credited to Mr. P. R. Uhler, who placed it in his collection thirty or more years ago and communicated it to various persons, who used it, sometimes in an incorrect form. The original specimens were received from Mr. Robert Kennicott, and were obtained by him from a migratory horde which settled in the then Red River settlements, now Winnipeg and vicinity, Manitoba. On Mr. Uhler's generous transfer of his collection to me, these specimens, with their history, came into my possession, and I now have them with his original labels. One has been placed in the National Museum.

It was thus known from the start as a migratory insect, and comparing it with any species of the genus one would at once be struck with the greater length of the tegmina and wings. These were measured by Riley; in forty-eight males the tegmina extended beyond the abdomen 5 to 10 mm., with an average of 7.6 mm.; in ninety-nine females they ranged from 3 to 10 mm. beyond the abdomen, the average 6.7 mm.

It is now well known as the "Rocky Mountain Locust" or destructive locust of the States in the western half of the Mississippi Valley. It has been more written about than any other American Orthopteron, and was specially discussed by the United States Entomological Commission, organized to devise methods of checking its ravages after a study of its natural history. It forms the almost exclusive subject of their first report, and occupies a considerable space in their second. Although a considerable body of the evidence adduced by them is contradictory and in part of doubtful application to this particular species, their conclusions are in very large measure well founded. As appears from a study of their work and other available material, the following conclusions may be fairly drawn:

(1) The home of the species is in favorable localities in the elevated region of the Rocky Mountains or immediately bordering it from the

South Saskatchewan to Wyoming, inclusive, and in the Rocky Mountain region proper in Colorado and Utah.

(2) In certain years, especially in dry seasons, between mid-July and mid-September, migratory hordes of incredible numbers and of both sexes pass from their natural breeding grounds to the east, southeast, and south, conveyed by the winds (toward which they head) over a greater or less and sometimes a vast extent of country from Lake Winnipeg to or almost to the Gulf of Mexico, rarely passing farther east than longitude 93°, and devastating the countries they reach to an alarming extent, sometimes in places absolutely destroying all standing crops and defoliating fruit trees.

(3) As they rise for flight from home only in dry clear weather (when the prevailing winds are from the north or northwest), they do not seriously invade the regions (mostly infertile) to the west of their home.

(4) The invaders extend or may extend their flights to a distance of at least 500 miles from their point of origin, but there is no clear evidence to show that (as claimed by the Commission) they extend it to double that distance.

(5) They deposit their eggs throughout the invaded territory, but their descendants therein of the succeeding year not only do not effect a tithe of the damage of the preceding year (although on the ground earlier), but when winged move about in swarms from place to place, their prevailing direction—at least during the earlier part of the season—being the reverse of that of their parents; but even when they alight and cover the ground they are far less harmful than were their invading parents.

(6) With few exceptions, movements on the wing are with or nearly with the wind, and are usually made in clear weather between 9 a. m. and 4 p. m., but they are sometimes certainly made at night.

(7) Relatively speaking, exceedingly few of the returning swarms ever reach the true home of the species. As a rule, they show signs of enfeeblement and deposit few eggs in the invaded region, so that their descendants on the invaded soil grow less and less numerous, and, in effect if not in fact, die out in the course of a very few, probably at most two or three, years.

I can add almost nothing to the facts given by the Entomological Commission. It may be worth while to state that in 1877 I took or noted this insect at the following points: July 11, between Idaho and Georgetown, Colorado, common, both mature and immature; July 12–13, Georgetown, Colorado, from 8,500 feet to above timber, mature and immature; July 16, Argentine Pass, Colorado, 13,000 feet, in abundance, from young just hatched to imagos, and masses of dead imagos under stones on the mountain crests; July 20, Laramie, Wyoming; July 21–31, Green River, Wyoming, plenty but not abundant and mostly mature; Alkali Station, north of Green River, Wyoming, 6,000 feet; August 1–4, Salt Lake Valley, mostly mature, very plenty everywhere

but particularly in the southern end of the valley; August 2-3, American Fork Canyon, Utah, 9,500 feet; August 6, Evanston, Wyoming, 6,800 feet, plenty; August 11-16, South Park, Colorado, 8,000 to 10,000 feet, everywhere, mature; August 13, Mount Lincoln, Colorado, 11,000 to 13,000 feet, crowds of nymphs and imagos, as well as masses of dead imagos under stones at summit; August 17-22, Florissant, Colorado, 8,000 feet; August 24, Pikes Peak, Colorado, 12,000 to 13,000 feet; August 24-25, Manitou, Colorado, 6,300 feet; August 26, Colorado Springs, Colorado, plenty; August 28-29, Garland, Colorado, 8,000 feet, plenty; August 29, Sierra Blanca, Colorado, below 10,000 feet, none seen above timber; August 30-31, Pueblo, Colorado, 4,700 feet, plenty; August 31, Animas, Colorado; September 1, Lakin, Kansas, plenty.

I have also seen specimens from the following localities, which have some special interest: Fort Hayes, Kansas, collected by J. A. Allen in June, 1871 (not heretofore reported in Kansas in this year); Preston, Texas, Captain Pope, May 15, 1854 (necessarily the progeny of an invading flight in a previous year, and none are recorded either in Texas or Arkansas between 1850 and 1853, inclusive); Ringgold Barracks, on the Lower Rio Grande, A. Schott, presumably also in the spring of 1854, when the Mexican Boundary Commission was at work there; Sonora, Mexico, A. Schott, and San Lorenzo, Chihuahua, Mexico, E. Palmer, showing that it reaches Mexico, and that too even as far west as Sonora. I have also a single specimen from California from Mr. H. Edwards, but it may have been taken in that part of the State east of the Sierra Nevada.

A tabular view of "locust years" for the different States will be found in the first report of the Commission, page 113.

This insect is normally single brooded; the eggs winter and the earliest (those in warm exposures) hatch in Texas from the middle to the last of March, and "continue to hatch most numerous about four days later with each degree of latitude north," so that in Montana and Manitoba it is from the middle of May to the first of June. This is in the temporary region; probably it is correspondingly later on the higher levels of the permanent breeding grounds. The young reach maturity in sixty to seventy-two days, to judge from those reared in confinement, and after a few days couple, the female beginning to lay eggs in about a fortnight thereafter. The eggs are laid in almost any kind of soil, but by preference in bare, sandy places, and in their permanent home they show a preference for the shaded base of shrubby plants; they are laid in a sort of pod, with a quadrilinear arrangement therein. Several pods may be laid by a single female, Mr. Riley having on three different occasions obtained two pods from single females in confinement, laid at intervals of eighteen, twenty-one, and twenty-six days, respectively.

The migratory instinct appears to be strongest within about three weeks from the time of attaining maturity, or shortly before and during

the season of oviposition. The return flights in the "temporary region" begin from the 5th to the 10th of May in latitude 35°, and about four days later with each degree farther north. Mr. Riley, from whose accounts these statements are drawn, gives a long list of plants and trees attacked by this locust and its preferences among them.¹

7. DEVASTATOR SERIES.

This group is composed of very closely related species, often difficult to distinguish, in which the male prozona is quadrate or subquadrate, and the immature markings on the lateral lobes of the pronotum, characteristic of the young of *Melanoplus*, occasionally persist in the adult and especially in the female; the interspace between the mesosternal lobes of the male is always longer than broad, varying from a little more than half as long again to a little more than twice as long as broad. The tegmina are always fully developed and generally maculate; the hind tibiae are variable in color, often within the species, and have from nine to thirteen spines in the outer series.

The supraanal plate is similar to that of the *femur-rubrum* series, but less constricted in the middle and shorter; the furcula consists of a pair of parallel or subparallel, tapering, tolerably long, generally flattened, acuminate fingers; the cerci are very simple, rather small, not reaching the tip of the supraanal plate, slender and subequal, tapering feebly in the basal half, equal beyond, bluntly rounded at tip, and a little incurved, generally slightly sulcate or dimpled apically on the outer side; the subgenital plate is broad, of subequal breadth, but slightly broader at base than at tip, apically elevated and the apical margin well rounded, thickened, and weakly notched.

The insects are of small or medium size, and the species, eight in number, are separable with difficulty. They are confined almost exclusively to California, a single one of them only occurring also a little beyond its boundaries in the neighboring regions. It is the characteristic group of the Pacific coast.

28. MELANOPLUS DIMINUTUS, new species.

(Plate XII, fig. 9.)

Dark brownish fuscous with a ferruginous tinge. Head somewhat prominent, brownish testaceous, more or less, generally profusely, dotted with fuscous, and a fuscous band behind the eyes; vertex rather tumid, somewhat elevated above the pronotum; interspace between the eyes not very broad, equal to (male) or slightly broader than (female) the first antennal joint; fastigium steeply declivent, deeply sulcate throughout; frontal costa fading out halfway between the ocellus and clypeus, distinctly contracted above, equal elsewhere and broader than (male) or as broad as (female) the interspace between the eyes, scarcely sulcate but with prominent margins, seriatly punctate at the sides;

¹ First report of the Entomological Commission, pages 251-252.

eyes large, prominent, especially in the male, much longer than the infraocular portion of the genae, broadly convex anteriorly; antennae about a half (male) or two-thirds (female) as long as the hind femora, dull castaneous. Pronotum feebly constricted in the middle, enlarging almost as much in front as behind, the front border truncate, the hind border somewhat obtusangulate, fusco-castaneous, profusely and rather coarsely punctate with fuscous above, the lateral lobes with a maculate piceous band on the upper part of the prozona, often divided obliquely, especially in the female, by a dull luteous stripe; median carina percurrent, sometimes feebler on the prozona and often subobsolete between the sulci, the disk passing by a rounded shoulder, more distinct on the metazona than on the prozona, into the slightly tumid lateral lobes; prozona quadrate (male) or feebly transverse (female), scarcely longer than the feebly punctate metazona. Prosternal spine not very long and moderately slender (male) or short and stout (female), appressed conical, blunt, erect; interspace between mesosternal lobes about half as long again as broad (male) or slightly longer than broad (female). Tegmina reaching the tips of the hind femora (male) or a little shorter than that, shorter than the abdomen (female), not very slender, tapering and narrowly rounded at tip, distinctly maculate in the discoidal area, especially in the female, brownish fuscous; wings moderately broad, pellucid, with glauco-fuscous veins. Hind femora dark testaceous with basal patch and oblique premedian and postmedian bars of blackish fuscous, dull red beneath, the genicular arc black, the lower genicular lobe pallid marked with fuscous; hind tibiae sordid glaucous, dull lutescent apically and basally, occasionally pale red, the spines black except at base, ten to eleven, usually eleven, in number in the outer series. Extremity of male abdomen clavate, a little elongate, well rounded, considerably upturned, the supraanal plate triangular with subrectangulate apex, the lateral margins basally rounded, broadly upturned, the percurrent median sulcus a mere slit between rather high compressed walls, with a pair of pronounced terminal ridges; furcula consisting of a pair of rather slender, depressed, tapering, acuminate, parallel fingers, reaching nearly to the middle of the supraanal plate; cerci small, slender, nearly straight and nearly equal, but basally tapering and apically a little inbent, rather stout, well rounded at apex, and with the inbent portion deeply dimpled exteriorly; subgenital plate rather broad, rather short, considerably and abruptly elevated apically, but not prolonged posteriorly, the apical margin subtruncate, distinctly notched.

Length of body, male 16 mm., female 17 mm.; antennae, male 6.25 mm., female 5 mm.; tegmina, male 12.5 mm., female 11 mm.; hind femora, male 9.5 mm., female 10 mm.

Five males, 9 females. San Francisco, California, November (U.S. N.M.—Riley collection); Marin County, California, August 8 (same); Monterey, California, October 19, next the seashore.

This is one of the smallest species of *Melanoplus*.

29. MELANOPLUS CONSANGUINEUS, new species.

(Plate XII, fig. 10.)

Dark ferrugineo-fuscous. Head slightly prominent, very dark testaceous, heavily infuscated above and sometimes flecked with fuscous on face and genae, a piceous band behind the eyes; vertex rather tumid, well raised above the pronotum, the interspace between the eyes rather narrow, about as wide as (male) or a little wider than (female) the first antennal joint; fastigium steeply declivent, broadly and rather deeply sulcate; frontal costa equal (female) or narrowed above (male), at its broadest considerably (male) or somewhat (female) broader than the interspace between the eyes, fading below, slightly sulcate at and below the ocellus, seriatly punctate on the sides; eyes as in *M. diminutus*; antennae dark castaneous, less than two-thirds as long as the hind femora, of about equal relative length in the two sexes. Pronotum subequal, enlarging a little on the metazona and feebly in front; front margin truncate, hind margin obtusangulate, the lateral lobes with a broad piceous belt across the prozona above, below which they are lighter than the disk; median carina distinct on the metazona, feeble on the prozona, and nearly obsolete between the sulci; lateral carinae marked only by a rounded shoulder more distinct on the metazona than on the prozona; prozona subquadrate, scarcely longer than the finely and not sharply punctate metazona. Prosternal spine erect and rather long, conico-cylindrical (male) or rather short, appressed conical (female); interspace between mesosternal lobes about half as long again as broad (male), or only a little longer than broad (female). Tegmina nearly reaching (male) or slightly surpassing (female) the tip of the hind femora, rather slender, tapering, strongly rounded apically, dark fuscous with tolerably distinct maculation in the discoidal area; wings not very broad, hyaline, with glauco-fuscous veins. Hind femora dull testaceous, marked as in *M. diminutus*, the hind tibiae glaucous, the spines pallid at base, black at tip, ten to eleven in number in the outer series. Extremity of male abdomen clavate, well upturned, the supraanal plate triangular, the lateral margins broadly elevated and at base well rounded, the median sulcus narrow and, except apically, deep, its bounding walls rather high and abrupt; furcula consisting of a pair of depressed, rather slender, tapering, acuminate, slightly divergent fingers, falling somewhat short of the middle of the supraanal plate; cerci small and slender, about four times as long as broad, nearly straight but gently incurved throughout, broadly rounded apically, subequal but tapering slightly on basal half, the apical third deeply sulcate exteriorly, the whole considerably shorter than the supraanal plate; subgenital plate moderately broad and short, the lateral margins somewhat abruptly and moderately elevated apically, but not prolonged posteriorly, the apical margin narrowly subtruncate and feebly emarginate.

Length of body, male, 16.5 mm., female, 22 mm.; antennae, male 6.25 mm., female, 7 mm.; tegmina, male, 11.5 mm., female, 16 mm.; hind femora, male, 10.5 mm., female, 11.5 mm.

One male, 1 female. Sacramento County, California (U.S.N.M.—Riley collection).

This species is closely related to the last, and with larger material may possibly prove the same.

30. MELANOPLUS SIERRANUS, new species.

(Plate XIII, fig. 1.)

Dark brownish fuscous, lighter beneath. Head fusco-olivaceous, punctate with fuscous, ferrugineo-testaceous above, with a postocular black stripe and the margins of the fastigium more or less marked with black; vertex very gently tumid, hardly elevated above the pronotum, the interspace between the eyes slightly wider than (male) or nearly twice as wide as (female) the first antennal joint; fastigium strongly declivent, heavily (male) or broadly and rather shallowly (female) sulcate; frontal costa subequal, feebly broader than the interspace between the eyes, percurrent, sulcate at and a little below the ocellus, sometimes to the base in the male, seriatly punctate laterally in black or fuscous; eyes moderately large, somewhat prominent in the male, distinctly longer than the infraocular portion of the genae; antennae rufotestaceous (male) or ferruginous (female), about four-fifths (male) or three-fifths (female) as long as the hind femora. Pronotum subequal, scarcely enlarging posteriorly, the disk nearly plane but feebly convex, passing by a well-rounded angle into the slightly tumid but vertical lateral lobes, the median carina distinct and sharp on the metazona, subobsolete on the prozona, the disk ferrugineo-testaceous, punctate with fuscous, especially in the female, the lateral lobes luteo-testaceous with a broad piceous band on the upper part of the prozona, in the female not infrequently broken in the middle by an oblique luteous stripe, and followed below on the posterior section of the prozona by a luteous patch; front border scarcely convex, hind border obtusangulate, the angle well rounded in the female; prozona quadrate or feebly longitudinal (male) or quadrate (female), slightly longer than the metazona. Prosternal spine feebly conical (male) or appressed conical (female), moderately long, rather slight, erect; interspace between mesosternal lobes fully twice as long as broad (male) or less than half as long again as broad (female). Tegmina reaching, occasionally slightly surpassing, the hind femora, moderately slender, feebly tapering, dark brownish fuscous, the discoidal area very feebly (male) or distinctly (female) maculate; wings moderately broad, hyaline, the veins and cross veins, except in the lower half of the anal area, blackish fuscous with a glaucous tinge. Hind femora fusco-ferruginous, the

outer face largely blackish fuscous, mesially interrupted narrowly with a very oblique luteo-testaceous cloud, giving it a broadly and very obliquely bifasciate appearance, intensified by the bifasciation of the upper surface and upper portion of the inner face; beneath luteo-rufescent or pale carmine; hind tibiae bright red, or less frequently greenish glaucous, with a subpatellar fuscous spot, the spines black except at base, ten to twelve in number in the outer series. Extremity of male abdomen feebly clavate, a little upturned, the supraanal plate triangular, acutangulate at tip, the sides full at base, throughout tilted upward, the median sulcus percurrent, deep, rather broad, the sharply tectate walls fading apically; furcula consisting of a pair of slight and delicate, divergent, acuminate fingers, not depressed, rarely reaching a third way across the supraanal plate; cerci rather small, hardly more than three times as long as broad, tapering gently in the basal half, beyond equal, and this portion bent a little inward and feebly sulcate externally, the apex well rounded; subgenital plate rather small, broad at base, apically as broad as long, the apical margin abruptly and slightly elevated but not prolonged, a little compressed and notched.

Length of body, male, 19.5 mm., female, 19 mm.; antennae, male, 8 mm., female, 6 mm.; tegmina, male, 13.5 mm., female, 12.5 mm.; hind femora, male, 10 mm., female, 10.5 mm.

Twenty-eight males, 23 females. Mountains near Lake Tahoe, Placer County, California, September, October, Henshaw, Wheeler's Expedition, 1876; Placer County, California, September (U.S.N.M.—Riley collection); Truckee, Nevada County, California, October 10.

31. *MELANOPLUS ATER*, new species.

(Plate XIII, fig. 2.)

Very dark brownish fuscous with a feeble ferruginous tinge. Head not prominent, dull fusco-olivaceous, delicately blotched with fuscous, above wholly fuscous, with a broad, piceous, postocular band; vertex gently tumid, feebly elevated above the pronotum, the interspace between the eyes slightly (male) or considerably (female) broader than the first antennal joint; fastigium very declivent, rather (female) or very (male) sulcate throughout; frontal costa hardly percurrent, especially in the male, a little contracted above, below broader than (male) or fully as broad as (female) the interspace between the eyes, shallowly sulcate at and, in the male, below the ocellus, punctate throughout; eyes moderately large, not very prominent, distinctly longer than the infraocular portion of the genae; antennae rufo-testaceous, in the male about two-thirds as long as the hind femora. Pronotum rather short, feebly expanding posteriorly, the lower part of the lateral lobes more or less tinged with luteous, the upper half of the prozona with an obscure fusco-piceous or fuscous band, the disk nearly plane but slightly tectate on the prozona, the median carina percurrent but

feebler on the prozona than on the metazona and more or less obsolete between the sulci, the disk passing into the lateral lobes by a well-rounded angle, becoming a tolerably distinct lateral carina on the metazona, the front margin subtruncate, the hind margin obtusangulate; prozona quadrate (male) or slightly transverse (female), scarcely if any longer than the finely punctate metazona. Prosternal spine short, erect, conico-cylindrical, feebly (male) or considerably (female) appressed, blunt; interspace between mesosternal lobes somewhat less than twice as long as broad (male) or feebly transverse (female). Tegmina dark brownish fuscous, almost equally opaque throughout, with distinct maculation in the discoidal field, reaching (male) or falling somewhat short of (female) the tips of the hind femora, not very slender, distinctly tapering, well rounded apically. Hind femora fusco-testaceous, rather obscurely and broadly fasciate with blackish fuscous, the inferior face ferruginous; hind tibiae obscure pale green, with an obscure fuscous basal annulus and often more or less flecked with fuscous, the spines black or brown with pallid base, ten to eleven in number in the outer series. Extremity of male abdomen clavate, somewhat upturned, the supraanal plate somewhat long triangular, with slightly convex and gently elevated lateral margins, a slightly produced acutangulate apex (its production not shown in the figure), a rather slender, not very deep, percurrent, median sulcus, with sharp but not high walls, and a pair of parallel, slight, short, apical ridges; furcula consisting of a pair of subparallel, flattened, tapering, acuminate fingers reaching nearly to the middle of the supraanal plate; cerci small and slender, subequal but mesially contracted laminae, nearly four times as long as broad, very faintly upcurved, apically a trifle incurved and well rounded, the external face distinctly punctate and apically feebly dimpled, with a very slight inward directed flange from the lower margin apically, the whole falling far short of the tip of the supraanal plate; infracercal plates rather broad and sulcate, but concealed by the recumbent cerci except apically, as they are a little larger than the supraanal plate; subgenital plate small, longer than broad, the apical margin transverse, somewhat elevated but not prolonged, thickened and distinctly notched.

Length of body, male, 18.75 mm., female, 19.5 mm.; antennae, male, 7 mm.; tegmina, male, 14.5 mm., female 13 mm.; hind femora, male, 10.5 mm., female, 12 mm.

Two males, 3 females. San Francisco, California, October. November (L. Bruner; S. H. Scudder).

This species is very closely related to the last, and with larger material may prove to be the same; but the anal cerci are faintly larger apically than mesially in the present form, while in *M. sierranus* they retain apically their mesial narrowness.

32. MELANOPLUS DEVASTATOR.

(Plate XIII, figs. 3-7.)

Melanoplus devastator SCUDDER! (pars), Proc. Bost. Soc. Nat. Hist., XIX (1878), pp. 285-286, 287-288; (pars), Entom. notes, VI (1878), pp. 46-47, 48-49; (pars), Rep. U. S. Ent. Comm., II (1880), App., p. 24, pl. XVII, figs. 2, 3, 19, 20.—? BRUNER, *ibid.*, III (1883), p. 60; ? Bull. Div. Ent. U. S. Dep. Agric., II, (1883), p. 11; ? *ibid.*, IV (1884), p. 58; (pars), Bull. Washb. Coll., I (1885), p. 138.—RILEY, Ent. Amer., I (1885), p. 177; Rep. U. S. Ent., 1885 (1886), pp. 229-232, pl. VIII, figs. 1-5 a-c.—COQUILLET, *ibid.*, 1885 (1886), pp. 291-295, 297.—? BRUNER, *ibid.*, 1885 (1886), pp. 306, 307.—COQUILLET, Ins. Life, I (1889), p. 227.—? RILEY, *ibid.*, II, (1889), p. 27.—BRUNER, Can. Ent., XXIII (1891), p. 193; Ins. Life, IV (1891), p. 21; Rep. Ent. Soc. Ont., XXII (1891), p. 48.—COQUILLET, Ins. Life, V (1892), pp. 22-23; Bull. Div. Ent. U. S. Dep. Agric., XXVII (1892), pp. 35-57.—BRUNER, *ibid.*, XXVIII (1893), pp. 22-24, figs. 10 a-d, 11 a-c; Rep. Nebr. St. Bd. Agric., 1893 (1893), p. 460, fig. 102; Rep. St. Hort. Soc. Nebr., 1894 (1894), pp. 163, 205, fig. 70; *ibid.*, 1895 (1895), p. 69.

Melanoplus affinis COQUILLET!, Ins. Life, I (1889), p. 227.

Caloptenus devastator RILEY, Bull. Div. Ent. U. S. Dep. Agric., XXV (1891), pp. 28-30, figs. 6 a-d, 7 a-c.—MILLIKEN, Ins. Life, VI (1893), p. 19.

Varying from dark brownish fuscous to ferrugineo-testaceous. Head feebly prominent, more or less livid testaceous, above darker, sometimes completely blackish fuscous, sometimes blackish fuscous in a median posterior stripe, and always with a fuscous or blackish postocular band; vertex somewhat tumid, especially in the male, raised well above the level of the pronotum, the interspace between the eyes moderate, fully as broad as (male) or much broader than (female) the first antennal joint; fastigium strongly declivent, deeply (male) or shallowly (female) sulcate throughout; frontal costa percurrent, rather broad, broader than (male) or as broad as (female) the interspace between the eyes, subequal but a little contracted at its upper extremity, feebly sulcate about the ocellus, punctate throughout, but especially laterally; eyes pretty large, not very prominent even in the male, distinctly longer than the infraocular portion of the genae; antennae about two-thirds (male) or but little more than half (female) as long as the hind femora, varying from luteous to ferruginous, often a little infuscated, especially apically. Pronotum feebly enlarging posteriorly, faintly constricted mesially, the lateral lobes a little lighter colored than the disk, except for the broad piceous band above, which extends across the prozona, occasionally a little broken; front margin faintly convex, hind margin a little obtus-angulate, the median carina distinct on the metazona only, subobsolete between the sulci; lateral carinae feebly indicated in the abrupt but rounded angle by which the disk passes into the lateral lobes; prozona quadrate or longitudinally subquadrate in both sexes, but little or no longer than the faintly punctate metazona. Prosternal spine not very long, moderately stout, cylindrical, blunt, erect, a little shorter and a little appressed in the female; interspace between mesosternal lobes much more than twice (male) or slightly (female) longer than

broad. Tegmina a little surpassing the hind femora, at least in the male, only moderately slender, tapering a little, well rounded apically, fuscous, generally very dark fuscous, the discoidal area maculate in a very variable degree, from a feeble indication only (in which case the whole surface of the tegmina is generally exceptionally dark) to a heavy and coarse or a pronounced, rather delicate and distant flecking; wings moderately broad, hyaline, with fuscous veins and cross veins more or less tinged with glaucous, and becoming wholly glaucous in the anal area. Hind femora dull testaceous, very obliquely and broadly bifasciate with blackish fuscous and with a basal patch of the same on the outer and upper faces, the lower face and lower half of the inner face red or reddish; hind tibiae either dark glaucous, or red, or luteo-glaucous, often more or less infuscated in threads basally, generally deepening there in color, and when deepest often with a narrow, pale, subbasal annulus; the spines black, except their pallid base, ten to eleven, rarely twelve, in number in the outer series. Extremity of male abdomen oblong clavate, considerably upturned, the supraanal plate triangular, with subrectangulate apex, convex and broadly upturned lateral margins, a deep and narrow, percurrent, median sulcus, bounded by high walls, and a pair of slight and short apical ridges; furcula consisting of a pair of parallel, flattened, rather slight, tapering, acuminate fingers, hardly reaching a third way across the supraanal plate; cerci small, slender, subequal but feebly tapering in basal half, very feebly upcurved and as feebly incurved, about four times as long as broad, the apical third or less externally excavate, the tip well rounded, the whole much shorter than the supraanal plate; subgenital plate moderately broad at base, longer than broad, the apical margin considerably and rather abruptly elevated, but not prolonged, and slightly notched mesially.

Length of body, male, 21 mm., female, 24 mm.; antennae, male, 7.75 mm., female, 6.25 mm.; tegmina, male, 16.5 mm., female, 16 mm.; hind femora, male, 11.75 mm., female, 12 mm.

Eighty-two males, 58 females. Wenas, Yakima County, Washington (Museum Comparative Zoology); California (L. Bruner); California. H. Edwards; California, Ricksecker (S. Henshaw); Siskiyou County, California (U.S.N.M.—Riley collection); Sissons, Siskiyou County, California, Packard; Fort Redding, Shasta County, California, Lieutenant Williamson; Tehama County, California (U.S.N.M.—Riley collection); Lakeport, Lake County, California, Crotch; Sierra Valley, Sierra County, California, Lemmon, August (U.S.N.M.—Riley collection); Placer County, California, August, September (same); Colfax, Placer County, California, October 11; Clarkson, Eldorado County, California, July 14 (U.S.N.M.—Riley collection); Calaveras County, California (same); Marble Valley and White Rock, Amador County, California, July 14, 15 (same); Sacramento County, Coquillett (same); Folsom, Sacramento County, California, July 3 (same); Natoma, Sacramento

County, July 2 (same); Marin County, California, August (same); Sauzalito, Marin County, California, Behrens; San Francisco, California, September, October 15, November (U.S.N.M.—Riley collection; S. H. Scudder; Museum Comparative Zoology); Alameda, California, December 15 (U.S.N.M.—Riley collection); Merced County, California (same); Atwater, Merced County, California, July 29, Coquillett (same); Los Angeles, California, June, August, in coitu September 20, Coquillett, October 24 (same; S. H. Scudder); Pasadena, Los Angeles County, California, October 23; Tighes, San Diego County, California, Palmer; Southern California, Coquillett (U.S.N.M.—Riley collection).

The species has also been reported from various other counties in California, mostly in the central portions of the State, such as Fresno, Yuba, Napa (Riley), Sutter, San Joaquin (Coquillett), and Lake Tahoe, Placer County (Scudder), as well as from districts immediately adjoining California, as the adjacent parts of Oregon (Bruner), Reno, Washoe County, and Glen Brook, Douglas County, Nevada (Scudder), and Arizona (Bruner).

It has also been stated to occur in Colorado (Scudder), Kansas, North Dakota, northwest Wyoming, and Montana (Bruner), Idaho (Bruner, Milliken), and in Utah in the Salt Lake Valley (Scudder) and Nephi, Juab County (Riley); but certainly in some, and probably in all these cases, the insect reported was mistakenly supposed to be this species.

Coquillett describes a dipterous parasite, *Sarcophaga opifera*, as found in this species, and gives in the Twenty-seventh Bulletin of the Entomological Bureau at Washington a full account of the ravages of this locust in California, where they appear to do most damage to vineyards and to deciduous fruit trees, the latter of which always suffer the most in the vicinity of grain fields, upon which the migrating swarms appear always to descend, attracted, perhaps, by their color. Grain, however, appears to suffer relatively little at their hands, though alfalfa proves attractive.

A description of the colors of the living young, by Mr. Coquillett, will be found in the report of the United States Entomologist for 1885, page 293.

The species is an exceedingly variable one, and with limited material it would be difficult to believe that there was but a single species, so widely different is the appearance of the extremes. This, I suspect, will prove partly dependent upon station, though the different forms into which I would provisionally separate the species appear to be found indifferently in almost all parts of the State, though, as far as the collections before me show, all appear to be more abundant in the central and northern portions.

There is first the dark and rather small form, which is prevalent about San Francisco, and which may be called *M. d. obscurus* (Plate XIII, figs. 3, 4). It is also found in Sierra, Placer, Marin, Sacramento, Eldorado, and Alameda counties, as well as in Siskiyou County, in the

north, and Los Angeles County, in the south. The typical forms are very dark, having tegmina surpassing but little the hind femora, with meager maculation of the discoidal area, rarely at all cinereous in the basal half; the hind tibiae are variable in color.

A second form, which appears to be the widest spread, occurring in nearly every county in which the species has been found, from Shasta to San Diego and from Marin to Sierra, is of a decidedly cinereous aspect, with abundant and generally rather confused maculation in the discoidal area of the tegmina, which usually much surpass the hind femora; the hind tibiae are variable, but rarely glaucous. This form best represents the original types of the species when first described, and being also the most common may bear the name *M. d. typicalis* (Plate XIII, fig. 5). It is of medium size.

The third form is also of medium size and is very closely related to the last, and often hardly distinguishable. It may be called *M. d. affinis*¹ (Plate XIII, fig. 6). It differs principally by its shorter tegmina, which rarely surpass the hind femora, and which are very sharply maculate, with well-defined spots, and the hind tibiae are usually glaucous, occasionally luteous. I have seen specimens from Sierra, Sacramento, and Los Angeles counties.

The fourth form is by far the largest and the most heavily marked of all, besides being of a rather light tint, in which the dark maculations appear with the greater distinctness, and it may accordingly be known as *M. d. conspicuus* (Plate XIII, fig. 7). It appears much like an exaggerated form of the last-mentioned type, and has a more prominent head, much longer tegmina, which well surpass the hind femora, and ample wings, so that I suspect the migrating flights will be found to be composed mainly or exclusively of this form; the pronotum is unusually clear of lateral markings, and the hind tibiae are pale glaucous. It has not been found south of the center of the State (nor have any migratory hordes been reported there), and indeed only in the central portions and the elevated districts, namely, in Sacramento, Eldorado, Amador, and Merced counties.

33. MELANOPLUS VIRGATUS, new species.

(Plate XIII, fig. 8.)

Melanoplus devastator SCUDDER! (pars), Proc. Bost. Soc. Nat. Hist., XIX (1878), pp. 285-286, 287-288; (pars), Entom. Notes, VI (1878), pp. 46-47, 48-49.

Pezotettix virgatus McNEILL!, MS.

Light testaceo-fuscous, more or less ferruginous above. Head moderately large and rather prominent luteo-testaceous, clouded with fuscous, above much infuscated, especially along the middle line posteriorly, and with a postocular piceous band sharply delimited below

¹ The form supposed by Coquillett (see synonymy) to be Bruner's *M. affinis* is not this, but *M. d. typicalis*.

by luteous; vertex rather tumid, considerably elevated above the pronotum, the interspace between the eyes fully as broad as (male) or considerably broader than (female) the first antennal joint; fastigium steeply declivent, rather shallowly sulcate even in the male; frontal costa hardly reaching the clypeus, slightly narrowed above to meet the fastigium, otherwise subequal, broad, slightly broader than the interspace between the eyes, feebly sulcate or depressed at the ocellus, punctate, seriatly at the sides above; eyes moderately large, not very prominent, distinctly longer than the infraocular portion of the genae; antennae luteous, apically becoming slightly ferruginous or fuscous, more than two-thirds (male) or about three-fifths (female) as long as the hind femora. Pronotum very feebly flaring anteriorly to receive the head, somewhat enlarging posteriorly, the disk passing by a blunt angle into the lateral lobes, the former brownish fuscous, more or less distinctly ferruginous, the latter passing from luteo-testaceous below to fuscous above, the prozona with a broad piceous band which is obliquely cut by a distinct, posteriorly narrowing, sometimes feebly arcuate, luteous stripe, which connects with the luteous field just below the postocular band of the head, a feature more prominent in the female than in the male; median carina percurrent, often black, hardly less distinct on the prozona than on the metazona; front margin feebly convex, often with a slight median emargination; hind margin obtusangulate, often nearly rectangulate; prozona slightly longitudinal (male) or quadrate (female), distinctly (male) or hardly (female) longer than the closely punctate metazona. Prosternal spine moderately long, cylindrical, feebly appressed, very blunt (male) or short, conical, appressed, blunt (female), erect; interspace between mesosternal lobes more than twice (male) or only a little (female) longer than broad. Tegmina surpassing more or less, generally considerably, the hind femora, moderately slender, distinctly tapering, brownish fuscous, with distinct quadrate black maculation in the discoidal area. Hind femora testaceous, sometimes tinged with ferruginous, broadly and obliquely bifasciate with blackish fuscous, with a basal patch of the same, the under surface luteous, sometimes faintly flushed with orange; hind tibiae very pale green, becoming more or less pallid or luteous at either extremity, the spines black, except basally, nine to twelve, usually ten to eleven, in number in the outer series. Extremity of male abdomen elongate-clavate, a little upturned, the supraanal plate long triangular, with lateral margins full at the base and scarcely elevated, acutangulate apex, and slender, rather shallow, median sulcus, bounded by rather slight but distinct walls; furcula consisting of a pair of slender, flattened, parallel fingers, subequal in basal half, beyond much narrowed and acuminate, reaching almost to the middle of the supraanal plate; cerci slender, slight, tapering feebly in basal half, about four times as long as broad, apically well rounded, very feebly incurved, hardly upcurved, the outer surface punctate and

apically dimpled, with a slight, inferior, indirected flange to the lower margin apically, the whole much shorter than the supraanal plate; infracercal plates extending noticeably beyond the supraanal plate and so exposed beyond the tips of the cerci to a considerable degree; subgenital plate longer than broad, broad and rectangulate at base, apically elevated but not prolonged, the apical border thickened and emarginate.

Length of body, male, 20.5 mm., female 22.5 mm.; antennae, male, 8.5 mm., female, 8 mm.; tegmina, male, 17 mm., female, 17.5 mm.; hind femora, male, 11.5 mm., female, 13 mm.

Eleven males, 12 females. California, H. Edwards; Siskiyou County, California, July (U.S.N.M.—Riley collection); Fort Redding, Shasta County, California, Lieutenant Williamson; Butte County, California (U.S.N.M.—Riley collection); Sierra Valley, Sierra County, California, J. G. Lemmon (same); Sacramento County, California, Coquillett (same; J. McNeill).

34. MELANOPLUS UNIFORMIS, new species.

(Plate XIII, fig. 9.)

Melanoplus devastator SCUDDER! (pars), Proc. Bost. Soc. Nat. Hist., XIX (1878), pp. 285-286, 287-288; (pars), Entom. Notes, VI (1878), pp. 46-47, 48-49.

Light and nearly uniform testaceous, more or less feebly tinged above with ferruginous. Head somewhat prominent, particularly in the male, pallid testaceous, darker above, with occasionally a feeble postocular fuscous line at the upper limit of the normal Melanoplan postocular band; vertex tumid, well elevated above the pronotum, the interspace between the eyes rather broad, half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium strongly declivent, sulcate throughout, more deeply and narrowly in the male than in the female; frontal costa broad, subequal, scarcely attaining the clypeus, fully as broad as the interspace between the eyes, feebly impressed about the ocellus, punctate throughout; eyes large, rather prominent, much larger than the infraocular portion of the genae; antennae luteous, growing slightly fulvous apically, nearly two-thirds (male) or scarcely more than half (female) as long as the hind femora. Pronotum feebly enlarged posteriorly, the lateral lobes slightly paler than the disk, and rarely with a few faint dusker streaks in the place of the postocular band, the disk passing into the lateral lobes by a rounded shoulder, which almost develops into a lateral carina on the metazona; median carina slight, percurrent, only slightly feebler on the prozona than on the metazona; front margin subtruncate, hind margin obtusangulate; prozona quadrate (male) or slightly transverse (female), scarcely or not longer than the closely and finely punctate metazona. Prosternal spine not very long, conico-cylindrical, appressed, blunt, blunter in the female than in the male, slightly retrorse; interspace between mesosternal

lobes nearly or quite twice as long as broad in both sexes. Tegmina uniform light yellowish testaceous, with no sign of maculation, although rarely a little beclouded, reaching somewhat, generally far, beyond the hind femora, rather slender, feebly tapering, well rounded at tip; wings pellucid, the veins and cross-veins sometimes wholly green, sometimes partly fuscous. Hind femora testaceous, generally feebly infuscated in the incisures of the outer face above, the inner half of the upper face often bimaculate with fuscous, the under surface with a tendency to become roseate, the genicular arc black; hind tibiae very pale dingy green, growing lutescent apically, the spines black with pallid base, ten to twelve, usually eleven, in number in the outer series. Extremity of male abdomen clavate, a little upturned, the supraanal plate subclypate, with sinuate sides and rectangulate apex, with a short, shallow, median sulcus and feebly elevated sides, the whole surface nearly plane; furcula consisting of a pair of moderately broad, flattened, tapering, acuminate fingers, parallel or slightly divergent, reaching about to the middle of the supraanal plate; cerci slender, subequal but basally tapering, feebly incurved laminae, about five times as long as broad, feebly arcuate and apically well rounded, with a slight, inferior, indirected flange to the lower margin apically, the whole much shorter than the supraanal plate; infracercal plates as in the last species; subgenital plate about as broad as long, the lateral margin arcuate, being produced both basally and apically, but especially the latter, the apical margin rounded subquadrate, very feebly or not at all emarginate, though thickened on either side of the middle.

Length of body, male, 25 mm., female, 22.75 mm.; antennae, male, 8.5 mm., female, 6.25 mm.; tegmina, male, 21.5 mm., female, 18.5 mm.; hind femora, male, 13.25 mm., female, 12 mm.

Nine males, 8 females. Fort Redding, Shasta County, California, Lieutenant Williamson; Yuba County, California (U.S.N.M.—Riley collection); Sacramento County, California, Coquillett (same); Folsom, Sacramento County, California, July 4 (same); Merced County, California (same).

35. *MELANOPLUS ANGELICUS*, new species.

(Plate XIII, fig. 10.)

Of rather large size, dark brownish fuscous, more or less ferruginous. Head not very prominent, plumbeous or ferruginous, more or less infuscated, above hardly darker but perhaps with more fuscous patches, a postocular piceous band; vertex gently tumid, but little elevated above the pronotum, the interspace between the eyes rather broad, somewhat broader than the first antennal joint; fastigium strongly declivent, deeply sulcate throughout; frontal costa broad, feebly constricted above, percurrent, slightly broader than the interspace between the eyes, gently sulcate at and below the ocellus, punctate above seriatly

at the sides; eyes large, not very prominent, distinctly longer than the infraocular portion of the genae; antennae fulvo-testaceous, about two-thirds as long as the hind femora (male). Pronotum subequal, feebly enlarging posteriorly, the median carina distinct throughout, though the feebler on the prozona, the lateral carinae forming a tolerably distinct angle, especially on the metazona, the disk darker than the lateral lobes, but the latter having a clouded piceous band on the prozona, much broken by luteous or ferruginous, and distinct only in the impressed portions; front margin faintly convex, hind margin obtus-angulate, nearly rectangulate; prozona quadrate, no longer than the closely punctate metazona. Prosternal spine short, appressed, conico-cylindrical, blunt, erect, stout; interspace between mesosternal lobes a little more than twice as long as broad (male). Tegmina greyish fuscous, very feebly and very sparsely sprinkled with fuscous dots in the discoidal field, considerably surpassing the hind femora, moderately slender, subequal, well rounded at tip; wings pellucid, with greenish fuscous veins. Hind femora dull testaceous, broadly, obliquely, and more or less distinctly bifasciate with dark olivaceo-fuscous, the under surface more or less ruddy; hind tibiae pale obscure glaucous, the spines black and pallid, ten to thirteen, generally eleven, in number in the outer series. Extremity of male abdomen a little clavate, a little upturned, the supraanal plate long triangular, with acutangulate apex and slightly convex sides, the surface nearly flat, a moderately narrow, percurrent, median sulcus marked by the elevation of its not very sharp nor high walls; furcula consisting of a pair of parallel, flattened, not very broad, rather rapidly tapering, subacuminate fingers, hardly surpassing the basal third of the supraanal plate; cerci small, slender, feebly upcurved, gently incurved, equal except for the slight basal enlargement, well rounded at apex, distinctly less than four times as long as broad, and much shorter than the supraanal plate; infracercal plates as in the preceding species; subgenital plate broad and short, apically elevated abruptly and considerably but not prolonged, the apical margin transverse, thickened, and notched.

Length of body, male, 23.5 mm.; antennae, 9 mm.; tegmina, 20.5 mm.; hind femora, 14 mm.

Two males. Los Angeles, California, Coquillett (U.S.N.M.—Riley collection).

8. IMPUDICUS SERIES.

This group is composed of a single species of medium size, and is more nearly related to the next group than to any other. The prozona is slightly longitudinal in the male. The interspace between the mesosternal lobes in the same sex is nearly half as long again as broad and the metasternal lobes are only approximate. The tegmina are fully developed and surpass the hind femora. The hind tibiae are red and have eleven to thirteen spines in the outer series.

The supraanal plate is regularly triangular with straight sides and acutangulate apex, the surface entirely in the same plane from base to apex, i. e., with no apical depression. The furcula in the single known species is reduced to a pair of very slight rather distant spines, no longer than the last dorsal segment. The cerci taper considerably at base, but more by excision of the lower than of the upper margin, and beyond the middle are subequal, hardly in the least incurved, and apically angulate. The subgenital plate is of equal breadth throughout and terminates in a postmarginal blunt tubercle above, the apical margin being abbreviated, rounded, and entire.

The single species occurs in the Southern States, east of the Mississippi.

36. MELANOPLUS IMPUDICUS, new species.

(Plate XIV, fig. 1.)

Of medium size, brownish fuscous, with a decided ferruginous tinge. Head moderately prominent, testaceous or ferrugineo-testaceous, dotted above with fuscous, the dots mesially forming a stripe, and with a distinct postocular piceous band; vertex rather tumid, distinctly elevated above the pronotum, the interspace between the eyes as broad (male) or fully half as broad again (female) as the first antennal joint; fastigium steeply declivent, feebly (male) or very feebly (female) sulcate; face more than usually retreating, the frontal costa failing to reach the clypeus, equal, as broad (male) or almost as broad (female) as the interspace between the eyes, sulcate excepting above where it is biserially punctate; eyes not very prominent, rather large, distinctly longer than the infraocular portion of the genae; antennae ferruginous, less than two-thirds (male) or about three-fifths (female) as long as the hind femora. Pronotum subequal, expanding a little on the metazona, the disk ferrugineo-luteous flecked with fuscous, very feebly convex, passing by a rounded shoulder nowhere forming lateral carinae into the anteriorly tumid vertical lateral lobes, which are of the color of the face, with a broad piceous postocular stripe across the prozona; median carina distinct on the metazona, feeble and in the female subobsolete on the prozona; front margin truncate; hind margin obtusangulate; prozona feebly longitudinal (male) or distinctly transverse (female), a little (male) or no (female) longer than the delicately punctate metazona. Prosternal spine rather long (male) or rather short (female), conical, rather blunt, suberect; interspace between mesosternal lobes nearly half as long again as broad in both sexes, the metasternal lobes approximate (male) or somewhat approximate (female). Tegmina surpassing a little (male) or considerably (female) the hind femora, moderately broad, tapering (more rapidly in the male than in the female), brownish fuscous, the discoidal area lighter at least on the basal half, and flecked throughout with tolerably large, more or less rounded, dark fuscous spots; wings rather broad, hyaline at base, beyond infumated

either apically (female) or over the whole apical half (male), the veins in the infumated area blackish fuscous. Fore and middle femora somewhat tumid in the male; hind femora ferruginous or ferrugineo-testaceous, obliquely bifasciate with blackish fuscous excepting below, the under face lighter or deeper orange, the whole geniculation infuscated; hind tibiae bright red, the spines black excepting at base, eleven to thirteen in the outer series. Extremity of male abdomen a little clavate, slightly recurved, the supraanal plate triangular with straight, scarcely and narrowly elevated margins, acutangulate apex, the median sulcus confined to the basal half, tapering, narrow, and very deep, between high and sharp walls, which unite in the middle of the plate; furcula consisting of a pair of slight, brief, parallel, moderately distant spines lying upon the bases of the ridges of the supraanal plate; cerci small compressed laminae, tapering rapidly in the basal half and more rapidly beneath than above, beyond equal and about half as broad as extreme base, apically rounded angulate, nowhere incurved, scarcely so long as the supraanal plate; infracereal plates very broad at base, extending far outside the cerci, rapidly narrowing with straight margins, distinctly shorter than the supraanal plate; subgenital plate small, subequal or broader apically than basally, hardly longer than broad, bluntly subconical, terminating in a very blunt, heavy tubercle, which lies beyond the well rounded, scarcely elevated, entire, apical margin.

Length of body, male, 18.5 mm., female, 22.5 mm.; antennae, male and female, 8 mm.; tegmina, male, 16 mm., female, 20 mm.; hind femora, male, 11.5 mm., female, 13.5 mm.

One male, 2 females. Georgia, Morrison (S. H. Scudder; S. Henshaw); Monticello, Lawrence County, Mississippi, Miss Helen Jennison.

9. ARIDUS SERIES.

In this group the antennae of the male are exceptionally long and the prozona is distinctly longitudinal. The interspace between the mesosternal lobes in the same sex varies from subquadrate to half as long again as broad, while in the female it varies from distinctly transverse to much longer than broad. The pronotum is posteriorly truncate or subtruncate, usually broadly emarginate. The tegmina are not only abbreviate but rarely as long as the pronotum, lateral and distant. The hind femora are long, and the hind tibiae light colored, with eight to twelve, generally about ten, spines in the outer series.

The supraanal plate of the male is triangular and rather simple; the last dorsal segment is obliquely and deeply sulcate on either side of the base of the furcula, which consists of a pair of very slender parallel fingers or spines of variable length, but never very long; the cerci rapidly narrow at the base to a long and exceedingly slender incurved blade, hardly as long as the supraanal plate, and narrower by far than

the frontal costa; the subgenital plate is small and subconical or subpyramidal, the margins lying in one plane and entire.

Three species are known, two in Arizona, and one from near the margin of the tropics in western Mexico and Lower California. They are rather above the medium and may be of large size.

37. MELANOPLUS HUMPHREYSII.

Pezotettix humphreysii THOMAS! (pars), Rep. Geogr. Expl. 100th mer., V (1875), p. 890.—SCUDDER! (pars), Proc. Bost. Soc. Nat. Hist., XX, 1879, p. 85; (pars), Cent. Orth. (1879), p. 74.

The only specimen seen has been in alcohol and the colors are more or less bleached; it is brownish testaceous, marked with black. Head large, somewhat protuberant, without markings except a slender black line behind the eye; vertex somewhat tumid and a little elevated above the pronotum, sharply punctate except in a posteriorly broadening mesial band which was probably darker colored, the interspace between the eyes much broader (a little distorted in the specimen) than the first antennal joint; fastigium rather steeply declivent, rather narrow, sulcate, biserially punctate; frontal costa rather prominent above, fading before the clypeus, much broader than the interspace between the eyes, equal, shallowly sulcate excepting above, sparsely punctate; eyes of moderate size, not prominent, about as long as the infraocular portion of the genae; antennae testaceous, apically infuscated, less than two-thirds (female) as long as the hind femora. Pronotum very regularly and feebly enlarging posteriorly, the upper half of the lateral lobes of the prozona with a very large, posteriorly narrowing, piceous patch, nearly split in two subequal portions by a wedge of the basal color extending obliquely upward from the lower anterior corner, and narrowly edged above on the disk by a pallid tint; disk transversely convex, passing by a very rounded and scarcely perceptible angle into the very steeply declivent and inferiorly vertical lateral lobes, with no lateral carinae; median carina percurrent, feeble on the metazona, coarse and rather prominent on the prozona; front margin truncate but feebly and narrowly flaring; hind margin roundly, broadly and feebly emarginate; disk of prozona very coarsely punctate, quadrate, fully a third as long again as the strongly transverse, finely punctate metazona. Prosternal spine short, conical, blunt; interspace between mesosternal lobes (female) distinctly transverse, narrower than the lobes. Tegmina abbreviate, shorter than the pronotum, lateral, widely separated, enlarging from the base to the middle, beyond equal, apically rounded, several times longer than broad, black on ground with testaceous veins. Hind femora brownish testaceous on upper half, its lower limit infuscated on the outer face, pallid on lower half, the genicular are black; hind tibiae pale testaceous, the spines black tipped, nine to ten in number in the outer series. Supraanal plate of male "bicarinately longitudinally"; cerci "flat and enlarged at the base and apex, the apical

portion being somewhat broader than the basal portion; the anterior apical angle is rounded, while the posterior one is somewhat acute, dentiform;" subgenital plate "slightly elongate and cone-shaped" (Quotations from Thomas).

Length of body, female, 26 mm.; antennae, 11 mm. (est.); tegmina, 5 mm.; hind femora, 18 mm.

One female. Arizona, G. W. Dunn (L. Bruner). It was originally described from southern Arizona.

I have here adhered to my original limitation¹ of Thomas's species, although I was mistaken in supposing that the male I then had before me was one of those used by him in his description, since he describes the cerci as enlarged at the extremity, which they certainly were not in the one then in my hands. Thomas's originals, so far as now preserved in the National Museum, all belong to my *Mel. aridus*, but fortunately a specimen in Professor Bruner's collection, although it is only a female, enables me to fix the species. It may be separated from *Mel. aridus* by the character which Thomas describes thus: "Posterior margin [of pronotum] truncate on the back [i. e., disk], or curved slightly forward" [i. e., emarginate], the posterior margin in *Mel. aridus* being distinctly obtusangulate, though subtruncate.

38. MELANOPLUS NITIDUS, new species.

(Plate XIV, fig. 2.)

Pezotettix humphreysii SCUDDER! (pars), Proc. Bost. Soc. Nat. Hist., XX (1879), p. 85; (pars), Cent. Orth. (1879), p. 74.

Pale brown suffused with flavous and marked with black. Head not prominent, or in the male scarcely prominent, pale flavo-testaceous heavily mottled with brown, above almost wholly brown, with a broad postocular piceous band margined with flavous (these markings not seen in the female); vertex tumid, distinctly elevated above the pronotum (male) or feebly tumid, not thus elevated (female), the interspace between the eyes nearly half as broad again as the first antennal joint; fastigium rather strongly declivent, deeply (male) or feebly (female) sulcate; frontal costa subequal, but slightly expanded at the ocellus, where it is equal to (male) or broader than (female) the interspace between the eyes, sulcate distinctly and throughout (male) or feebly and at and a little below the ocellus (female); eyes rather large and rather prominent especially in the male, elongate, very much longer than the infraocular portion of the genae; antennae flavous, a little shorter than (male) or about two-thirds as long as (female) the hind femora. Pronotum subequal on the prozona, expanding on the metazona, nearly uniform in coloring except for a large flavous-margined, piceous, postocular patch crossing the prozona, more or less broken and irregular in the female; disk pretty strongly convex, passing almost insensibly into the lateral lobes with no trace of lateral carinae, though the position of these

¹ Proc. Bost. Soc. Nat. Hist., XX, p. 85.

marked on the prozona by the flavous stripe bordering the piceous patch; median carina percurrent, dull and heavy, more pronounced on the prozona than on the metazona; front margin subtruncate, feebly and narrowly flaring in the male, hind margin broadly and roundly but not deeply emarginate; prozona punctate next the front margin, distinctly longitudinal (male) or quadrate (female), mesially twice as long (male) or fully half as long again (female) as the finely punctate metazona. Prosternal spine appressed conical and slightly retrorse (male) or erect, conical (female), rather long and slender; interspace between mesosternal lobes transversely subquadrate (male) or a little transverse (female), the metasternal lobes subattingent (male) or somewhat approximate (female). Tegmina about as long as the prozona, elliptical, about three times as long as broad, broadly rounded at tip, lateral, widely distant, black with testaceous veins. Fore and middle femora somewhat enlarged especially in depth in the male; hind femora flavous, more or less longitudinally infuscated or ferruginous, especially on or next the carinae, the genicular arc piceous, the lower genicular lobe wholly pallid; hind tibiae pale dull flavous, delicately mottled with ferruginous, the spines black excepting at base, eight (female) or ten (male) in number in the outer series. Abdomen feebly carinate, nearly uniform in color, the extremity subclavate in the male, a little recurved, the supraanal plate triangular, roundly acutangulate at tip, the surface vaulted, with a large subbasal rounded basin taking the place of the usual median sulcus, and into which falls the furcula, consisting of a pair of very slender, parallel and adjacent, subequal, cylindrical fingers, extending less than a third the distance across the plate; cerci slender, gradually incurved but otherwise straight, compressed blades, tapering at the very base, but beyond subequal, rounded at tip, considerably shorter than the supraanal plate; subgenital plate small, subpyramidal, of about equal breadth and length, the margin apically angulate, entire. Length of body, male, 17.5 mm., female, 31.5 mm.; antennae, male and female, 11 mm.; tegmina, male, 3 mm., female, 5 mm.; hind femora, male, 12 mm., female, 17 mm.

One male, 1 female. Tepic, Jalisco, Mexico, November, Coll. Calif. Acad. Sc. (L. Bruner); Cape St. Lucas, Lower California (?), J. Xantus.

The female, collected by Xantus (presumably at Cape St. Lucas), is the one referred to by me in my original description of *M. aridus* as belonging to that species, but it differs from it (and agrees with *M. humphreysii*) in the emargination of the posterior border of the pronotum, and differs from both in the greater robustness of the body, especially in the metathoracic region. It is quite possible that the male and female here brought together do not properly belong to one species; there is great disparity in size and, as the description shows, some unusual disagreements between sexes of the same species; but they certainly belong in close proximity, even if distinct; if they should prove distinct, the name should be retained for the male, from which the description (especially in colors) has principally been drawn.

39. MELANOPLUS ARIDUS.

(Plate XIV, fig. 3.)

Pezotettix humphreysii THOMAS! (pars), Rep. Geogr. Expl. 100th mer., V (1875), p. 890, pl. XLV, figs. 1, 2.

Pezotettix aridus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 84-85; Cent. Orth. (1879), pp. 73-74.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Brownish flavous, inclining to flavous below, marked with black. Head slightly prominent especially in the male, more or less embrowned, with a narrow mesial black stripe on summit and a broad postocular piceous band; vertex rather tumid, distinctly elevated above the pronotum, the interspace between the eyes slightly narrower (male) or slightly broader (female) than the first antennal joint; fastigium steeply declivent, sulcate, narrow, considerably expanding in front, the bounding walls stout, rounded; frontal costa moderate, nearly equal, contracted slightly just below the ocellus, above flat, below the ocellus a little sulcate, rather broader than the interspace between the eyes; eyes rather prominent especially in the male, as long as (female) or distinctly longer than (male) the infraocular portion of the genae; antennae flavo-testaceous, about five-sixths (male) or two-thirds (female) as long as the hind femora. Pronotum simple, expanding a very little posteriorly, the prozona slightly swollen on the upper part of the lateral lobes, into which the disk passes insensibly; there is a broad black band at the upper limit of the lateral lobes of the prozona, which either narrows on the metazona so as only to edge the lower side of the position of the lateral carinae, or, if of equal width with the preceding portion, is enlivened by a yellow stripe passing longitudinally through the middle, a continuation of the black bordered yellowish stripe on the metathoracic epipleura; occasionally the band is wholly obsolete on the metazona; in the middle of the portion of the band on the prozona is also a roundish or oblique pyriform yellowish spot; median carina distinct, equal, but low and rounded; front margin truncate, hind margin gently convex, subangulate; prozona obscurely and sparsely punctate, distinctly (male) or very feebly (female) longitudinal, a third (male) or a fourth (female) longer than the finely and clearly punctate metazona. Prosternal spine not very long, conical, blunt-tipped, suberect; interspace between mesosternal lobes fully (male) or nearly (female) half as long again as broad. Tegmina abbreviate, shorter or at least no longer than the pronotum, rounded ovate, about twice as long as broad, the costal and inner margins about equally convex, the extremity truncate and broadly rounded, not in the least produced, dark brownish fuscous, clouded with olivaceous. Fore and middle femora very gently tumid in the male; hind femora dull olivaceo flavous, the outer face more or

less infuscated, the upper face indistinctly bimaculate with fuscous, the whole geniculation excepting the lower lobe beyond its base blackish; hind tibiae glaucous (pale yellowish in alcoholic specimens), the spines black to their base, or excepting the extreme base, ten to eleven, rarely twelve, in number in the outer series. Extremity of male abdomen very feebly clavate, scarcely recurved, the supraanal plate triangular, about equally long and broad, the sides straight, the tip angulate; furcula consisting of a pair of subapproximate slight and equal fingers, bluntly tipped, hardly more than a quarter the length of the supraanal plate; cerci very slender, compressed, rapidly narrowing at extreme base, beyond equal, slightly and broadly sulcate exteriorly, directed backward and a little inward, tapering and bluntly rounded at tip, scarcely reaching the tip of the supraanal plate; subgenital plate truncato-conical, much broader than long, incurved at base, the lateral and apical margins in one plane, entire.

Length of body, male, 17.5 mm., female, 21 mm.; antennae, male, 10.5 mm., female, 8.5 mm.; tegmina, male, 4 mm., female, 4.5 mm.; hind femora, male, 12.5 mm., female, 13 mm.

Four males, 9 females. Arizona (U.S.N.M.—Riley collection; L. Bruner); San Carlos, Gila County, Arizona, Wheeler's Exp. (U.S.N.M.—Riley collection); Fort Whipple, Yavapai County, Arizona, E. Palmer; Fort Buchanan, Pima County, Arizona, E. Palmer; Fort Grant, Graham County, Arizona (U.S.N.M.—Riley collection).

See the remarks on this species under *Melanoplus humphreysii*. The specimen from Cape St. Lucas which I referred¹ to this species does not belong to it, but probably to *Melanoplus nitidus*.

10. INDIGENS SERIES.

In this group, consisting of only a single species of medium size, the prozona of the male is very longitudinal and the interspace between the mesosternal lobes of the same sex only slightly longer than broad. The antennae of the male are almost as long as the hind femora. The tegmina are abbreviate, about as long as the pronotum, subelliptical with rounded apex. The hind tibiae are greenish and have ten to twelve spines in the outer series.

The extremity of the male abdomen is hardly clavate and the supraanal plate triangular with distinct median sulcus and mesially notched lateral margins; the furcula consists of a small pair of tapering fingers; the cerci are large and broad, almost equally broad throughout, and apically rounded, nearly straight; the subgenital plate is broad and short, the apical margin elevated to a blunt tubercle.

The single species occurs in Idaho.

¹Proc. Bost. Soc. Nat. Hist., XX, p. 85.

40. MELANOPLUS INDIGENS, new species.

(Plate XIV, fig. 4.)

Of medium size, brownish fuscous above, sordid testaceous beneath. Head a little prominent, olivaceo-testaceous flecked with fuscous, above blackish fuscous with a broad piceous postocular band; vertex somewhat tumid, scarcely elevated above the pronotum, the interspace between the eyes half as broad again as the first antennal joint; fastigium steeply declivent, shallowly and broadly sulcate; frontal costa scarcely reaching the clypeus, faintly expanded at the ocellus, but otherwise equal, a little narrower than the interspace between the eyes, a little sulcate below the ocellus, distinctly punctate above; eyes rather large, not prominent, somewhat longer than the infraocular portion of the genae; antennae castaneous, almost as long as the hind femora. Pronotum slightly expanding on the metazona, the sides with a percurrent, piceous, postocular stripe which is rather feeble on the metazona, the disk rather broadly convex, passing by a rounded shoulder, posteriorly forming feeble lateral carinae, into the somewhat tumid vertical lateral lobes; median carina distinct on the metazona, obsolescent on the prozona; front margin subtruncate, hind margin very broadly rotundate; prozona distinctly longitudinal, about a third longer than the finely punctate metazona. Prosternal spine long, conical, bluntly pointed, feebly appressed; interspace between mesosternal lobes subquadrate, barely longer than broad. Tegmina abbreviate, almost as long as the pronotum, slightly distant, obovate, almost twice as long as broad, the tip strongly rounded. Fore and middle femora somewhat tumid in the male; hind femora rather slender, somewhat compressed, ferrugineo-testaceous, irregularly clouded and flecked with fuscous, the under face flavo-olivaceous, the upper genicular lobe and base of lower black; hind tibiae sordid pale greenish with a fuscous patellar annulus, the spines black almost to their base, ten to twelve in number in the outer series. Extremity of male abdomen hardly clavate, somewhat recurved, the supraanal plate triangular with acutangulate apex, the lateral margins considerably and rather abruptly elevated and mesially notched, the median sulcus distinct and percurrent between rather narrow and sharp ridges which fade beyond the middle; furcula consisting of a pair of rather slender, tapering and acuminate, tumid, feebly arcuate and slightly divergent fingers, slightly longer than the last dorsal segment; cerci broad and rather coarse, straight, subequal, apically rounded or subangulate laminae, nearly four times as long as their middle breadth, obliquely vertical throughout except apically, where by a feeble twist they become vertical; subgenital plate short and broad, the apical margin rising considerably above the lateral into a slight rounded tubercle, the lateral and apical margins as seen from above parabolic.

Length of body, male, 20 mm.; antennae, 10 mm.; tegmina, 4.25 mm; hind femora, 11 mm.

One male. Salmon City, Lemhi County, Idaho, August (L. Bruner).

This species has a close general resemblance to *Podisma marshallii* with its much shorter antennae and wide separation of the mesosternal lobes.

11. MANCUS SERIES.

In this group, composed of species mostly of small size, the prozona of the male varies from quadrate to distinctly longitudinal, and the interspace between the mesosternal lobes of the same sex varies from a little longer than broad to more than twice as long as broad. The antennae of the male are rarely as long as the hind femora. The tegmina are always abbreviate, about as long as the pronotum, usually rather broad and either angulate or more or less acuminate at tip. The hind tibiae are red, rarely greenish, and have nine to sixteen, more commonly about eleven, spines in the outer series.

The extremity of the male abdomen is usually very feebly clavate, and the supraanal plate usually triangular and rather flat except for the submedian ridges; but it is sometimes long subclypeate with margins more or less raised; the furcula always consists of a feeble or rather feeble pair of denticulations; the cerci are generally rather small, sometimes nearly equal, at others tapering more or less in the basal half, but rarely anywhere very slender, generally incurved or inbent, and occasionally somewhat arcuate as seen laterally, always well rounded apically and generally exteriorly sulcate on the apical half; the subgenital plate is broad, generally also short, subconical or subpyramidal, the lateral and apical margins in the same plane and entire.

The species are five in number and have together a wide range, though all but one are rather local, so far as known. The one which is widely distributed occurs from Nebraska and Kansas to Texas in the West, and from southern New England and central New York to Virginia in the East. The other species are known respectively from Lower California, Colorado, Idaho, and northern New England, but the last is also reported from Illinois.

This series represents in brachypterous forms the glaucipes series in macropterous, and in an ideal arrangement the series should not be so widely separated as here.

41. MELANOPLUS SCUDDERI.

(Plate XIV, figs. 5, 6.)

Pezotettix scudderi UHLER!, Proc. Ent. Soc. Phil., II (1864), p. 555.—SMITH, Rep. Conn. Bd. Agric., 1872 (1872), pp. 370, 381.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 152; Bull. Ill. Mus. Nat. Hist., I (1876), p. 67.—BRUNER, Can. Ent., IX (1877), p. 144.—SCUDDER, *ibid.*, XII (1880), p. 75.—THOMAS, Rep. Ent. Ill., IX (1880), pp. 91, 95, 121.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.—COMSTOCK, *Intr. Ent.* (1888), p. 107.—DAVIS, Ent. Amer., V (1889), p. 80.—SMITH, Cat. Ins. N. J. (1890), p. 412.—BLATCHLEY!, Can. Ent., XXIII (1891), p. 80.—MCNEILL!, Psyche, VI (1891), p. 76.—OSBORN, Proc. Iowa Acad. Sc., I, ii (1892), p. 117.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 27.—MORSE, Psyche, VII (1894), p. 106.—GARMAN, Orth. Ky. (1894), p. 8.—BEUTENMÜLLER, Bull. Am. Mus. Nat. Hist., VI (1894), p. 309, pl. VIII, fig. 6.

Pezotettix rubricerus WALSH!, MS. (1865).

Podisma scudderi WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 718.

Pezotettix unicolor THOMAS!, Rep. U. S. Geol. Surv. Terr., V (1873), p. 151; Proc. Dav. Acad. Nat. Sc., I (1876), p. 260.—GLOVER, Ill. N. A. Ent., Orth. (1876), pl. XIII, fig. 9.—THOMAS, Bull. Ill. Mus. Nat. Hist., I (1876), p. 66; Rep. Geol. Expl. W. 100th Mer., V (1875), p. 888, pl. XLV, fig. 4.—BRUNER, Can. Ent., IX (1877), p. 144.—RILEY, Rep. U. S. Ent. Comm., I (1878), pp. 220, 226.—THOMAS, Rep. Ent. Ill., IX (1880), pp. 95, 118-119.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59; Bull. Washb. Coll., I (1885), p. 136; Publ. Nebr. Acad. Sc., III (1893), p. 27.

Of medium or rather small size, ferrugineo-fuscous, a little lighter beneath. Head not prominent, dark testaceous, much mottled with fuscous or generally infuscated, above almost wholly infuscated, with an obscure fuscous postocular band; vertex somewhat tumid, scarcely elevated above the pronotum, the interspace between the eyes half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium steeply declivent, plane, with feebly raised lateral margins; frontal costa fading before the clypeus, subequal, of the same breadth as the interspace between the eyes, the lateral margins faintly elevated throughout and besides that feebly sulcate at and below the ocellus, punctate biserially above; eyes moderately large, rather prominent, very much longer than the infraocular portion of the genae; antennae ferruginous, more or less infuscated apically, about four-fifths (male) or less than two-thirds (female) as long as the hind femora. Pronotum often heavily ferruginous on the disk, the lateral lobes with a postocular piceous belt, occasionally subobsolete, either crossing the whole pronotum but generally enfeebled on the metazona, or confined to the prozona; disk broadly convex, passing by a distinct but everywhere distinctly rounded shoulder into the at first very steeply declivent and afterwards vertical lateral lobes; median carina distinct, delicate and equal throughout; front margin very feebly convex and often faintly emarginate in the middle, hind margin obtusangulate, occasionally rotundato-obtusangulate; prozona distinctly longitudinal (male) or varying from quadrate to distinctly longitudinal—the latter especially in southern examples (female), fully half (male) or generally about a fourth (female) longer than the heavily and densely punctate metazona. Prosternal spine not very long, appressed cylindrical, tapering apically, bluntly pointed, erect; interspace between mesosternal lobes fully twice as long as broad (male) or quadrate (female). Tegmina about as long as the pronotum, broad ovate, overlapping, roundly subacuminate at tip (excepting in extreme southern examples, where it is well rounded); wings not half the length of the tegmina. Fore and middle femora slightly tumid in the male; hind femora ferrugineo-testaceous, occasionally with an olivaceous tinge, feebly bimaculate with fuscous above, the spots often extending halfway across the inner face, the lower face castaneous, occasionally ruddy, the whole geniculation fuscous and the genicular arc black; hind tibiae bright red, sometimes feebly infuscated or dulled toward the base, and with a fuscous patellar

spot, the spines black in the apical half, crowded, eleven to sixteen, usually twelve to thirteen, in number in the outer series. Extremity of male abdomen a little clavate, a little recurved, the supraanal plate triangular, acutangulate at tip, with strongly elevated and sharp submedian ridges on either side of the deep, narrow, and subequal median sulcus, which fades and widens apically; furcula consisting of the slightly tumid attingent portions of the mesially divided last dorsal segment, each produced posteriorly as a triangular tooth projecting over the supraanal plate, the tooth sometimes shorter than, usually as long as, the basal swelling, in southern examples half as long again as it (the length slightly exaggerated in fig. 6); cerci simple, feebly fal-ciform blades about twice as long as their basal breadth, at the rounded apex about half as broad as at base, usually slightly incurved, and generally exteriorly sulcate on the apical half, sometimes to a considerable degree; subgenital plate small, conical, the upper margin acutangulate as seen from above, in one plane, entire.

Length of body, male, 17 mm., female, 22 mm.; antennae, male and female, 8 mm.; tegmina, male, 5 mm., female, 5.25 mm.; hind femora, male, 10 mm., female, 12.75 mm.

Seventy-three males, 95 females. Brunswick, Maine, Packard (Museum Comparative Zoology); Springfield, Hampden County, Massachusetts, Allen (same); Deep River, Middlesex County, Connecticut, August 24 (A. P. Morse); New Haven, Connecticut, S. I. Smith, A. P. Morse (S. H. Scudder; Museum Comparative Zoology); North Haven, New Haven County, Connecticut, August 23 (A. P. Morse); South Kent, Litchfield County, Connecticut, August 19-20 (A. P. Morse); Staten Island, New York, September 18, W. T. Davis; Maryland, September 15, 19, October 18, 25, P. R. Uhler; Middle States, R. Osten Sacken; Washington, D. C. (L. Bruner, U.S.N.M.); Virginia (U.S.N.M.—Riley collection); Shenandoah Valley, Virginia, October, Packard (Museum Comparative Zoology); Vigo County, Indiana, W. S. Blatchley (S. H. Scudder; A. P. Morse); Bloomington, Monroe County, Indiana, Bollman (U.S.N.M.); Lexington, Fayette County, Kentucky, August 29, September 3, H. Garman; near Mammoth Cave, Kentucky, October, Putnam (Museum Comparative Zoology); Illinois, Uhler (S. H. Scudder; L. Bruner); Northern Illinois, Kennicott; Ogle County, Illinois, J. A. Allen; Chicago, Cook County, Illinois, September (U.S.N.M.—Riley collection); Rock Island, Illinois, Walsh; Moline, Rock Island County, Illinois, McNeill; Southern Illinois, November 1 (U.S.N.M.—Riley collection); Saint Clair County, Illinois, October 29 (same); Jackson County, Illinois (same); Dallas County, Iowa, August 8-10, September 1-3, J. A. Allen; Jefferson, Greene County, Iowa, July 20-24, Allen; Crawford County, Iowa, July 13-24, Allen; West Point, Cuming County, Nebraska, L. Bruner; Missouri, September 24-25 (U.S.N.M.—Riley collection); Savannah, Andrew County, Missouri, October 30 (same); Central Missouri (same); Boone County, Missouri, November 1 (same); Saint

Louis, Missouri, October 10 (same); Kirkwood, Saint Louis County, Missouri, September 6, October (same); Bushberg, Jefferson County, Missouri, August 24 (same); Mississippi (L. Bruner); Texas, September 20, October 13, Belfrage; Dallas, Texas, Boll (S. H. Scudder; U.S.N.M.—Riley collection); Fort Worth, Tarrant County, Texas (U.S.N.M.—Riley collection).

It has also been reported from New Jersey (Smith), Ithaca, New York (Comstock), Normal, McLean County, Illinois (Thomas), various parts of Kentucky (Garman), Topeka, Shawnee County, Kansas (Bruner), and, with doubt, by Thomas from Colorado "subalpine" and southern Colorado.

The species varies to a considerable degree, as appears in part from the above description. Texan specimens have the tegmina uniformly less acuminate apically and a longer furcula. Occasionally the tegmina are considerably longer than the pronotum, as appears especially in a pair sent me by Professor H. Garman from Kentucky. Specimens from southern New England appear uniformly somewhat smaller than others, while there is no difference in size between specimens from Maryland and Texas.

Walsh, supposing the species here described as *M. walshii* to be the true *M. scudderi*, named the present species in his letters *Pezotettix rubricrus*, and I still possess several specimens sent me by him in 1865 under that name. Examination of the types of Uhler and Thomas show that *scudderi* and *unicolor* are identical, as McNeill thought.

Riley states that this species attains maturity in the vicinity of Saint Louis, Missouri, about September 1, and begins to oviposit on September 24. The eggs have a quadrilinear arrangement in the pod. Uhler found it abundant near Baltimore, Maryland, on "the sides of high hills," Beutenmüller about New York City in "dry places," and Comstock about Ithaca, New York, "among scattered trees on the crests and slopes of our highest hills." In the West, however, Allen found it in Iowa "common in grassy groves" and "on prairies," while McNeill says that in Illinois it "is very frequently found along roadsides or in pastures," and in Indiana Blatchley finds it "in open woods and pastures."

42. MELANOPLUS GILLETTEI, new species.

(Plate XIV, fig. 7.)

Of rather small size, blackish fuscous, testaceous beneath. Head not prominent, brownish fuscous deepening in tint above and flecked with testaceous below, the clypeus and labrum testaceous, flecked with fuscous; vertex rather feebly tumid, not elevated above the pronotum, the interspace between the eyes twice as broad as the first antennal joint; fastigium steeply declivent, rather feebly sulcate; frontal costa fading well before the clypeus, feebly narrowed above, as broad as the interspace between the eyes, faintly sulcate at and below the ocellus, biserially punctate; eyes moderately large, not very prominent, some-

what longer than the infraocular portion of the genae; antennae dark castaneous, about four-fifths as long as the hind femora. Pronotum narrowest at the hinder section of the prozona, feebly expanding in front, slightly more on the metazona, the piceous postocular band of the lateral lobes confined to the prozona and inconspicuous from the dark color of the insect, though brought slightly into prominence by the slight paling of the lower portion of the lateral lobes and the rufous tinge of the sides of the disk, the disk very broadly convex and passing by rounded shoulders simulating lateral carinae into the vertical lateral lobes, where each half of the prozona is slightly and independently tumid; median carina distinct and rather prominent on the metazona, blunt on the prozona, particularly between the sulci; front margin feebly convex, hind margin rotundato obtusangulate; prozona longitudinally subquadrate, slightly longer than the somewhat coarsely punctate metazona. Prosternal spine short and stout, appressed conical, retrorse; interspace between mesosternal lobes about half as long again as broad. Tegmina abbreviate, rather broad ovate, subfusiform, apically acuminate, about as long as the pronotum, attingent, blackish fuscous. Fore and middle femora considerably tumid in the male; hind femora rather long and slender, blackish fuscous, the outer face more or less and irregularly blotched with dull testaceous, the inferior face dull rufous, the whole geniculation and lower genicular lobe blackish; hind tibiae very pale dull greenish, minutely flecked with fuscous, the spines black almost to the base, ten to eleven in the outer series. Extremity of male abdomen feebly clavate, strongly recurved, the supraanal plate long triangular, subhastate, the apex subrectangulate, the lateral margins narrowly elevated, the median sulcus with its low rounded walls shallow, broad at extremities and narrowed near the middle, where the plate is traversed by a slight transverse ridge which does not reach the margins; furcula consisting of a pair of widely divergent, slender, tapering, acuminate spines crossing nearly the basal fourth of the supraanal plate; cerci broad, flat, subvertical laminae, slightly more compressed at apex than at base, lying nearly in one plane but feebly incurved and very faintly upcurved, subequal, well rounded apically particularly on the inferior margin, a little more than twice as long as broad, falling considerably short of the tip of the supraanal plate, rather coarsely punctate; subgenital plate small, feebly subpyramidal, the apex elevated only by the gradual and exceedingly slight upward curve of the margin, which as seen from above is well rounded and entire.

Length of body, male, 16 mm.; antennae, 6 mm.; tegmina, 4 mm.; hind femora, 9.75 mm.

Two males. Rabbit Ears Pass, Colorado, at the height of about 10,000 feet, or probably 1,000 feet below timber line, July 20, C. F. Baker (C. P. Gillette). Mr. Baker has also sent me specimens taken by him at Cameron Pass in northern Colorado at a height of 11,800 feet, and on Clark's Peak, Colorado, at a height of 11,700 feet.

43. MELANOPLUS ARTEMISIAE, new species.

(Plate XIV, fig. 8.)

Pezotettix artemisiae BRUNER!, MS.*Pezotettix parabilis* MCNEILL!, MS.

Of rather small size, cinereo-fuscous. Head rather prominent, dull testaceous, heavily blotched with fuscous if not wholly infuscated, deepest on the elevated portions, above cinereo-testaceous, heavily flecked with fuscous in stripes radiating from the fastigium and in a postocular band; vertex somewhat tumid, distinctly elevated above the level of the pronotum, the interspace between the eyes fully half as wide again (male) or fully twice as wide (female) as the first antennal joint; fastigium rather steeply declivent, sulcate; frontal costa percurrent, equal or faintly enlarging below, nearly as wide as the interspace between the eyes, very feebly sulcate at and a little below the ocellus, punctate above; eyes not very large but prominent, especially in the male, distinctly larger than the infraocular portion of the genae; antennae testaceous, five-sixths (male) or scarcely three-fifths (female) as long as the hind femora. Pronotum rather short, subequal, feebly enlarging posteriorly, the lateral lobes with a feeble fuscous postocular band on the prozona, the disk frequently punctate with fuscous, very broadly convex and passing by a rounded shoulder, feebly angulated on the metazona, into the anteriorly feebly tumid subvertical lateral lobes; median carina percurrent, but blunt on the prozona, especially between the sulci where it is often subobsolete; front margin truncate, hind margin rotundato-obtusangulate, slightly more angulate in the male than in the female; prozona transversely subquadrate (male) or distinctly transverse (female), about a fifth longer than the densely punctate metazona. Prosternal spine rather short, erect, conico-pyramidal, subappressed; interspace between mesosternal lobes truncato-cuneiform, a little longer than broad (male) or distinctly transverse, not much narrower than the lobes (female). Tegmina broad-ovate, broader in the female than in the male, scarcely shorter than the pronotum, attingent, the apex angulate. Fore and middle femora very feebly enlarged in the male; hind femora long and slender, sordid flavo-testaceous, twice rather narrowly demi-cingulate with fuscous above and touched with fuscous at the base, the genicular arc fuscous; hind tibiae very pale and very dull glaucous, with a fuscous patellar spot, the spines black on the apical half, ten to eleven, rarely nine, in number in the outer series. Extremity of male abdomen barely clavate, scarcely recurved, the supraanal plate triangular with straight or nearly straight sides, acutangulate apex, the surface nearly plane, rising mesially and basally into a pair of high, sharp, feebly convergent ridges, inclosing a very deep and tapering median sulcus which covers two-thirds of the plate; furcula consisting of a pair of distant minute denticulations overlying the submedian ridges of the

supraanal plate; cerci moderately stout, nearly equal in width throughout, the basal half exteriorly tumid, the apical half roundly bent inward and exteriorly broadly sulcate, the apex well rounded and nearly reaching the tip of the supraanal plate; subgenital plate small, feebly subpyramidal, the margin as seen from above acutely bent apically and feebly tuberculate by its slight apical elevation.

Length of body, male, 16 mm., female, 21 mm.; antennae, male, 7.5 mm., female, 5.75 mm.; tegmina, male and female, 3.5 mm.; hind femora, male, 9 mm., female, 10 mm.

Four males, 10 females. Salmon City, Lemhi County, Idaho, August (U.S.N.M.—Riley collection; L. Bruner; S. H. Scudder).

44. MELANOPLUS MANCUS.

(Plate XIV, fig. 9.)

Pezotettix manca SMITH!, Proc. Portl. Soc. Nat. Hist., I (1868), p. 149.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 149.—SCUDDER!, Hitche., Rep. Geol. N. H., I (1874), p. 374.—GIRARD, Traité d'Ent., II (1879), p. 246.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.—FERNALD, Orth. N. E. (1888), pp. 29, 30; Ann. Rep. Mass. Agric. Coll., XXV (1888), pp. 113, 114.—MCNEILL, Psyche, VI (1891), p. 77.—MORSE, *ibid.*, VII (1894), p. 106.

Podisma manca WALKER, Cat. Derm. Salt. Brit. Mus., V (1871), p. 72.

Of rather small size, blackish fuscous above, the abdomen and legs more or less ferruginous, below light castaneous. Head not prominent, the face and genae testaceous, feebly olivaceous, and sometimes faintly clouded with fuscous, the summit blackish fuscous with a distinct and broad piceous postocular band; vertex gently convex, scarcely elevated above the pronotum, the interspace between the eyes half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium rather steeply declivent, rather (male) or very (female) shallowly sulcate; frontal costa subequal, a little contracted narrowly at summit, especially in the male, slightly narrower than the interspace between the eyes, fading just before the clypeus, feebly sulcate at and below the ocellus, punctate throughout; eyes of moderate size, rather prominent, particularly in the male, distinctly longer than the infraocular portion of the genae; antennae dark castaneous, apically infuscated, less than three fourths (male) or about two-thirds (female) as long as the hind femora. Pronotum rather short, feebly enlarging posteriorly but more rapidly on the metazona, the upper portion of the lateral lobes occupied by a broad piceous postocular band, broadening posteriorly and generally weaker on, but never absent from, the metazona; disk broadly convex, passing by a broadly rounded shoulder nowhere forming semblance of lateral carinae into the inferiorly vertical lateral lobes; median carina distinct on the metazona, blunt, equal, and almost subobsolete on the prozona; front margin truncate or subtruncate, hind margin very broadly convex, occasionally subangulate, the angle exceedingly obtuse; prozona slightly longitudinal (male) or quadrate (female), about a fourth (male) or a fifth (female) as long

again as the densely and finely punctate metazona. Prosternal spine rather short, slightly appressed conical, blunt, erect, rather shorter and stouter in the female than in the male; interspace between mesosternal lobes nearly half as long again as broad (male) or transverse, but much narrower than the lobes (female). Tegmina broad rounded-ovate, shorter than the pronotum, attingent or subattingent, feebly subangulate at apex, dark brownish fuscous. Fore and middle femora a little tumid in the male; hind femora ferrugineo-testaceous, sometimes with an olivaceous tinge, often more or less infuscated on the outer face, especially next the carinae, the geniculation infuscated, sometimes almost black; hind tibiae rather deep red, often paler next the base, with a feeble and narrow fuscous patellar annulus, the spines black almost or quite to their base, ten to eleven in number in the outer series. Extremity of male abdomen very feebly clavate, somewhat recurved, the supraanal plate long subclypeate, the lateral margins raised and slightly contracted mesially, the apex roundly subrectangulate, the median sulcus rather narrow, equal, percurrent, the bounding ridges not very high, but moderately sharp; furcula consisting of a pair of approximate, parallel, slight, cylindrical, tapering spines, projecting over the submedian ridges of the supraanal plate by no more than the length of the last dorsal segment; cerci rather long and slender, the lower margin nearly straight, tapering in the proximal half to about half its basal breadth, thereafter subequal, a little incurved and faintly twisted, scarcely reaching the tip of the supraanal plate, well rounded at tip; subgenital plate pyramidal, a little elongate and at tip subtuberculate, the margins in one plane, as seen from above with a parabolic curve, entire.

Length of body, male, 15.5 mm., female, 22 mm.; antennae, male, 6.25 mm., female, 7.25 mm.; tegmina, male, 3.25 mm., female, 4.25 mm.; hind femora, male, 8.75 mm., female, 11 mm.

Eighty-six males, 103 females. Speckled Mountain, Stoneham, Oxford County, Maine, August 15, S. I. Smith; the same, August 18, A. P. Morse (A. P. Morse; Museum Comparative Zoology; S. H. Scudder); Mount Sargent, Mount Desert Island, Maine, August; Kearsarge Mountain, North Conway, Carroll County, New Hampshire, 2,000 to 3,251 feet, September 4 (A. P. Morse). It has also been reported by McNeill from Running Lake, Illinois.

45. MELANOPLUS CANCRI, new species.

(Plate XIV, fig. 10.)

Of small size, testaceous. Head not prominent, uniformly testaceous, except in being darker above along the middle line in the male, and with a narrow postocular black stripe; vertex gently tumid, scarcely elevated above the pronotum, the interspace between the eyes hardly as wide as (male) or scarcely half as wide again as (female) the first antennal joint; fastigium steeply declivent, narrowly sulcate, at least

in the male, broadening a little anteriorly; frontal costa faintly wider than the interspace between the eyes, equal, fading just before the clypeus, feebly sulcate at and below the ocellus, punctate above; eyes rather large and rather prominent, particularly in the male, half as long again as the infraocular portion of the genae; antennae (?). Pronotum feebly enlarging on the metazona, the lateral lobes with only broken signs of a postocular dark band on the prozona, the disk very broadly convex, passing by a distinct rounded angle, forming a feeble lateral carina, into the rounded subvertical lateral lobes; median carina distinct but slight on the metazona, subobsolete or obsolete on the prozona; front margin truncate, hind margin strongly obtusangulate; prozona feebly transverse, but little longer than the densely and not very finely punctate metazona. Prosternal spine moderately long, rather slender, at least in the male, conical, erect; interspace between mesosternal lobes nearly twice as long as broad (male) or quadrate (female). Tegmina as long as or slightly longer than the pronotum, ovate, moderately broad, attinent or overlapping, apically acuminate. Fore and middle femora a little tumid in the male; hind femora not very long, somewhat compressed, uniform light testaceous, with fuscous genicular arc; hind tibiae light testaceous, the apical half of the spines black, nine to ten in number in the outer series. Extremity of male abdomen hardly clavate, a little recurved, the supraanal plate triangular, with acutangulate apex, the surface nearly plane, except that it sweeps up to the sharp, elevated, and apically united submedian ridges inclosing a very narrow and deep median sulcus, which crosses two-thirds of the plate; furcula consisting of a pair of approximate, small, triangular denticulations, no longer than the last dorsal segment, overlying the ridges of the supraanal plate; cerci small, subfalciiform, tapering to two-thirds the basal width on proximal half, beyond equal, bent a little inward and curved upward, exteriorly sulcate, apically rounded, much shorter than the supraanal plate; subgenital plate small, feebly subconical, projecting slightly, the apical margin rising very feebly to an obscure apical tubercle, and as seen from above with a parabolic curve, entire.

Length of body, male, 14 mm., female, 20 mm.; tegmina, male, 3.5 mm., female, 5.5 mm.; hind femora, female, 12 mm.

One male, 1 female. Cape St. Lucas, Lower California, J. Xantus. The single pair are somewhat broken and have been bleached in alcohol, so that the colors of the above description will have to be revised with fresh material.

12. DAWSONI SERIES.

This group is composed of rather heterogeneous material if the macropterous forms alone are considered, and is even more loosely compacted when the brachypterous species are mingled with them. In size they range from rather small to medium. A single species is dimorphic, being both brachypterous and macropterous.

The prozona is quadrate or subquadrate in the male, but in some brachypterous forms longitudinal. The interspace between the mesosternal lobes in the same sex is always longer than broad and sometimes more than twice as long as broad. The tegmina are either fully developed or slightly abbreviate so as not to surpass the hind femora, or else they are shorter than the pronotum, and then apically rounded or very bluntly subacuminate, generally slightly maculate. The hind tibiae vary in color, and have from nine to thirteen spines in the outer series.

The supraanal plate of the male is generally as in the femur-rubrum series, but the apical third or more is frequently depressed. The furcula is very variable, being either as in the devastator series, but generally rather shorter, or reduced to distant slight dentations or to rounded partially projecting lobes. The cerci are generally symmetrically rounded at tip and otherwise as in the femur-rubrum series, or with very slight difference in breadth basally and apically, usually rather short, and in one instance bent abruptly inward at less than a right angle. The subgenital plate is usually broad throughout, the apical margin well rounded and slightly elevated but not emarginate, but sometimes it is rather narrow throughout and not apically elevated.

The species of this group, seven in number, are divided unequally between macropterous and brachypterous forms, one species being dimorphic, four others brachypterous, and two macropterous. They occur almost wholly in the great interior region between the Mississippi River and the Rocky Mountains, and extend from Alberta and Assiniboia to central Mexico. No species are known from the Pacific Coast and only one east of the Mississippi, in Georgia and North Carolina.

46. MELANOPLUS REFLEXUS, new species.

(Plate XV, fig. 1.)

Dull ferruginous brown, lutescent below and on abdomen. Head luteo-testaceous, more or less marmorate with light fuscous, fusco-ferruginous above, with a broad postocular piceous patch; vertex very gently tumid, not elevated above the pronotum, the interspace between the eyes rather broad, much broader than, in the female twice as broad as, the first antennal joint; fastigium rather rapidly declivent, very feebly and broadly sulcate in the male, nearly plane in the female; frontal costa broad, failing to reach the clypeus, slightly contracted above, at least in the male, almost (female) or fully (male) as broad as the interspace between the eyes, feebly and narrowly sulcate at and below the ocellus, punctate throughout but nowhere seriatly; eyes moderately large, not prominent, a little longer than the infraocular portion of the genae; antennae ferruginous, in the female less than two-thirds as long as the hind femora. Pronotum short, subequal, very faintly and uniformly enlarging posteriorly, rather full than contracted in the middle, very

feebly tectate above, passing by a well-rounded angle into the inferiorly vertical lateral lobes, ferruginous brown above, fading out on the metazona into ferruginous, luteo-testaceous below; front margin subtruncate, hind margin broadly convex; median carina percurrent, slight, the transverse sulci of the prozona slight and not cutting the median carina; prozona longitudinal, very sparsely and feebly punctate, about a third longer than the finely and densely punctate metazona. Prosternal spine short, appressed cylindrical, blunt, strongly retrorse; interspace between mesosternal lobes more than twice as long as broad (male) or subquadrate (female), the metasternal lobes subattinent (male) or subapproximate (female). Tegmina broad oval, shorter than the pronotum, very broadly rounded apically, overlapping, wood-brown, with a basal blackish fuscous cloud in the costal area. Femora luteo-ferruginous, the fore pair feebly tumid in the male, the hind pair dull ferruginous on the upper face, feebly and irregularly blotched or freckled with light fuscous on the outer and inner faces, flavous or vinous beneath, the genicular arc and most of the geniculation black; hind tibiae glaucous-green, the spines black with pallid bases, ten in number in the outer series. Thoracic pleura piceous, with the front face of the mesothoracic episterna and the ridge of the metathoracic epimera luteo-testaceous. Abdomen testaceous, with the sides, especially of basal segments, piceous or blackish fuliginous; extremity in the male clavate, well upturned, the supraanal plate broad triangular, the apex rectangulate but compressed so that the sides are sinuate, the lateral halves very broadly and very shallowly sulcate, the median sulcus broad at base, narrowing as far as the middle and thereafter narrow and percurrent, its lateral walls sharp and high only in the basal portion; furcula consisting of a pair of lobate distant expansions of the middle of the last dorsal segment, resting upon the outer side of the base of the marginal ridges of the median sulcus of the supraanal plate; cerci moderately broad, straight, slightly tapering, flat on the external face, which is a little more than twice as long as the median breadth, then abruptly recurved inward, leaving a ragged, concave terminal edge, the reversed flange a little longer than broad, apically rounded, deeply excavated, pressing against the compressed portion of the supraanal plate; subgenital plate small, considerably longer than broad, not prolonged, of equal width throughout, except for a feeble apical elevation, forming a small blunt tubercle.

Length of body, male, 16.75 mm., female, 21.5 mm.; antennae, female, 7.25 mm.; tegmina, male, 4 mm., female, 4.75 mm.; hind femora, male, 10.25 mm., female, 12.5 mm.

One male, one female. Ciudad del Maiz, San Luis Potosi, Mexico, E. Palmer.

The character of the cerci with their reversed apex distinguishes this species at a glance from all other *Melanopli*.

47. MELANOPLUS MERIDIONALIS, new species.

(Plate XV, fig. 2.)

Fusco-ferruginous, more or less lutescent beneath. Head not prominent, fusco-ferruginous above, elsewhere dark olivaceous, except a piceous postocular band, the vertex gently tumid, slightly elevated above the pronotum, the interspace between the eyes rather broad, much broader than, in the female fully half as broad again as, the first antennal joint; fastigium rapidly declivent, abruptly broadened in front, very shallowly sulcate throughout; frontal costa broad, subequal, slightly contracted above in the male, failing to reach the clypeus, rather broader than the interspace between the eyes, feebly sulcate at and below the ocellus, densely punctate; eyes of moderate size, moderately prominent in the male, longer than the infraocular portion of the genae; antennae ferruginous, slightly infuscated apically, about three-fourths (male) or nearly two-thirds (female) as long as the hind femora. Pronotum fusco-ferruginous above, luteous or olivaceo-luteous on the lower half of the lateral lobes, the upper half on the prozona brownish fuscous, deepening below into piceous, or wholly dull piceous; subequal, scarcely expanding on the metazona, the disk broadly convex, passing almost insensibly, but with a very bluntly rounded angle, into the vertical lateral lobes, the median carina slight, percurrent, and similar throughout; transverse sulci feeble, not cutting the median carina; prozona very sparsely and feebly punctate, longitudinal (male) or longitudinally subquadrate (female), one-third (male) or one fourth (female) longer than the obscurely and finely punctate metazona. Prosternal spine moderately long (male) or rather short (female), conico-cylindrical, appressed, blunt; interspace between mesosternal lobes nearly twice as long as broad (male) or slightly transverse (female). Tegmina broad oval, shorter than the pronotum, apically broadly rounded and slightly emarginate, brownish fuscous. Hind femora fusco-ferruginous, the upper carinae often fuscous, the inferior basal half of the outer face often gradually lutescent, the inferior face and base of inner face fulvous or roseate, the geniculation, including most or all of the lower genicular lobe, blackish; hind tibiae glaucous, often more or less diffusely infuscated basally, sometimes lutescent apically, clothed with rather long pile, the spines black with pallid base, ten to eleven in number in the outer series. Extremity of the male abdomen clavate, much upturned, the supraanal plate broad triangular, with nearly straight, narrowly and slightly raised lateral margins, slightly depressed faintly acutangulate tip, and a short, triangular, rather deeply impressed, basal, median sulcus; furcula consisting of a pair of rather large, thickened, brief, lobate expansions of the last dorsal segment, overlying the bases of the apically convergent ridges, which bound the median sulcus of the supraanal plate; cerci

very simple, being slightly incurved, but otherwise straight and subequal laminae, a little more than three times as long as broad, tapering feebly for a short distance from the base and apically expanding in the slightest degree, the apical margin broadly rounded; subgenital plate a little longer than broad, a little prolonged and slightly elevated apically, the apical margin angulate, but rounded and entire.

Length of body, male, 17 mm., female, 22 mm.; antennae, male, 7 mm., female, 7.5 mm.; tegmina, male, 3.5 mm., female, 4 mm.; hind femora, male, 10 mm., female, 12 mm.

Three males; 8 females. Mount Alvarez, San Luis Potosi, Mexico, E. Palmer.

48. *MELANOPLUS MILITARIS*, new species.

(Plate XV, fig. 3.)

Blackish fuscous above with some ferruginous tints, pallid below. Head not prominent or feebly so in the male, blackish fuscous above, sometimes heavily irrorate with testaceous, the rest, except a rather narrow postocular piceous band, very pallid plumbeous, sometimes with a pinkish hue, the genae more or less flecked with fuscous posteriorly; vertex gently tumid, distinctly elevated above the pronotum, the interspace between the eyes rather broad, nearly or quite twice as broad as the first antennal joint, similar in the two sexes; fastigium rapidly declivent, shallowly sulcate; frontal costa only moderately broad, as broad as (female) or slightly narrower than (male) the interspace between the eyes, subequal, just failing to reach the clypeus, slightly sulcate at and below the ocellus, rather feebly punctate; eyes not very large, rather prominent in the male, rather shorter than the infraocular portion of the genae; antennae fusco-luteous or fusco-ferruginous, more than three-fourths (male) or less than three-fifths (female) as long as the hind femora. Pronotum dull testaceous, very heavily sprinkled with blackish fuscous above, especially on the prozona, sometimes so as to become almost wholly blackish fuscous, the metazona ferruginous, the upper half of the lateral lobes with a sometimes broken, broad, piceous band, which fades partially or completely on the metazona, the whole pronotum short, equal on the prozona, enlarging gradually and slightly on the metazona, the disk very broadly convex and passing almost insensibly but with a very broadly rounded angle into the vertical (male) or subvertical (female) lateral lobes; front margin truncate, hind margin broadly convex with a feeble angulation in the male; median carina feeble on the metazona, subobsolete on the prozona; transverse sulci of the prozona tolerably distinct, percurrent; prozona quadrate, about a fourth longer than the obscurely punctate metazona. Prosternal spine short, stout, very blunt, conical, erect, in the female a little appressed; interspace between mesosternal lobes nearly twice as long as broad (male) or strongly transverse, nearly as broad as the lobes

(female). Tegmina short, sublanceolate, lateral, shorter than the pronotum, the tip rounded, subangulate, brownish fuscous, blackish at the base of the discoidal area. Hind femora pallid testaceous, very transversely and narrowly bifasciate with blackish fuscous, the inferior face and lower half of interior face roseate and unbroken, the geniculation black; hind tibiae red, the spines black almost or quite to the base, nine to ten in number in the outer series. Abdomen sordid pale testaceous, heavily overlaid or blotched with blackish fuscous, the extremity in the male feebly clavate, a little upturned, the supraanal plate triangular, with convex sides, rectangular apex, the mesial region broadly elevated in more than the basal half and with a median closed sulcus of considerable depth, the sides of the plate also basally elevated, so that two lateral valleys are formed with synclinal sides; furcula consisting of a pair of slender, a little divergent, tapering, acuminate spines, crossing the basal third of the supraanal plate; cerci rather small, rapidly tapering in the basal half by the excision of the upper margin (much more rapidly than shown in the figure), beyond subequal and arcuate, being a little upturned, narrowed and well rounded apically, not at all incurved, as long as the supraanal plate; subgenital plate small, much longer than broad, not at all produced apically and elevated only at extreme tip and slightly, the apical margin well rounded, entire.

Length of body, male, 17.5 mm., female, 22 mm.; antennae, male, 7.5 mm., female, 6.5 mm.; tegmina, male and female, 3.25 mm.; hind femora, male, 9.1 mm., female, 11.75 mm.

One male, 1 female. Soldier, Logan County, Idaho (L. Bruner).

49. MELANOPLUS NIGRESCENS.

(Plate XV, fig. 4.)

? *Pezotettix zimmermanni* SAUSSURE, Rev. Mag. Zool., 1861 (1861), p. 159; Orth. Nov. Amer., II (1861), p. 9.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 150.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

? *Podisma zimmermanni* WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 718.

Caloptenus nigrescens SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1877), p. 27;

Ent. Notes, VI (1878), p. 5; Cent. Orth. (1879), p. 44.

Pezotettix nigrescens SCUDDER!, Can. Ent., XII (1880), p. 75.

Melanoplus nigrescens SCUDDER, Cent. Orth. (1879), p. 84.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 61.

Dull wood-brown, the sides and tegmina marked with black. Antennae reddish brown, a little infuscated at the tip; front of head more or less infuscated, the upper border of the eye margined by a pale yellowish stripe, followed inferiorly behind the eye by a more or less distinct, broad, blackish belt, which extends upon the pronotum, where it infuscates the upper third of the lateral lobes, especially anteriorly, and deepens to black next the lateral carinae; metathoracic epimera yellowish or pale yellowish brown, edged on either side with black. Anal

field of tegmina testaceous, the remainder black, the extreme tip testaceous. Fore and middle legs dull fusco-testaceous; hind femora yellow, more or less tinged with brownish, with a broad black band on either side of the middle, whose edges follow the impressed lines, the basal one sending a median shoot to the base; hind tibiae vinous red, a little infuscated at the base, the spines black, ten to twelve in number in the outer series.

Vertex gently tumid, a little elevated above the pronotum, the interspace between the eyes broader than (female) or scarcely as broad as (male) the basal joint of the antennae; fastigium rapidly declivent, broadly and shallowly sulcate; frontal costa broad, subequal, sulcate throughout excepting just above the antennae; eyes pretty large, a little prominent in the male, shorter than the infraocular portion of the genae; antennae about as long as (male) or two-thirds as long as (female) the hind femora. Pronotum with equal sides, the transverse sulci moderate, continuous, nearly straight, the median carina distinct on the metazona, the disk separated from the lateral lobes by a distinct but bluntly rounded angle; front margin subtruncate, faintly emarginate in the female, hind margin very obtusely angulate; prozona longitudinal (male) or subquadrate (female), about a fourth longer than the ruguloso-punctate metazona. Prosternal spine rather long, cylindrical, apically tapering but blunt, retrorse, in the female appressed and stouter; interspace between mesosternal lobes half as long again as broad (male) or quadrate (female). Tegmina only half as long as the abdomen, longer than the pronotum, tapering, the inner margin convex, apically subacuminate; wings slightly shorter. Hind femora stout and long. Extremity of male abdomen clavate, a little upturned, the supra-anal plate triangular, with convex sides, acutangulate apex, and a percurrent, not very deep, median sulcus; furcula consisting of a pair of slight approximate spines overlying the ridges bordering the sulcus of the supraanal plate; cerci moderate in size, compressed, tapering and straight on the middle half, with an obscure inner superior basal tubercle, beyond the middle bent inward and a little upward, equal, the tip squarely truncate with rounded angles; subgenital plate small, longer than broad, slightly elevated and feebly prolonged at apex, forming a slight tubercle.

Length of body, male, 23 mm., female, 26.5 mm.; antennae, male, 13 mm., female, 11 mm.; tegmina, male, 9 mm., female, 9.5 mm.; hind femora, male, 13.5 mm., female, 16.5 mm.

One male, three females. Georgia, Morrison; Smithville, North Carolina, November 22.

It seems very probable that this species is the *Pezotettix zimmermanni* of Saussure, described from the female only, but I find it impossible to determine from the description. If it should so prove, of course the name has priority over the one here employed.

50. MELANOPLUS DAWSONI.

(Plates I, fig. a; XV, fig. 5.)

Pezotettix dawsoni SCUDDER!, Daws. Rep. Geol. Rec. 49th Par. (1875), p. 343; Butt. Orth. N. A. Bound. Comm. (1875), p. 3; Can. Ent., XII (1880), p. 75.—CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), p. 71; Can. Rec. Sc., II (1887), p. 401; Can. Orth. (1887), p. 13.

Pezotettix tellustris SCUDDER!, Ann. Rep. Chief Eng., 1876 (1876), p. 502; Ann. Rep. Geogr. Surv. 100th Mer., 1876 (1876), p. 282; Can. Ent., XII (1880), p. 75.—BRUNER, Rep. U. S. Ent. Comm., III, (1883), p. 59.

Pezotettix abditum DODGE!, Can. Ent., IX (1877), p. 113.—SCUDDER!, Can. Ent., XII (1880), p. 75.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 27.

Melanoplus abditum OSBORN, Proc. Iowa Acad. Sc., I, Pt. II (1892), p. 118.

Obscure fusco testaceous. Head slightly prominent in the male only, olivaceo-testaceous, infuscated above, with a broad piceous, post-ocular band; vertex tumid, distinctly elevated above the pronotum, the interspace between the eyes rather broad, at least twice as broad as the first antennal joint; fastigium steeply declivent, plane, the lateral margins feebly and broadly elevated; frontal costa broad, subequal, as broad as the interspace between the eyes, fading out before reaching the clypeus, above plane (male) or feebly convex (female), at and below the ocellus slightly sulcate, everywhere punctate, with a tendency above to a biseriate arrangement; eyes not very large, not prominent, scarcely longer than the infraocular portion of the genae; antennae ferruginous, four-fifths (male) or three fifths (female) as long as the hind femora. Pronotum subequal (male) or distinctly compressed above anteriorly (female), short, the disk transversely a little convex and passing into the vertical lateral lobes by a rounded angle, which is nevertheless so abrupt as to form, at least in the male, tolerably distinct lateral carinae; lateral lobes lighter colored below than the disk, above on the prozona a broad, lustrous, dark colored band, sometimes obsolete, sometimes deepening to piceous; median carina slight, percurrent, equal, but blunter on the prozona than on the metazona; front margin feebly convex, with a slight mesial emargination not always distinct, hind margin obtusangulate equally in macropterous and brachypterous forms; prozona distinctly longitudinal (male) or quadrate or subquadrate (female) a third to a fourth longer than the more closely punctate metazona. Prosternal spine very short and blunt, rather stout, somewhat transverse; interspace between mesosternal lobes half as long again as broad (male) or a little transverse (female). Tegmina brownish fuscous, more or less feebly flecked with fuscous and either greatly surpassing the hind femora, moderately broad and subequal nearly to the well rounded tip (*M. d. completus*, Plate I, fig. a), or ovate-lanceolate, apically subacuminate, a little longer than the pronotum only (*M. d. tellustris*); wings when fully developed ample, hyaline, with pale brownish fuscous veins, paler and sometimes wholly pallid in the anal area. Fore femora of male very feebly enlarged;

hind femora luteo- or ferrugineo-testaceous, very obliquely and broadly bifasciate with blackish fuscous above and outside, with a basal patch of the same, the whole sometimes reduced to mere clouds, the genicular arc and sometimes the whole geniculation blackish fuscous; hind tibiae wholly red, the spines black except at base, ten to thirteen in number in the outer series. Extremity of male abdomen a little clavate, upturned, the supraanal plate small, subclypeate, much longer than broad, the lateral margins elevated a little and broadly on the basal half, the apex subrectangulate, a little rounded, the median sulcus not deep, percurrent, with sharp but low bounding walls in the basal half; furcula consisting of a pair of subparallel, slender, tapering, acuminate, flattened fingers, seated on rather tumid bases (forming part of the last dorsal segment), lying outside the ridges of the supraanal plate, and extending about halfway across it; cerci small feebly falciform lamellae, tapering on the basal half only and well rounded at tip, gently incurved and almost as long as the supraanal plate; infracercal plates large, scarcely longer than the supraanal plate, almost completely concealed by the recumbent cerci; subgenital plate small, broad but longer than broad, subpyramidal, being apically compressed, the apical margin slightly elevated and subtubercular, entire.

Length of body (*M. d. tellustris*), male, 16 mm., female, 18.5 mm.; antennae, male, 7.5 mm., female, 6.25 mm.; tegmina, male and female, 5.25 mm.; hind femora, male, 9 mm., female, 10.5 mm. Length of body (*M. d. completus*), male, 14.5 mm., female, 17.5 mm.; antennae, male, 7 mm., female, 6 mm. (est.); tegmina, male, 15 mm., female, 16 mm.; hind femora, male, 8.75 mm., female, 10 mm.

Thirty-four males, 42 females. Fort McLeod, Alberta, Canada, August (L. Bruner; U.S.N.M.—Riley collection); Souris River, Assiniboia, G. M. Dawson; Montana (U.S.N.M.—Riley collection); Dakota (same; S. H. Scudder); Clifford, Traill County, North Dakota (L. Bruner); Custer, Black Hills, South Dakota, Bruner (U.S.N.M.—Riley collection); Wyoming, Morrison (same); St. Paul, Minnesota, August 27, Whitman (same); Red River, Manitoba, R. Kennicott; Dallas County, Iowa, August, J. A. Allen; Jefferson, Greene County, Iowa, July 20–24, Allen; Crawford County, and Denison, Crawford County, Iowa, July 10–24, Allen; Nebraska, Dodge (U.S.N.M.—Riley collection; S. Henshaw; S. H. Scudder); Lincoln, Lancaster County, Nebraska, September (L. Bruner); Fort Robinson, Dawes County, Nebraska, August 21, Bruner (U.S.N.M.—Riley collection); Colorado, Morrison (same; S. H. Scudder); Northern New Mexico, Lieutenant Carpenter Allen found the species in Iowa in grass on prairies.

There are two very distinct forms of this species, differing however only in the length of the organs of flight, the tegmina being abbreviated and subacuminate at tip in the form *M. d. tellustris* (retaining the second oldest name for the form incapable of flight), and fully developed, broad and ample, greatly surpassing the hind femora and well rounded

apically in that to which the name *M. d. completus* may be given. The latter appears to be rarer and has so far been found only in Dakota and at Red River, Manitoba. We owe its discovery to Professor Bruner.

51. MELANOPLUS GLADSTONI, new species.

(Plates I, fig. *b*; XV, fig. 6.)

Melanoplus gladstoni BRUNER!, MS.

Very dark testaceous, much infuscated, especially above. Head not prominent, luteo-castaneous, more or less clouded or blotched with fuscous, above wholly fuscous, with a narrow, posteriorly broadening, testaceous stripe, following the posterior upper edge of the eye and separating the vertex from a piceous or blackish fuscous postocular band; vertex gently tumid, very slightly elevated above the pronotum, the interspace between the eyes rather broad, nearly (male) or fully (female) twice as broad as the basal antennal joint; fastigium steeply declivent, broadly sulcate throughout; frontal costa rather prominent, as broad as the interspace between the eyes, equal, percurrent or almost percurrent, punctate especially laterally, feebly sulcate at and below the ocellus; eyes moderately large, not very prominent, anteriorly subtruncate, a little longer than the infraocular portion of the genae; antennae luteo-ferruginous, gradually and slightly infuscated apically, about three-fourths (male) or two thirds (female) as long as the hind femora. Pronotum subequal, feebly enlarging on the metazona, ferrugineo-testaceous, much infuscated on the disk, the lateral lobes with a broad, more or less distinct, dark, sometimes piceous band crossing the prozona above; disk nearly plane, passing by a tolerably distinct but rounded angle into the anteriorly slightly tumid vertical lateral lobes; median carina slight, percurrent, somewhat feebler and blunter on the prozona than on the metazona; front margin subtruncate, hind margin obtusangulate; prozona quadrate, sometimes feebly longitudinal in the male, scarcely if any longer than the closely but feebly punctate metazona. Prosternal spine rather stout, moderately long, appressed conical, blunt, feebly retrorse; interspace between mesosternal lobes fully half as long again as broad (male) or slightly transverse (female). Tegmina reaching and sometimes a little surpassing the tips of the hind femora, moderately slender, distinctly tapering, brownish fuscous, distinctly but not conspicuously maculate in the discoidal area; wings hyaline, with mostly brownish fuscous veins. Fore femora of male not greatly tumid; hind femora flavo-testaceous, twice broadly and very obliquely banded with blackish fuscous, with a basal patch of the same, all sometimes confluent on the outer face, which it then nearly fills, the lower face and lower half of inner face immaculate, the genicular arc black; hind tibiae faintly valgate, red with an inconspicuous fuscous patellar spot, the spines black except their pallid bases, ten to twelve, usually eleven, in number in the outer series. Extremity of male abdomen

clavate, upturned, the supraanal plate rather long triangular, with tolerably straight sides, slightly and broadly elevated in the basal half, acutangulate apex, the whole apical half at a slightly lower plane than the basal, the median sulcus rather broad and distinct, with rather sharp walls, terminating with the upper shelf; furcula consisting of a pair of slight, distant, slender denticulations, lying outside the ridges of the supraanal plate, much shorter than the last dorsal segment; cerci subequal, punctate, compressed laminae, about four times as long as broad, feebly and broadly constricted mesially, the apical portion scarcely so broad as the base, and gently incurved, somewhat sulcate, the tip well rounded but subangulate inferiorly, reaching the tip of the supraanal plate; subgenital plate small, a little broader at base than at apex, feebly compressed apically and faintly elevated, the apical margin well rounded, entire.

Length of body, male, 20 mm., female, 23 mm.; antennae, male and female, 9 mm.; tegmina, male and female, 16 mm.; hind femora, male, 12 mm., female, 13.25 mm.

Eighteen males, 9 females. Medicine Hat, Assiniboia, September, (U.S.N.M.—Riley collection; L. Bruner); Montana (L. Bruner); Gordon, Sheridan County, Nebraska (U.S.N.M.—Riley collection); Fort Robinson, Dawes County, Nebraska, August 21, L. Bruner (same); Custer County, Colorado, T. D. A. Cockerell (same).

Colorado and Nebraska specimens appear to have the male cerci slightly broader apically than those from farther north and may prove distinct.

52. *MELANOPLUS PALMERI*, new species.

(Plate XV, fig. 7.)

Grayish or brownish fuscous, darker above than below. Head not prominent, testaceous, sometimes ferrugineo-testaceous, more or less flecked with fuscous, which prevails above and appears in a broad post-ocular band; vertex gently tumid, slightly elevated above the pronotum, the interspace between the eyes rather broad, much broader than (male) or twice as broad as (female) the basal antennal joint; fastigium steeply declivent, sulcate throughout; frontal costa rather prominent, equal, as broad as the interspace between the eyes, percurrent, sulcate at and below the ocellus, feebly punctate; eyes rather large, moderately prominent in the male, distinctly longer than the infraocular portion of the genae; antennae luteous or luteo-testaceous, about four-fifths (male) or two-thirds (female) as long as the hind femora. Pronotum subequal, enlarging a very little posteriorly, the lower half of the lateral lobes cleaner and brighter in color than the rest, the prozona with a more or less distinct but sometimes nearly obsolete postocular blackish fuscous band; disk passing by a well-rounded angle into the vertical lateral lobes, the median carina distinct on the metazona only, almost wholly obsolete on the prozona; front margin truncate, hind margin feebly

obtusangulate; prozona a little longitudinal (male) or quadrate (female), generally a little (male) or no (female) longer than the finely punctate metazona. Prosternal spine erect, conico-cylindrical, rather long, bluntly pointed, in the female slightly compressed; interspace between mesosternal lobes nearly twice (male) or a little (female) longer than broad. Tegmina surpassing considerably the hind femora, slender, tapering gently in apical half, brownish fuscous, almost the whole discoidal area maculate with fuscous with varying distinctness and delicacy; wings ample, hyaline, the anterior veins and cross-veins fuscous. Fore femora of male tolerably tumid; hind femora rather short and moderately stout and compressed, dull testaceous, rather broadly bifasciate, at least above, with blackish fuscous, the base and apex also infuscated, the under surface a little warmer in tint; hind tibiae very delicate pale green, the spines black from a little before their middle, nine to twelve in number in the outer series. Extremity of male abdomen clavate, upturned, the supraanal plate tolerably flat, triangular with straight sides, acutangulate apex, the median sulcus percurrent, with low bounding ridges which die out apically; furcula consisting of a pair of divergent, flattened, tapering, acuminate fingers, which hardly cross the basal third of the supraanal plate; cerci moderately large and broad, compressed, incurved laminae, a little more than three times as long as broad, a very little contracted mesially, the apical portion with its well-rounded tip more or less externally sulcate and narrower than the basal portion, reaching nearly to the tip of the supraanal plate; subgenital plate broad but not so broad as long, apically a little elevated, the apical margin well rounded, a little thickened and entire.

Length of body, male, 21 mm., female, 23 mm.; antennae, male, 11.5 mm., female, 10 mm.; tegmina, male, 21 mm., female, 22 mm.; hind femora, male, 13.25 mm., female, 15.25 mm.

Four males, 4 females. Fort Wingate, Bernalillo County, New Mexico (U.S.N.M.—Riley collection); Fort Whipple, Yavapai County, Arizona, E. Palmer.

13. RUSTICUS SERIES.

This is a tolerably homogeneous group in which the prozona of the male varies from quadrate to distinctly longitudinal and in which the mesosternal lobes of the same sex are separated by an interspace which is rarely a little transverse, usually quadrate or subquadrate, and rarely as much as nearly half as long again as broad. The hind border of the pronotum is usually very obtusangulate, and the tegmina always abbreviate, usually about as long as the pronotum. The hind tibiae are usually red, rarely pale greenish, with usually ten to eleven spines in the outer series, but sometimes nine or twelve, and in one case only seven spines may be found in the female.

The male abdomen is usually more or less clavate and recurved, the supraanal plate triangular, its median sulcus inclosed by high walls

which generally terminate beyond the middle; the furcula is usually developed as slight, tapering denticulations only, and in one case these disappear, but sometimes they are longer so as to be nearly or quite a fourth as long as the supraanal plate; the cerci are simple blades of moderate breadth, generally a little arcuate, tapering a little in the proximal, subequal in the distal half and rounded apically, not reaching the tip of the supraanal plate; the subgenital plate is small and the lateral and apical margins usually on the same plane, except for a slight apical elevation or angulation which may take the form of a tubercle, but in one species this also is wanting.

The species, mostly of medium or small size and seven in number, have a tolerably wide range in the western portion of the continent, from Washington, South Dakota, and Michigan to southern California, Texas, and Mexico; but with a single exception (Montana), the same district does not support two species. One species is found about and near the upper Mississippi, a second along the eastern border of the Rocky Mountains from Montana to New Mexico, a third in Montana, a fourth in Washington, and the others respectively in southern California, Texas, and Mexico.

53. MELANOPLUS MONTANUS.

(Plate XV, fig. 8.)

Platyphyma montana THOMAS¹, Rep. U. S. Geol. Surv. Terr., V (1873), p. 155.—GLOVER, Ill. N. A. Ent., Orth. (1874), pl. XVIII, fig. 11.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 58.

Of medium size, blackish fuscous with a ferruginous tinge. Head not prominent, fusco-plumbeous, the mouth parts paler, blackish fuscous above, with a broad postocular piceous band; vertex somewhat tumid, somewhat elevated above the pronotum, the interspace between the eyes fully half as broad again (male) or fully twice as broad (female) as the first antennal joint; fastigium steeply declivent, deeply (male) or rather shallowly (female) sulcate throughout; frontal costa lost before the clypeus, subequal, rather narrower than the interspace between the eyes, slightly (male) or distinctly (female) sulcate at and for a brief distance below the ocellus, rather heavily punctate throughout, the larger puncta above the ocellus arranged biserially and laterally; eyes not very prominent but a little more so in the male than in the female, of moderate size, as long as the infraocular portion of the genae; antennae nearly as long as the hind femora in the male. Pronotum subequal, feebly expanding posteriorly in the female, the lower portion of the lateral lobes dull dark testaceous in contrast to the piceous band of the upper half, which is not lost (though obscured) on the metazona, the disk rather broadly convex, passing (on the prozona insensibly, on the metazona with a rounded shoulder) into the subvertical lateral lobes; median carina distinct on the metazona, obsolete on the prozona; front margin truncate, hind margin broadly obtusangulate, the angle well rounded; prozona feebly longitudinal (male) or transverse (female),

a little longer than the rather feebly punctate metazona. Prosternal spine short, transverse, apically subtruncate; interspace between mesosternal lobes a little transverse, much narrower than the lobes, alike in both sexes, the metasternal lobes subattinent (male) or rather distant (female). Tegmina abbreviate, about as long as the pronotum, attinent, ovato-fusiform, broader in the female than in the male, apically acuminate, blackish ferruginous. Fore and middle femora considerably tumid in the male; hind femora very dull brownish testaceous, heavily bifasciate with blackish fuscous, the premedian fasciation angulate on the outer face, the whole geniculation, except sometimes the tip of the lower genicular lobe blackish, the inferior face dull flavous; hind tibiae red, the extreme base and a subbasal annulation fuscous, the spines black almost to their very base, ten in number in the outer series. Extremity of male abdomen distinctly clavate, considerably recurved, the supraanal plate triangular with slightly convex, basally-raised lateral margins, acutangulate apex and moderately broad and deep equal median sulcus extending over a little more than the basal half of the plate, its bounding ridges sharp and moderately high; furcula consisting of a pair of approximate, slight but rather coarse, parallel denticulations, shorter than the last dorsal segment; cerci rather small, subfalcate, being slightly curved upward but not incurved, tapering somewhat in the basal half, beyond equal and two-thirds as broad as the extreme base, the tip well rounded, shorter than the supraanal plate; subgenital plate small, subconical, apically subtuberculate, moderately narrow, subequal, the margin as seen from above well rounded, entire.

Length of body, male, 19 mm., female, 26 mm.; antennae, male, 9 mm.; tegmina, male, 5 mm., female, 5.5 mm.; hind femora, male, 9.5 mm., female, 11.5 mm.

Three males, 2 females. Montana (L. Bruner; U.S.N.M.—Riley collection).

I formerly¹ gave Thomas's name of this species to *M. monticola*, q. v.

54. MELANOPLUS WASHINGTONIANUS.

(Plate XV, fig. 9.)

Pezotettix washingtonianus BRUNER¹, Can. Ent., XVII, 1885, pp. 14-15.

Of medium size, rather stout-bodied, brownish fuscous tinged with ferruginous, flavo-testaceous beneath. Head not prominent, fusco-testaceous with a feeble olivaceous tinge, brownish fuscous above, sometimes blotched with testaceous, with a broad postocular piceous band; vertex gently tumid, feebly elevated above the pronotum, the interspace between the eyes nearly (male) or fully (female) twice as broad as the first antennal joint; fastigium steeply declivent, deeply (male) or moderately (female) and broadly sulcate; frontal costa failing to reach the clypeus, subequal but slightly contracted above, especially in the

¹Appalachia, I, 263.

male, a little narrower than the interspace between the eyes, sulcate at and below the ocellus, punctate throughout like the rest of the face and genae; eyes of moderate size, only moderately prominent even in the male, scarcely longer than the infraocular portion of the genae; antennae castaneous becoming slightly infuscated apically, considerably more (male) or slightly less (female) than two-thirds as long as the hind femora. Pronotum subequal, faintly enlarging posteriorly, especially in the female, the prozona with a broad postocular piceous band, beneath which the lateral lobes are dull flavo-testaceous, the disk broadly convex, passing by a broadly rounded angulation nowhere forming lateral carinae into the vertical lateral lobes; median carina distinct but very low on the metazona, subobsolete on the prozona except at the extreme front; front margin truncate, hind margin obtusangulate; prozona quadrate or feebly longitudinal (male) or feebly transverse (female), a little (male) or scarcely (female) longer than the ruguloso-punctate metazona. Prosternal spine moderately large, stout, appressed conical, very blunt, slightly retrorse; interspace between mesosternal lobes subquadrate, a little longer than broad (male) or transverse, but narrower than the lobes (female). Tegmina abbreviate, about as long as the pronotum, overlapping, broad subovate, the costal margin convex, the apex acuminate, brownish fuscous, minutely flecked with fuscous. Fore and middle femora considerably tumid in the male; hind femora rather robust, testaceous, rather narrowly bifasciate with fuscous, the premedian fasciation angulate on the outer face, the geniculation fuscous, the lower face pale flavous; hind tibiae red, generally rather pale red, with an obscure fuscous patellar spot, the spines black beyond their base, ten to eleven, rarely twelve, in number in the outer series. Extremity of male abdomen a little clavate, considerably recurved, the supraanal plate triangular, the apex acutangulate, the median sulcus straight, rather narrow and moderately deep, extending over the basal three-fifths of the plate between narrow and sharp ridges, terminating abruptly; furecula consisting of a pair of slight spinous denticulations shorter than the last dorsal segment, overlying the base of the submedian ridges of the supraanal plate; cerci small, subfalcate, slightly upturned but otherwise straight lamellae, tapering gently from the base nearly or quite to the middle, beyond equal, about two-thirds as broad as the extreme base, apically rounded or subtruncate, much shorter than the supraanal plate; subgenital plate small, rudely subconical, terminating in a feeble blunt tubercle.

Length of body, male, 20 mm., female, 24 mm.; antennae, male, 8 mm., female, 7.5 mm.; tegmina, male, 6.25 mm., female, 6 mm.; hind femora, male, 11 mm., female, 12.25 mm.

Four males, 3 females. Loon Lake, Colville Valley, Washington, July 23-25, S. Henshaw (Museum Comparative Zoology; U.S.N.M.—Riley collection).

55. MELANOPLUS WALSHII, new species.

(Plate XV, fig. 10.)

Pezotettix scudderi WALSH!, MS.

Rather above the medium size, cinereo-fuscous. Head not prominent, dull testaceous, more or less infuscated, especially above, with a distinct or obsolete piceous postocular band; vertex gently tumid, feebly elevated above the pronotum, the interspace between the eyes almost (male) or much more than (female) twice as broad as the first antennal joint; fastigium steeply declivent, broadly and moderately (male) or very shallowly (female) sulcate; frontal costa hardly reaching the clypeus, equal, a little (male) or distinctly (female) narrower than the interspace between the eyes, faintly and broadly sulcate at and below the ocellus, punctate throughout, but above particularly in lateral series; eyes not very large, moderately prominent, particularly in the male, the front margin truncate in the female, a little (female) or distinctly (male) longer than the infraocular portion of the genae; antennae testaceous, basally lutescent, apically fuscous, slightly more than two-thirds as long as the hind femora in the female. Pronotum equal except for a feeble posterior enlargement of the metazona, the sides with a very broad piceous postocular band crossing the prozona and, obscurely, also the metazona (male) or with scarcely the slightest trace of the same, but at most a growing depth of tint at the upper limit of the lateral lobes (female), the disk plano-convex, passing into the subvertical lateral lobes by a well but abruptly rounded angulation, forming dull lateral carinae; median carina distinct but low on the metazona, obsolete on the prozona except sometimes a slight appearance at extreme front; front margin truncate, hind margin strongly obtusangulate; prozona distinctly longitudinal (male) or quadrate or subquadrate (female), much longer than, generally half or nearly half as long again as, the ruguloso-punctate metazona. Prosternal spine moderately long and stout, especially in the female, appressed conical, not very blunt, erect; interspace between mesosternal lobes truncatocuneiform, quadrate (male) or distinctly transverse but narrower than the lobes (female). Tegmina abbreviate, a little longer than the pronotum, overlapping, with angularly separated dorsal and lateral fields, particularly in the male, ovate-lanceolate, apically bluntly acuminate, the costal margin rotundato-angulate, cinereo fuscous, the dorsal field often wholly cinereous; wings briefer than the tegmina. Fore and middle femora not greatly tumid in the male; hind femora testaceous or luteo-testaceous, rather broadly and distinctly bifasciate with fuscous or blackish fuscous, sometimes suffused on the upper face, the inferior face pale reddish, the genicular arc black; hind tibiae bright red, at extreme base infuscated, with a fuscous patellar spot, followed beyond by a broad but not very conspicuous pallid annulus, the spines

black beyond the base, ten to eleven, rarely nine or twelve, in the outer series. Extremity of male abdomen rather strongly clavate, considerably recurved, the supraanal plate triangular, with feebly elevated lateral margins and bluntly acutangulate apex, the median sulcus narrow, deep, and equal, between high but rounded walls, terminating a little beyond the middle of the plate and leaving the tip cochlearate; furcula consisting of a pair of minute slender denticulations overlying the submedian ridges of the supraanal plate; cerci subequal, tapering in the basal fourth only, beyond enlarged to the slightest degree, gently incurved throughout but otherwise nearly straight, feebly sulcate exteriorly at the rounded apex, falling well short of the tip of the supraanal plate; subgenital plate small, narrowed feebly in the middle of either side, the apical margin gradually and gently elevated, entire, well rounded as seen from above.

Length of body, male, 20 mm., female, 23 mm.; antennae, female, 10.5 mm.; tegmina, male, 7 mm., female, 8.5 mm.; hind femora, male, 11 mm., female, 15 mm.

One male, 7 females. Michigan, M. Miles; Rock Island, Illinois, B. D. Walsh; Dallas County, Iowa, August, J. A. Allen.

This species was determined in 1865 by the late B. D. Walsh as *Pez. scudderi* Uhler, described from the same place but quite distinct. It is possible that the two sexes here described belong to two different species, as there is considerable and unusual difference between them in the shape of the eye and the character of the postocular band; but they agree so well otherwise, and show the same pallid annulus on the hind tibiae, that I regard them as the same. If distinct, the name here applied should be given to the female, as only the female was received from Walsh. The male comes from Michigan.

56. MELANOPLUS ALTITUDINUM.

(Plate XVI, fig. 1.)

Pezotettix marshallii SCUDDER!, Ann. Rep. Chief Eng., 1876 (1876), p. 502; Ann. Rep. Geogr. Surv. 100th Mer., 1876 (1876), p. 282.

Pezotettix altitudinum SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), p. 86; Cent. Orth. (1879), p. 75.

Pezotettix sanguinipes BRUNER!, Publ. Nebr. Acad. Sc., III (1893), p. 27—undescribed.

Of medium (male) or moderately large (female) size, there being unusual disparity between the sexes, blackish griseous, ferrugineo-testaceous beneath. Head not prominent, ferrugineo-testaceous below, passing into blackish fuscous above, with a broad, piceous postocular band; vertex somewhat tumid, elevated but little above the pronotum, the interspace between the eyes nearly twice (male) or nearly thrice (female) as broad as the first antennal joint; fastigium not very steeply declivent, rather deeply (male) or very shallowly (female) sulcate; frontal costa failing to reach the clypeus, equal or subequal, much narrower than the interspace between the eyes, sulcate at and below the ocellus particularly in the male, punctate throughout like the rest of the face

and genae; eyes not very large, moderately (female) or distinctly (male) prominent, scarcely longer (male) or a little shorter (female) than the infraocular portion of the genae; antennae castaneous, apically fuscous, a little more than (male) or about (female) two thirds as long as the hind femora. Pronotum subequal, feebly and gradually enlarging posteriorly, the lateral lobes with a broad piceous postocular band confined to the prozona and sometimes followed beneath by lighter spots, the disk plano-convex, passing into the vertical lateral lobes by a distinct but rounded angulation forming dull lateral carinae, most distinct on the posterior section of the prozona; median carina distinct and moderately high on the metazona, subobsolete on the prozona, often obsolete between the sulci; front margin truncate, hind margin obtus-angulate, the angle broadly rounded in the female; prozona slightly longitudinal (male) or distinctly transverse (female), considerably (male) or not (female) longer than the ruguloso-punctate metazona. Prosternal spine rather short, conical with a blunt point, suberect; interspace between mesosternal lobes subquadrate (male) or transverse, as broad as the lobes (female), the metasternal lobes approximate (male) or distant (female). Tegmina somewhat abbreviate, attaining about the middle of the hind femora, overlapping, long lanceolate, very roundly acuminate at tip, the dorsal field more or less ferrugineo-testaceous, the rest blackish griseous, the whole profusely sprinkled with blackish fuscous spots; wings a little shorter than the tegmina. Fore and middle femora, and especially the latter, a little tumid in the male; hind femora testaceous or ferrugineo-testaceous, rather narrowly bifasciate with blackish fuscous, the geniculation fuscous, the lightest region of the femora being a not very broad, dull flavo-testaceous, pregenicular annulation, the inferior surface and lower part of inner surface very dark red; hind tibiae dark and generally bright red, with a narrow fuscous patellar annulation, the spines black almost to their very base, ten to eleven, rarely nine, in number in the outer series. Extremity of male abdomen clavate, considerably recurved, the supraanal plate triangular, the apex acutangulate, the basal half or more of the lateral margins feebly convex and feebly and broadly elevated, the median portion of the basal three-fifths of the plate broadly elevated and provided with a deep and equal median sulcus; furcula consisting of a pair of distant, feeble, blunt denticulations, much shorter than the last dorsal segment; cerci slender, and tapering rapidly on the basal fourth or third, mainly by the excision of the upper margin, beyond subequal, gently incurved and faintly curved upward, apically rounded, faintly sulcate exteriorly at tip, but failing to reach the tip of the supraanal plate; subgenital plate subconical, nearly as broad as long, apically tuberculate.

Length of body, male, 20 mm., female, 28 mm.; antennae, male, 8 mm., female, 9 mm.; tegmina, male, 9.5 mm., female, 10 mm.; hind femora, male, 11.5 mm., female, 13 mm.

Thirteen males, 16 females. Montana (U.S.N.M.—Riley collection); Fort Ellis, Montana, July 29–30 (same); Englewood, Lawrence County, South Dakota, Haggard (L. Bruner); Custer, Black Hills, South Dakota, Bruner (U.S.N.M.—Riley collection); Harneys Peak, South Dakota, 7,000 to 8,000 feet, Bruner (same); Fort McKinney, Johnson County, Wyoming, July (same); Sheridan, Wyoming, August 12, L. Bruner; Poudre River, Colorado, June (U.S.N.M.—Riley collection); southern Colorado, June 11–20, Lieutenant Carpenter (same; S. H. Scudder); Taos Peak, Sangre de Cristo Mountains, New Mexico, 13,000 feet, Carpenter (U.S.N.M.—Riley collection).

It is also credited to Pine Ridge, in the extreme northwestern part of Nebraska (Bruner).

57. *MELANOPLUS GRACILIPES*, new species.

(Plate XVI, fig. 2.)

Pezotettix gracilipes MCNEILL!, MS.

Of small size and slender form, fusco-testaceous, more or less ferruginous. Head not prominent, testaceous, more or less heavily and distinctly punctate with fuscous, generally fuscous above, with a broad, fuscous, postocular band; vertex feebly tumid, scarcely elevated above the pronotum, the interspace between the eyes narrow, not (male) or scarcely (female) wider than the first antennal joint; fastigium steeply declivent, moderately sulcate; frontal costa fading before the clypeus, equal or subequal, as wide as (female) or slightly wider than (male) the interspace between the eyes, sulcate at and below the ocellus, punctate throughout and more or less biserially; eyes moderately large, rather prominent, much longer than the infraocular portion of the genae; antennae testaceous, about four-fifths (male) or one-half (female) as long as the hind femora. Pronotum subequal, faintly enlarging posteriorly, the lower portion of the lateral lobes testaceous, the upper occupied by a piceous postocular stripe which only crosses the prozona, the disk broadly convex, passing into the subvertical lateral lobes by a rounded but abrupt angulation, which forms very blunt percurrent lateral carinae; median carina distinct but low, percurrent, hardly more distinct on the metazona than on the prozona; front margin faintly convex, hind margin subtruncate but faintly angulate; prozona distinctly longitudinal (male) or transverse (female), more than half as long again as the densely and very distinctly punctate metazona. Prosternal spine moderately long, erect, appressed, conical, blunt; interspace between mesosternal lobes nearly half as long again as broad (male) or transverse, but much narrower than the lobes (female). Tegmina abbreviate, about as long as the pronotum, broad ovate, attingent, apically angulate, brownish fuscous. Fore and middle femora slightly tumid in the male; hind femora long and slender, dull testaceous, sometimes with a ferruginous tinge, more or less sprinkled with fuscous dots, which when most profuse are collected in two oblique fasciations seen most clearly

on the upper face, the lower face pale red, the geniculation hardly infuscated; hind tibiae pale testaceous with a faint greenish tinge, especially upon the upper half, often minutely flecked with fuscous, the spines pallid at base and black at tip, ten to eleven in number in the outer series. Extremity of male abdomen clavate, considerably recurved, the supraanal plate triangular or subhastate with acutangulate apex, the lateral margins broadly and gently elevated on the basal half, the median sulcus percurrent, deep basally and gradually shallowing; furcula consisting of a pair of parallel, approximate, slender, acuminate spines, less than one-fourth the length of the supraanal plate; cerci small, slender, tapering gently on basal third, beyond equal, nearly straight but feebly incurved, well rounded at tip, much shorter than the supraanal plate; subgenital plate small, subequal, a little longer than broad, the lateral and apical margins in the same plane, angulate as seen from above.

Length of body, male, 14 mm., female, 18 mm.; antennae, male, 7 mm., female, 4.75 mm.; tegmina, male, 4.25 mm., female, 4.5 mm.; hind femora, male, 9 mm., female, 10 mm.

Three males, 1 female. Los Angeles, California, Coquillett (U.S.N.M.—Riley collection; L. Bruner).

58. MELANOPLUS GENICULATUS, new species.

(Plate XVI, fig. 3.)

Of every small size, fusco-testaceous, the legs and under surface flavous. Head rather prominent, especially in the male, flavous, more or less feebly punctate with fuscous, above with a pair of divergent obscure fuscous stripes; vertex gently tumid, slightly elevated above the pronotum, the interspace between the eyes scarcely (male) or only (female) as wide as the first antennal joint; fastigium steeply declivent, rather deeply sulcate, broadening anteriorly to double the basal width; face considerably oblique, the frontal costa fading just before the clypeus, equal except for a slight contraction above, a little broader than the interspace between the eyes, distinctly sulcate throughout excepting above, feebly and biserially punctate; eyes large, prominent, much longer than the infraocular portion of the genae; antennae rufo-testaceous, almost as long (male) or a little more than two-thirds as long (female) as the hind femora. Pronotum subequal on the prozona, flaring a little on the metazona, with no piceous postocular band, the lateral lobes short and nearly unicolorous, the disk broadly convex and passing insensibly into the vertical lateral lobes; median carina faint and slight on the metazona, obsolete on the prozona, especially in the male; front margin truncate or subtruncate, hind margin truncate and very feebly and broadly emarginate; prozona distinctly punctate and transversely rugose, at least in the male, subquadrate, almost twice as long as the densely and rather heavily punctate metazona. Prosternal spine of moderate size, erect, strongly appressed conical; interspace between mesosternal lobes quadrate (male) or transverse but much

narrower than the lobes (female). Tegmina abbreviate, much shorter than the pronotum, lateral and widely distant, obovate, twice as broad as long, well rounded apically. Fore and middle femora somewhat tumid in the male; hind femora uniformly flavous with a faint greenish tinge, the entire geniculation and base of tibiae black; rest of hind tibiae greenish yellow, the spines black beyond the base, seven (female) to nine (male) in number in the outer series. Extremity of male abdomen scarcely clavate, somewhat recurved, the supraanal plate subtriangular with sinuous sides and rounded subrectangulate apex, the surface subtectate, rising to the sharp submedian ridges which inclose the percurrent but mesially interrupted median sulcus; furcula obsolete, represented by mere disk-like thickenings of the inner portion of the divided halves of the last dorsal segment; cerci small, moderately slender, subequal, nearly straight but incurved, apically truncate, shorter than the supraanal plate; subgenital plate very small and very short, of very unequal breadth, the lateral and apical margins on the same plane, as seen from above angulate.

Length of body, male, 12.25 mm., female, 14.5 mm.; antennae, male, 8 mm., female, 6.5 mm.; tegmina, male, 2.5 mm., female, 2 mm.; hind femora, male, 8.75 mm., female, 9 mm.

One male, 1 female. Mexico, W. S. Blatchley.

59. MELANOPLUS RUSTICUS.

(Plate XVI, fig. 4.)

Pezotettix rusticus STÅL, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 13.

I have not seen this species, but by the courtesy of Doctor Aurivillius I am able to give an illustration of the male abdominal appendages. Stål's description is as follows:

Præcedenti [Mel. plebejus] simillimus, differt oculis nonnihil minoribus, antennis longioribus, vitta laterali pronoti percurrente, forma intervalli sternorum, lobis genicularibus femorum posteriorum nigris, tantum apice imo pallidis nec non forma partium analium maris. ♂, ♀. Long. 20 mill.

♂. Antennae femoribus posticis vix breviores; oculi majusculi, modice convexi; intervallum loborum mesosternalium anterius lobis dimidio angustius, retrorsum sensim ampliatur; lobi mesosternales leviter transversi; lobi metasternales fortiter appropinquati; abdomen posterius haud vel vix tumescens, apice levissime recurvum; segmentum dorsale ultimum e medio lobos duos sat longos, sensim acuminatos, divaricatos, emittens; lamina supraanal triangularis paullo longior quam basi latior, lateribus leviter rotundatis instructa, apice angulum subacutum formans, sulco longitudinali ante medium distincto, pone medium obsolete instructa, prope latera longitudinaliter impressa; cerci compressi, latiusculi, basi sensim nonnihil angustati, dein ubique aequè lati, posterius extus leviter excavati; lamina subgenitalis brevis, fortiter recurva, sinuato-truncata, macula parva apicali nigra notata.

♀. Antennae femoribus posticis nonnihil breviores; oculi minores; lobi mesosternales transversi, intervallo circiter duplo latiores; intervallum loborum mesosternalium utrimque sinuatum, prope basin angustius, hinc retrorsum ampliatur; lobi metasternales sat distantes."

Patria: Texas. (Mus. Holm.)

Stål places this species in his fourth division of the genus *Pezotettix*, which he regards as equivalent to *Paroxya* Scudder, and which he defines

merely in terms of the abdominal appendages of the male; it is, therefore, not equivalent to *Paroxya* as I formerly defined it and as I here still more closely distinguish it from the other genera.

14. BORCKII SERIES.

A homogeneous group in which the prozona of the male is distinctly longitudinal and from a third to a half longer than the metazona, the posterior margin of the pronotum being subtruncate. The interspace between the mesosternal lobes in the same sex varies from a little longer than broad to twice as long as broad. The antennae vary considerably in length, but generally differ but little between the two sexes. There is also little diversity between the sexes in the prominence of the eyes. The hind tibiae are dark blue, sometimes purplish, and have nine to twelve spines in the outer series.

The supraanal plate is triangular with acutangulate or rectangulate apex; the furcula is reduced to mere projecting points; the cerci are broad and swollen at the base, taper rapidly, and terminate in a slender, produced, more or less curling finger; the supraanal plate is either very narrow as compared to its length and then deeply hollowed apically, with a strongly sinuate lateral margin, or it is only a little longer than broad with a nearly straight margin, the apical margin always entire.

There are six species, ranging from rather small to a little above the medium size, and they are mainly confined to the Pacific coast from Washington to California. But one of the species occurs also as far inland as Idaho and Wyoming, and another is known from San Luis Potosi, Mexico.

60. MELANOPLUS PACIFICUS.

(Plate XVI, fig. 5.)

Pezotettix pacificus SCUDDER!, Rep. U. S. Ent. Comm., II (1881), App., pp. 24-25, pl. XVII, fig. 16.—BRUNER, *ibid.*, III (1883), p. 59.

Of medium or slightly less than medium size, ferrugineo-fuscous above, flavo-testaceous beneath. Head scarcely prominent, flavo-testaceous, heavily punctate with fuscous, above also faintly clouded with fuscous, with a broad piceous postocular band; vertex gently tumid, a little elevated above the pronotum, the interspace between the eyes nearly half as broad again (male) or nearly twice as broad (female) as the first antennal joint; fastigium rather steeply declivent, distinctly (male) or feebly (female) sulcate throughout with weak anterior termination; frontal costa subobsolete below, subequal, but above slightly narrowed, about as broad as the interspace between the eyes, a little sulcate at and sometimes a short distance below the ocellus, punctate throughout; eyes moderate in size, not very prominent, scarcely more so in the male than in the female, a little longer than the infraocular

portion of the genae; antennae luteo-testaceous, gradually darkening from base to apex, nearly two-thirds (male) or three-fifths (female) as long as the hind femora. Pronotum subequal, faintly expanding posteriorly, the disk ferrugineo-fuscous, sometimes testaceous flecked with fuscous, gently convex transversely and passing by an abrupt but rounded shoulder, scarcely forming lateral carinae, into the slightly tumid subvertical lateral lobes; these are flavo-testaceous on the lower, piceous on the upper half, the division line between the colors sharp, arcuate; median carina sharp and distinct on metazona, feeble on prozona, and sometimes obsolete between the sulci; front margin truncate, hind margin feebly produced, subtruncate; prozona distantly, coarsely, and shallowly punctate, feebly convex anteroposteriorly, longitudinal, nearly one-half (male) or about one-third (female) longer than the closely and rather finely punctate metazona. Prosternal spine small, stout, conical, and rather sharply pointed (male) or blunt (female); interspace between mesosternal lobes fully half as long again as broad (male) or fully half as broad again as long but narrower than the lobes (female); ridge of metathoracic episterna flavous like the mesothoracic, piceous between. Tegmina abbreviate, shorter than the pronotum, in the female scarcely longer than the prozona, very broadly ovate, very broadly rounded apically, attingent or subattingent, brownish fuscous, the anal area often cinereous. Fore and middle femora very tumid in the male; hind femora rather stout and plump, ferrugineo-testaceous, sometimes immaculate, sometimes obscurely and brokenly trifasciate with blackish fuscous above, sometimes the whole outer face completely infuscated (the carinae sometimes flavescens), the inferior surface flavous or pale sanguineous, the geniculation feebly infuscated; hind tibiae very dark glaucous or bronze green, sometimes with a narrow fuscous patellar annulus, the spines long, pallid on basal, blackish on apical half, ten to eleven, rarely nine or twelve, in the outer series. Abdomen flavous, testaceous or ferruginous, the sides marked with piceous, in the male sharply delimited in a narrowing band; extremity in the male clavate, considerably recurved, the supraanal plate triangular, expanded at extreme base, the apex acutangulate, the lateral margins broadly elevated, the median sulcus very broad at base, rapidly narrowing so that at and beyond the middle it is very slender, the arcuate bounding ridges high and sharp; furcula reduced to the slightly projecting inner angles of the divided halves of the last dorsal segment; cerci strongly compressed, very broad and rounded on basal half, with marginal borders, and a little tumid in the middle, the apical half subcylindrical, slender, tapering, pointed, not one-third the width of the base, the whole not more than half as long again as broad and hardly attaining the tip of the supraanal plate; subgenital plate much longer than broad, with very convex lateral margins, deeply hollowed and entire apical margin, the margins quadrate as seen from above.

Length of body, male, 18 mm., female, 19 mm.; antennae, male, 6.5

mm., female, 6.75 mm.; tegmina, male and female, 4 mm.; hind femora, male, 10.5 mm., female, 11.25 mm.

Four males, 7 females. Siskiyou County, California (U.S.N.M.—Riley collection); Edgewood, Siskiyou County, California (L. Bruner); Sissons, Siskiyou County, Packard; Mount Shasta, California (L. Bruner); Shasta County, California, June, J. Behrens (same); Santa Cruz Mountains, California (U.S.N.M.—Riley collection); mountains near Lake Tahoe, California, September, Henshaw, Wheeler's Expedition, 1876.

This species may readily be confounded with the following: it is a little smaller and somewhat slenderer than *M. borckii*, and differs also in the points mentioned in the table.

61. MELANOPLUS BORCKII.

(Plate XVI, fig. 6.)

Acridium (*Podisma*) *borckii* STÅL, Orth. Eug. Res. (1861), p. 332.

Podisma borckii WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 718.

Pezotettix (*Melanoplus*) *borckii* STÅL, Recens. Orth., I (1873), p. 79.

Pezotettix borckii THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 149.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59; Can. Ent., XVII (1885), p. 12; Bull. Div. Ent. U. S. Dep. Agric., IV (1884), p. 58.

Of fully medium size, ferrugineo-fuscous, dull testaceous beneath. Head scarcely prominent, flavous, often more or less clouded with fuscous, above always more or less brownish fuscous, occasionally punctate or streaked with black, rarely with any sign of a postocular band; vertex very gently tumid, feebly elevated above the pronotum, the interspace between the eyes fully half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium moderately declivent, sulcate throughout but more feebly in the female than in the male; frontal costa fading before the clypeus, equal but for the slight narrowing above, as broad as the interspace between the eyes, slightly sulcate at and sometimes shortly below the ocellus, punctate throughout like the rest of the face and genae; eyes of moderate size, feebly tumid and scarcely more so in the male than in the female, only a little longer than the infraocular portion of the genae; antennae luteous or rufous, becoming dusky apically, slightly more than half (male) or about three-fifths (female) as long as the hind femora. Pronotum distinctly enlarging posteriorly especially in the female, of nearly uniform color but becoming dull fusco-testaceous on the lower part of the lateral lobes, and sometimes, and especially in the male, with a broad, dull piceous, postocular band confined to the prozona, the disk broadly convex and separated by a distinct and tolerably sharp angulation, forming rather distinct lateral carinae, from the gently tumid but otherwise subvertical lateral lobes; median carina distinct, percurrent but feebler on the prozona, and feeblest and sometimes subobsolete between the sulci; front margin truncate or faintly convex, hind margin truncate or feebly rounded, rarely subangulate; prozona distinctly (male) or feebly (female)

longitudinal, feebly convex antero-posteriorly, fully a half (male) or about a third (female) longer than the closely and finely punctate metazona. Prosternal spine rather stout, conical, a little blunter in the female than in the male; interspace between mesosternal lobes longitudinally subquadrate or somewhat longer than broad (male) or transversely subquadrate or feebly transverse (female). Pleura marked as in *M. pacificus*. Tegmina a little or considerably shorter than the pronotum, broad or very broad oval, attingent or subattingent, well rounded apically, usually half as long again as broad but sometimes little longer than broad, especially in the female, brownish fuscous. Fore and middle femora very tumid in the male; hind femora ferrugineo-fuscous, very obliquely bifasciate with blackish fuscous, the proximal fasciation usually narrow, the distal broad, sometimes more or less suffused on the outer face, the genicular arc black, the lower surface sanguineous, though the outer half is sometimes flavous; hind tibiae very dark bluish purple, sometimes dull dark glaucous and then with a broad, subbasal, pallid annulation, the spines long, pallid at base, the apical half or more black, ten to eleven, rarely nine, in number in the outer series. Extremity of male abdomen clavate, strongly recurved, the supraanal plate precisely as in *M. pacificus*; furcula as there, but slightly more prominent; cerci broad, somewhat rounded and tumid at base, in the middle third tapering rapidly, the apical third subequal, very slender, incurved and a little arcuate as seen from the side, the tip bluntly pointed and almost attaining the tip of the supraanal plate, scarcely differing from the same parts in *M. pacificus*; subgenital plate as there, but the lateral margins rather angulate than rounded at base.

Length of body, male, 19 mm., female, 24.5; antennae, male, 6.75 mm., female, 8 mm.; tegmina, male, 4.5 mm., female, 5 mm.; hind femora, male, 13 mm., female, 14 mm.

Eight males, 12 females. California, Ricksecker (S. Henshaw); California, Behrens (U.S.N.M.—Riley collection); Sonoma and Marin counties, California, Baron Osten Sacken; Sauzalito, Marin County, California, July 26, September, Behrens; Santa Cruz Mountains, California (U.S.N.M.—Riley collection); Los Angeles, California, Coquillett (L. Bruner); between San Luis Obispo and San Simeon Bay, California, E. Palmer.

It has also been reported from Washington, Montana, Idaho, and Wyoming by Bruner.

62. MELANOPLUS TENUIPENNIS, new species.

(Plate XVI, fig. 7.)

Pezotettix tenuipennis MCNEILL!, MS.

Of medium or rather above the medium size, the female robust, rather dark testaceous. Head not prominent, testaceous, feebly and sparsely punctate with fuscous, above sometimes faintly infuscated especially along the middle, and with faint and narrow or no postocular band;

vertex gently tumid, but little elevated above the pronotum, the interspace between the eyes half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium moderately declivent, rather shallowly (male) or scarcely (female) sulcate; frontal costa fading before the clypeus, subequal, about as broad as the interspace between the eyes, scarcely sulcate (male) or feebly sulcate at and below the ocellus (female), punctate throughout; eyes moderate in size, not very prominent, only a little longer than the infraocular portion of the genae; antennae testaceous or rufo-testaceous, more than two-thirds (male) or about one-half (female) as long as the hind femora. Pronotum distinctly enlarging from in front backward particularly in the female, the disk broadly convex, subtectiform, passing by an abrupt angle forming distinct lateral carinae into the anteriorly feebly tumid vertical lateral lobes, the lateral carinae faintly marked with flavous or rufous, followed beneath at least on the prozona with a narrow bordering of black, occasionally extending, but generally as a feeble suffusion, over the upper half of the lateral lobes; median carina percurrent, sharp on the metazona, dull but distinct on the prozona, except that it is always feebler and sometimes subobsolete between the sulci; front margin truncate, hind margin truncate but mesially emarginate, especially in the female; prozona subequal and distinctly longitudinal (male) or tapering and longitudinally subquadrate (female), fully (male) or less than (female) half as long again as the closely and heavily punctate metazona. Prosternal spine long, slender, erect, conical (male) or moderately long, stout, conical, rather blunt, erect (female); interspace between mesosternal lobes somewhat variable, being from half as long again to fully twice as long as broad (male) or subquadrate either longitudinally or transversely (female). Tegmina much shorter than the pronotum, distant, lateral, elliptical, varying from hardly more than half as long again as broad to more than twice as long as broad, apically well rounded, brownish fuscous. Fore and middle femora considerably tumid in the male; hind femora rather stout but pretty long, testaceous, generally with feeble remnants of bifasciation with fuscous, especially on the outer face and upper half of inner face, the lower half of the latter with the inferior face sanguineous, the genicular arc fuscous; hind tibiae paler or darker glaucous, sometimes a little infuscated, the basal third sometimes with a postbasal flavous annulation, the spines pallid on basal, black on apical half, nine to twelve in number in the outer series. Extremity of male abdomen clavate, considerably recurved, the supranal plate triangular with rectangulate apex and straight sides, the surface nearly plane, the median sulcus occupying at base a large flat triangular field (represented far too small in our figure), beyond which it continues to the tip as a feeble slit; furcula consisting of a pair of approximate, slight, blunt denticulations; cerci broad at base, tapering pretty regularly and somewhat rapidly, the apical third subequal and very slender, not a fourth the width of the base, a little twisted and

incurved, the tip bluntly angulate below, the whole fully twice as long as basal breadth; subgenital plate long and narrow, narrowest in the middle, the lateral margins ampliate and well rounded at the base, and as a whole sinuate, rising again at the apex, the apical margin as seen from behind broadly angulate, entire.

Length of body, male, 16 mm., female, 26 mm.; antennae, male, 7 mm., female, 8 mm.; tegmina, male, 3 mm., female, 4.75 mm.; hind femora, male, 10 mm., female, 15.5 mm.

Three males, 5 females. Monterey County, California, M. R. Curran (L. Bruner); Los Angeles, California, Coquillett (same); Los Angeles County, California, Koebele (same); San Bernardino County, California, August 18 (U.S.N.M.—Riley collection); Kern County, California (U.S.N.M.).

As there is considerable variation in the slenderness of the tegmina, the name given by McNeill is not closely applicable.

It is possible that the single female from Monterey County does not belong here, as it varies from the others, as indicated in part by the description, in having a subbasal annulus on the hind tibiae, and has considerably broader tegmina than any of the others and hardly any trace of markings on the hind femora. If it is distinct, it indicates an undescribed species of this same series very closely allied to the present.

63. MELANOPLUS MISSIONUM, new species.

(Plate XVI, fig. 8.)

Of average size, dark, ferrugineo-fuscous. Head feebly prominent, at least in the male, testaceous, heavily punctate with fuscous, above blackish fuscous, enlivened by a testaceous stripe following the margin of the eye posteriorly, and separating the fuscous summit from the broad piceous postocular band; vertex gently tumid, distinctly elevated above the level of the pronotum, the interspace between the eyes nearly (male) or fully (female) half as broad again as the first antennal joint; fastigium somewhat declivent, throughout distinctly (male) or scarcely (female) sulcate; frontal costa rather prominent, almost reaching the clypeus, equal or, in the male, sometimes feebly narrowed above, slightly broader than the interspace between the eyes, feebly sulcate at, and in the male below, the ocellus, rather closely punctate throughout like the rest of the face; eyes moderately large, slightly prominent, much longer than the infraocular portion of the genae; antennae luteo-testaceous, about three-fourths (male) or more than three-fifths (female) as long as the hind femora. Pronotum feebly expanding posteriorly, the disk broadly convex, passing by a distinct though slight ruga or rough angulation into the vertical lateral lobes, these lateral carinae marked, at least in the male, by a slender flavous stripe, followed beneath on the lateral lobes by a slender (female) or broad but posteriorly narrowing (male) piceous postocular band, mostly or wholly confined to the prozona; median carina percurrent and distinct, but duller on the

prozona, though in the female, excepting between the sulci, it is nearly as elevated though not so sharp as on the metazona; front margin subtruncate, hind margin produced, but broadly truncate, with the faintest possible indication of emargination; prozona distinctly longitudinal (male) or longitudinally subquadrate (female), very faintly and sparsely punctate, about half as long again as the closely and sharply punctate metazona. Prosternal spine moderately long, conical, rather blunt; interspace between mesosternal lobes about twice as long as broad (male) or quadrate (female.) Tegmina abbreviate, much shorter than the pronotum, rather distaut, obovate, nearly twice as long as broad, well rounded apically. Fore and middle femora of male only moderately tumid; hind femora testaceous or ferrugineo-testaceous, more or less confusedly bifasciate with blackish fuscous, the entire geniculation blackish fuscous, the inner half of under surface and lower half of inner surface pale sanguineous; hind tibiae very dark glaucous, almost purplish, the spines pallid in basal, black in apical half, nine to ten, usually nine, in number in the outer series. Extremity of male abdomen clavate, strongly recurved, the supraanal plate triangular, with subrectangulate apex and feebly and broadly crenate margins, the sharp and low ridges bounding the exceptionally shallow and flat median sulcus forming a broad triangle in somewhat less than the basal half of the plate, though the sulcus continues as a delicate incision and broadens a little at the apex; furcula consisting only of the rectangulate but projecting inner corners of the gradually broadening divided lateral halves of the last dorsal segment; cerci broad at base, gently tumid, rapidly and regularly narrowing in the basal half, beyond subequal, very slender, hardly a fourth as broad as at base, incurved, the tip bluntly pointed, the whole about twice as long as the basal breadth; subgenital plate long and narrow, the lateral and apical margins in nearly the same plane, but feebly elevated apically, as seen from above well rounded, entire.

Length of body, male, 16.5 mm., female, 20.5 mm.; antennae, male, 7.5 mm., female, 8 mm.; tegmina, male and female, 4 mm.; hind femora, male, 10.5 mm., female, 12.75 mm.

Two males, 1 female. Los Angeles, California, Coquillett (U.S.N.M.—Riley collection).

This species differs from the preceding mainly in coloring and in the larger and bulkier female.

64. MELANOPLUS FUSCIPES, new species.

(Plate XVI, fig. 9.)

Pezotettix fuscipes McNEILL!, MS.

Of rather small size, dark ferrugineo-fuscous with black markings. Head feebly prominent, testaceous, heavily flecked or sometimes suffused with fuscous, above dark fuscous mesially, separated by a dull flavo-testaceous stripe bordering the eye from the broad piceous post-ocular band; vertex moderately tumid, elevated somewhat above the

pronotum, the interspace between the eyes hardly (male) or fully (female) half as broad again as the first antennal joint; fastigium not very declivent, distinctly (male) or rather feebly (female) sulcate; frontal costa rather prominent, not reaching the clypeus, subequal but narrowly and feebly contracted above, as broad as the interspace between the eyes, scarcely sulcate below the ocellus, punctate throughout; eyes rather large, rather prominent in the male, not at all in the female, much longer than the infraocular portion of the genae; antennae luteo- or fulvo-testaceous, a little infuscated apically and paler at the base, nearly four fifths (male) or two-thirds (female) as long as the hind femora. Pronotum feebly expanding posteriorly, the disk dark fuscous, a broad dull flavous or cinereous stripe on either side, limited exteriorly by the lateral carinae and generally fading or obsolete on the metazona, leaving between them a mesial fuscous stripe no broader than they, the lateral lobes flavo-testaceous below with a postocular piceous band, very broad and sometimes percurrent, but then broadened and diffused or embrowned on the metazona; disk very broadly convex, passing almost insensibly into the subvertical lateral lobes; median carina distinct and sharp on the metazona, almost wholly wanting on the prozona; front margin truncate, hind margin very broadly rounded or subtruncate, occasionally subangulate; prozona sparsely punctate, varying from quadrate to distinctly longitudinal, the latter only in the male, a third to a half longer than the finely punctate metazona. Prosternal spine short, stout, conical, shorter and stouter in the female than in the male; interspace between mesosternal lobes twice or more than twice as long as broad with parallel sides (male) or longitudinally subquadrate (female). Tegmina abbreviate, shorter than the pronotum, rotundato-ovate, from a fourth to a half as long again as broad, well rounded apically, approximate or subattinent, rarely attinent, brownish fuscous sometimes streaked with cinereous. Fore and middle femora of male considerably tumid; hind femora moderately slender, flavo-testaceous, distinctly and rather narrowly bifasciate with blackish fuscous, the geniculation blackish fuscous, the inferior face flavous sometimes infuscated; hind tibiae pale fusco-glaucous, the spines pallid on basal, black on apical half, nine to eleven, usually eleven, in number in the outer series. Extremity of male abdomen clavate, very strongly recurved, the supraanal plate triangular with acutangulate apex, nearly plane, with a pair of lateral arcuate blunt incurved ridges, formed of a plication beginning with the basal half of the lateral margins but ending abruptly before the median line, the median sulcus very slight and slender, percurrent; furcula entirely wanting; cerci broad and slightly tumid at base, rapidly and regularly tapering in the proximal half, beyond much less rapidly, the distal half forming a compressed, subequal, slender, incurved ribbon, hardly more than a third as broad as the base, the tip rounded but slightly angulate below, the whole about twice as long as the basal breadth, suberect; subgenital plate bluntly

conical, about as long as broad, ending in a slight postmarginal tubercle, the margins in one plane, broadly rounded, entire.

Length of body, male, 15 mm., female, 20.5 mm.; antennae, male, 6.75 mm., female, 7.5 mm.; tegmina, male, 3.5 mm., female, 4 mm.; hind femora, male, 9 mm., female, 11.25 mm.

Six males, 4 females. California (U.S.N.M.—Riley collection); San Bernardino County, California, May (same); Los Angeles, California, Coquillett (same); San Diego County, May (U.S.N.M.); between San Luis Obispo and San Simeon Bay, California, E. Palmer.

This species is very close indeed to the preceding, but differs from it in lacking the lateral carinae of the pronotum and the angulations representing the furcula, in the possession of an apical tubercle to the supraanal plate, and in the heavier flavous stripe of the disk of the pronotum.

The name, apparently chosen from the color of the hind tibiae, is not very closely descriptive of them.

65. MELANOPLUS SCITULUS, new species.

(Plate XVI, fig. 10.)

Of small size, brownish fuscous. Head not prominent, olivaceous-fuscous, above much infuscated, with a broad piceous postocular band; vertex very gently tumid, feebly elevated above the pronotum, the interspace between the eyes scarcely broader than (male) or nearly twice as broad as (female) the first antennal joint; fastigium moderately declivent, feebly sulcate; frontal costa almost or quite percurrent, equal, about as broad as (male) or slightly narrower than (female) the interspace between the eyes, feebly sulcate at and below the ocellus (male), or distinctly sulcate almost throughout (female), feebly punctate; eyes rather large, only moderately prominent even in the male, considerably longer than the infraocular portion of the genae; antennae luteo-testaceous, slightly infuscated apically, about three-fifths (male) or but little more than one-half (female) as long as the hind femora. Pronotum very gently enlarging from in front backward, varying from testaceous-fuscous to blackish fuscous, always with more or less ferruginous, luteo-testaceous on the lower half of the lateral lobes, with a broad, piceous, postocular band either confined to the prozona or extending obscurely and more widely upon the metazona, the disk broadly convex, passing by an abruptly rounded shoulder into the inferiorly vertical lateral lobes; median carina equally distinct and sharp throughout; front margin truncate, hind margin very broadly rounded, subtruncate; prozona sparsely and shallowly punctate, distinctly longitudinal, much more than half as long again as the sharply and closely punctate metazona. Prosternal spine appressed subconical, not very long, transversely and broadly rounded apically; interspace between mesosternal lobes slightly longer than broad (male) or transverse, but much narrower than the lobes (female). Tegmina abbreviate, somewhat shorter

than the pronotum, attingent, rotundato-ovate, less than half as long again as broad, apically rounded, brownish fuscous. Fore and middle femora somewhat rounded in the male; hind femora ferrugineo-fuscous or flavo-fuscous, darkest along the upper half of the outer face, without fasciation, the under and inner faces flavous or pale sanguineous, the genicular arc blackish; hind tibiae dark glaucous, the spines pallid in basal, black in apical half, nine to eleven, usually ten, in number in the outer series. Extremity of male abdomen clavate, considerably recurved, the supraanal plate hastate with rectangulate apex, the surface nearly plane, the median sulcus shallow, narrow, and narrowing, inclosed between low rounded walls, which unite near the middle of the plate; furcula reduced to two slight, approximate, blunt denticulations, overlying the base of the just-mentioned ridges; cerci broad at base, tapering rapidly and subequally so as to form long triangular plates, faintly incurved, apically faintly decurved and finely acuminate at tip, the lower margin faintly concave; subgenital plate small, not much longer than broad, very broadly and bluntly subconical, the cone forming a feeble and blunt apical tubercle, the lateral and apical margins on the same plane, well rounded, entire.

Length of body, male, 14.5 mm., female, 18 mm.; antennae, male, 5.6 mm., female, 5.5 mm.; tegmina, male and female, 3.25 mm.; hind femora, male, 9.1 mm., female, 10 mm.

Two males, 1 female. Mount Alvarez, San Luis Potosi, Mexico, E. Palmer.

This species is the most aberrant of its series.

15. PUER SERIES.

In the species of this small group, the prozona of the male (and generally of the female) is longitudinal and nearly twice as long as the metazona, with its truncate or feebly produced hind margin; the median carina is similar throughout. The interspace between the mesosternal lobes in the same sex is slightly or much longer than broad. The male antennae are long and considerably longer proportionately than those of the female. The tegmina are abbreviate, of about the length of the pronotum, obovate and apically rounded. The hind tibiae are prevailingly glaucous, the spines ten to eleven, rarely nine, in number in the outer series.

The supraanal plate of the male is triangular or hastate, the surface subtectate with a deep median sulcus; the furcula is variable in length, either reduced to mere denticulations or developed as parallel spines nearly a third as long as the supraanal plate; the cerci are small and styliform with slight concavity of the upper margin, acuminate and much shorter than the supraanal plate; the subgenital plate varies considerably but is rather full, and the apical margin entire.

Two species are known, one very small from Florida, the other rather large from Texas, and they are brought together in one group principally from their simple styliform cerci.

66. MELANOPLUS FLABELLATUS.

(Plate XVII, fig. 1.)

Pezotettix flabellatus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 82-83; Cent. Orth. (1879), pp. 71-72.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Somewhat above the medium size. Head not prominent; vertex feebly tumid, barely elevated above the pronotum, the interspace between the eyes slightly broader than (male) or fully half as broad again as (female) the first antennal joint; fastigium rather steeply declivent, shallow, broad, subspatulate, with distinct but low and coarse bounding walls; frontal costa broad, equal, rather broader than (male) or as broad as (female) the interspace between the eyes, flat throughout or faintly sulcate down the middle below the ocellus, biserially punctate above; eyes moderately large, moderately prominent, a little longer than the infraocular portion of the genae; antennae nearly four-fifths (male) or four-sevenths (female) as long as the hind femora. Pronotum very simple, enlarging backward uniformly but slightly, and less so in the male than in the female; front margin truncate, hind margin gently angulato-arcuate; median carina distinct, slight, equal, percurrent; lateral carinae scarcely indicated and on the metazona wholly obsolete; whole disk gently punctate, the prozona more sparsely than the metazona; prozona distinctly longitudinal (male) or quadrate or feebly longitudinal (female), fully (male) or about (female) half as long again as the metazona. Prosternal spine moderately long, appressed conical, blunt, erect; interspace between mesosternal lobes fully half as long again as broad (male) or transverse but shorter than the lobes (female). Tegmina abbreviate, a little shorter than the pronotum, rounded ovate, half as long again as broad, the apex not at all produced, slightly overlapping at their inner margins. Extremity of male abdomen a little clavate, somewhat recurved, the supraanal plate triangular, of about equal length and breadth, the apex bluntly pointed, the sides very nearly straight, with a slight transverse median ridge not reaching the sides; furcula formed of two rather distant, nearly straight, subconical processes, scarcely reaching the transverse ridge; cerci simple, conical, scarcely curved, tapering more on the basal than the apical half, about half as long as the supraanal plate; subgenital plate broader than long, the lateral and apical margins on the same plane, well rounded or feebly angulate apically, entire, the lateral margins incurved basally.

The general color above is either a very pale brownish yellow or a brownish griseous; below dirty yellow with a greenish tinge; antennae fulvous, lutescent basally, darker apically; a broad blackish fuliginous belt runs from behind the eye across the lateral lobes of the pronotum, generally broadening slightly and fading a little on the metazona. The pleura are marked as in *M. texanus* and the tegmina are unicolorous and of the color of the disk of the pronotum. The hind femora partake of

the color of the upper surface of the body and have faint fuscous indications of bifasciation above; hind tibiae glaucous, but at the base yellowish with a glaucous or fusco-glaucous annulation; spines black with a pallid base, usually eleven in number in the outer series. The upper surface and sides of the abdomen are uniform in tint, the sides unmarked by any black band.

Length of body, male, 19 mm., female, 27 mm.; antennae, male, 7.75 mm., female, 8 mm.; tegmina, male, 5 mm., female, 6 mm.; hind femora, male, 10.25 mm., female, 14 mm.

Ten males, 21 females. Texas, Belfrage (U.S.N.M.—Riley collection); Dallas, Texas, Boll (same; S. H. Scudder).

In general appearance and in most points of its structure this species resembles *M. discolor*. It may at once be distinguished from it by the shape of the tegmina and the male cerci and by the color of the hind tibiae.

67. MELANOPLUS PUER.

(Plate XVII, fig. 2.)

Pezotettix puer SCUDDER! (pars), Proc. Bost. Soc. Nat. Hist., XIX (1877), p. 87; (pars), Entom. Notes, VI (1878), p. 28.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Brownish fuscous with a ferruginous tinge. Head feebly prominent, yellowish brown, heavily mottled with dusky brown in small spots, often deepening (especially above) to blackish brown; vertex feebly tumid, elevated but slightly above the pronotum, the interspace between the eyes narrow, not (male) or scarcely (female) broader than the first antennal joint; fastigium very steeply declivent, deeply sulcate throughout; frontal costa narrow, scarcely wider than the interspace between the eyes, equal, percurrent, sulcate at and below the ocellus; eyes large and prominent, in the male as high as the vertex, much larger than the infraocular portion of the genae; antennae castaneous, gradually infuscated apically, nearly three fourths (male) or nearly two-thirds (female) as long as the hind femora. Pronotum brownish yellow, more or less infuscated above, regularly expanding posteriorly, very slightly in the male, noticeably in the female, the disk feebly convex transversely and passing by a tolerably distinct but smoothed angle into the vertical lateral lobes, which in the male are marked with an exceptionally large piceous spot on the upper portion of the prozona, especially on the anterior section—a mark which is only indicated in the female in dull fuscous and is much broken or subobsolete; median carina equally distinct throughout; front and hind margins truncate, the latter distinctly emarginate in the middle; prozona longitudinal, nearly twice as long as the more finely punctate metazona. Prosternal spine rather short, erect, lobate, very strongly appressed, well rounded, the posterior face flat; interspace between mesosternal lobes slightly longer than broad (male) or quadrate (female), the metasternal lobes subattingent (male) or approximate (female). Teg-

mina brownish fuscous, minutely flecked with fuscous in the interstices of the crowded veins, obovate, well rounded, twice as long as broad, lateral, widely separated, hardly longer than the prozona. Legs variable in color but generally dull yellowish brown, the hind femora generally bifasciate with fuscous above besides the black geniculation; hind tibiae at base and at tip dull yellow mottled with brown, the rest purplish glaucous, the spines black beyond the base, nine to ten, usually ten, in number in the outer series. Extremity of male abdomen hardly clavate, not at all recurved, the supraanal plate triangular with slightly convex sides and acutangulate apex, tectate but with elevated lateral margins forming large lateral sulci, the median sulcus deep, tapering, crossing the basal half of the plate; furcula consisting of a pair of minute pointed projections overlying the submedian ridges of the supraanal plate; cerci slight, styloform, slender beyond the thickened base, then scarcely tapering, gently incurved, the tip bluntly pointed; subgenital plate small, subconical, of equal breadth, somewhat longer than the apical breadth, with a slight erect tubercle.

Length of body, male, 10.5 mm., female, 16 mm.; antennae, male, 5.5 mm., female, 7 mm.; tegmina, male, 2.2 mm., female, 2.5 mm.; hind femora, male, 8 mm., female, 10 mm.

One male, 4 females. Fort Reed, Orange County, Florida, April 8-10, J. H. Comstock; Jacksonville, Duval County, Florida, November, Maynard (S. Henshaw).

This is the smallest known species of *Melanoplus*.

16. INORNATUS SERIES.

The prozona of the male is here distinctly longitudinal, and the interspace between the mesosternal lobes in the same sex quadrate, or feebly longitudinal. The hind margin of the pronotum is either truncate or very broadly obtusangulate. The tegmina are abbreviate and nearly as long as if not somewhat longer than the pronotum, sometimes rounded and sometimes subacuminate apically. The hind tibiae are generally green, and the species vary much in the number of spines in the outer series, ranging from nine to fifteen.

The supraanal plate is triangular and generally rather flat, the lateral margins hardly elevated; the furcula may be either reduced to slight prominences or produced as delicate spines crossing the basal fourth of the supraanal plate; the cerci again vary considerably, being either stout, strongly constricted in the middle and widely expanded apically, or tapering to a half or two-thirds the basal breadth and then forming a relatively slender, slightly decurved, compressed finger; the subgenital plate is narrower, generally considerably narrower, than long, with angulate, slightly elevated and tuberculate extremity.

The species are rather slender, of about medium size, and are three in number. One occurs in Mexico, a second in North Carolina, and the third in Illinois and Indiana.

68. MELANOPLUS INORNATUS, new species.

(Plate XVII, fig. 3.)

Pezotettix inornatus McNEILL!, MS.

A little above medium size, ferrugineo-testaceous. Head not prominent, ferrugineo-testaceous, a little darker above, with a broad piceous postocular band; vertex somewhat tumid, slightly elevated above the pronotum, the interspace between the eyes as broad as (male) or fully half as broad again as (female) the first antennal joint; fastigium steeply declivent, faintly and broadly sulcate; frontal costa nearly percurrent, equal, as broad as the interspace between the eyes, feebly sulcate at and below the ocellus, punctate throughout; eyes moderately large, slightly prominent in the male, only a little longer than the infraocular portion of the genae; antennae testaceous, a little infuscated apically, about three-fourths (male) or five-sevenths (female) as long as the hind femora. Pronotum subequal but feebly expanding posteriorly, the sides with a broad, piceous, postocular band confined to the prozona, the disk broadly subtectate and gently convex, passing by a tolerably abrupt shoulder, forming tolerably distinct lateral carinae at least on the posterior part of the prozona, into the anteriorly tumid subvertical lateral lobes; median carina tolerably distinct and percurrent, sharper on the metazona than on the prozona, and on the latter very feebly arched longitudinally; front margin faintly convex, hind margin very obtusangulate; prozona sparsely and very shallowly punctate and longitudinal (male) or quadrate or longitudinally subquadrate (female), about a third as long again as the closely and not very deeply punctate metazona. Prosternal spine moderate, appressed conical, retrorse, stouter in the female than in the male; interspace between mesosternal lobes somewhat longer than broad with diverging sides (male) or longitudinally subquadrate (female). Tegmina abbreviate, somewhat longer than the pronotum, overlapping, ovate-lanceolate, apically subacuminate, ferrugineo-fuscous. Fore and middle femora only a very little tumid in the male; hind femora rather slender, compressed, testaceous with a ferruginous tinge, growing flavescens inferiorly, the geniculation fuscous; hind tibiae rufo-testaceous, the spines black on the apical half, eleven to twelve in number in the outer series. Extremity of male abdomen clavate, somewhat recurved, the supraanal plate triangular with acutangulate apex, the margins not elevated, a transverse, percurrent, median plica, and a median sulcus which is triangular on the basal half, slender in the apical half, and crosses two-thirds of the plate; furcula consisting of the feebly projecting lobular expansions of the inner extremities of the divided lateral halves of the last dorsal segment; cerci rather large and clepsydral, strongly contracted before the middle, the basal portion tapering but slightly, while the larger apical portion expands greatly, especially above, the rounded tip

thus reaching the extremity of the supraanal plate; subgenital plate small, moderately broad but much narrower than long, the apical portion a little elevated and tumid, subtuberculate.

Length of body, male, 19 mm., female, 29 mm.; antennae, male, 9 mm. (est.), female, 10 mm.; tegmina, male, 7.5 mm., female, 9 mm.; hind femora, male, 11.75 mm., female, 14 mm.

One male, 2 females. Locality unknown (J. McNeill); Montelovez, Cohahuila, Mexico, September 20, E. Palmer.

All the specimens seen have been immersed in alcohol, which may have somewhat affected their colors.

69. MELANOPLUS VIRIDIPES, new species.

(Plate XVII, fig. 4.)

Pezotettix viridipes WALSH!, MS. (1865).—BLATCHLEY, Can. Ent., XXIII (April, 1891), p. 80; *ibid.*, XXIV (1892), p. 34—undescribed.

Pezotettix viridicrus WALSH!, MS. (1865).

Pezotettix viridulus [by error for *viridicrus*] McNEILL, Psyche, VI (May, 1891), pp. 75-76.—BLATCHLEY, Can. Ent., XXIV (1892), p. 34; *ibid.*, XXVI (1894), p. 245—undescribed.

Of medium size, brownish fuscous above, flavous beneath; head not prominent, dark olivaceo-testaceous, sometimes plumbeous, above much infuscated, with a broad piceous postocular band; vertex moderately tumid, scarcely elevated above the pronotum, the interspace between the eyes half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium rather steeply declivent, distinctly (male) or shallowly (female) sulcate; frontal costa almost percurrent, slightly narrowed at upper extremity, especially in the male, otherwise equal, about as broad as the interspace between the eyes, sulcate at and below the ocellus, punctate throughout; eyes moderately large, rather prominent, particularly in the male, somewhat longer than the infraocular portion of the genae; antennae testaceous or rufo-testaceous, apically infuscated, distinctly longer than (male) or three-fourths as long as (female) the hind femora. Pronotum subequal, faintly expanding posteriorly, above ferrugineo-testaceous, sometimes infuscated, on the sides flavous or flavo-testaceous below, but the upper portion wholly occupied by a very broad, percurrent, piceous, postocular band, broadening slightly on the metazona, the disk convex and passing by a slight shoulder into the anteriorly tumid vertical lateral lobes; median carina distinct though rather slight on the metazona and, in the female at least, on the front of the prozona, elsewhere obsolete or subobsolete; front margin faintly convex, and in the male with a scarcely perceptible emargination, hind margin rotundato-obtusangulate, almost subtruncate; prozona distinctly (male) or faintly (female) longitudinal, about half as long again as the densely but not deeply punctate metazona. Prosternal spine short and rather stout, conical; interspace

between mesosternal lobes quadrate (male) or very transverse but narrower than the lobes (female). Tegmina abbreviate, generally a little longer than the pronotum, slightly overlapping, elliptical, apically rounded, more than twice as long as broad, brownish fuscous. Fore and middle femora considerably tumid in the male; hind femora moderately slender, flavous, sometimes more or less ferruginous, obliquely bifasciate with brownish or blackish fuscous, with a large blackish genicular patch; hind tibiae pale green or glaucous, pallid or pale flavous at the base, with a dusky patellar spot, the spines black in more than the apical half, nine to ten in number in the outer series. Extremity of male abdomen clavate, much recurved, the supraanal plate triangular with acutangulate apex, rather flat, the median sulcus broad, equal, shallow and percurrent, lying between low ridges which, as well as the sulcus, are interrupted mesially; furcula consisting of a pair of small, distant, triangular denticulations; cerci long and rather slender, erect and gently incurved, tapering gradually from base to middle, which is about two-thirds as broad as the base, beyond almost equal but feebly enlarged, slightly produced inferiorly at the apex, and the whole apical subequal portion feebly decurved; subgenital plate somewhat longer than broad, subequal, apically elevated slightly and produced to a delicate conical tubercle.

Length of body, male, 16 mm., female, 21.5 mm.; antennae, male, 9.5 mm., female, 9 mm.; tegmina, male, 5 mm., female, 5.25 mm.; hind femora, male, 8.5 mm., female, 11.75 mm.

Twelve males, 13 females. Illinois, Uhler; Rock Island, Illinois, Walsh; Moline, Rock Island County, Illinois, J. McNeill; Ogle County, Illinois, June 20, J. A. Allen; Rivière de Parc, June 14, L. Bruner; Vigo County, Indiana, May 25, June 8, 11, Blatchley (W. S. Blatchley; A. P. Morse). A specimen in the U. S. National Museum from Montana perhaps belongs here.

It has also been reported by McNeill from McLean County, Illinois, and Monroe County, Indiana.

This species is remarkable for the length of the antennae. It matures very early, McNeill having taken it as early as June 5 in Illinois, where he thinks it is the first Orthopteron to mature from eggs of the same season. Blatchley records it in Indiana even as early as May 11. McNeill says "it is by no means common, . . . being restricted to a few localities [about Moline]. It shows a decided preference for the sides of open, grassy ravines." One specimen before me is marked by Blatchley as found in woods.

The species has never before been described, but has been mentioned by Walsh's names in several publications; the specific name "viridulus" used on one or two occasions was a misreading of Walsh's name "viridicus," and probably originally due to bad chirography on my part.

70. MELANOPLUS DECORUS, new species.

(Plate XVII, fig. 5.)

Of medium size, very slender and elongate, brownish fuscous with a ferruginous tinge above, flavous beneath. Head not at all prominent, olivaceo-flavous more or less infuscated, above fuscous, with a broad piceous postocular band; vertex hardly at all tumid, not raised above the level of the pronotum, scarcely or not reaching the level of the upper arch of the eyes, the interspace between the eyes very narrow, hardly as broad as the first antennal joint; fastigium steeply declivent, feebly sulcate, oblong obpyriform; frontal costa percurrent, equal, scarcely broader than the interspace between the eyes, feebly sulcate at and below the ocellus, faintly punctate; eyes large, very prominent, nearly twice as long as the infraocular portion of the genae; antennae testaceous at base. Pronotum long, equal, with a scarcely perceptible expansion of the metazona, brownish fuscous above, flavous or flavo-testaceous on the sides, with a rather broad, percurrent, piceous, postocular band, narrower on the metazona than on the prozona, the disk considerably convex and passing with only a feeble shoulder into the vertical lateral lobes; median carina distinct, sharp, equal, percurrent; front margin feebly convex with the faintest possible emargination, hind margin subtruncate; prozona very longitudinal, nearly twice as long as the densely and sharply punctate metazona. Prosternal spine moderate, slender, conico-cylindrical, blunt, erect; interspace between mesosternal lobes a little longer than broad. Tegmina abbreviate, shorter than the pronotum, attingent or subattingent, ovate, well rounded apically, less than twice as long as broad, brownish fuscous. Fore and middle femora somewhat tumid in the male; hind femora flavous, sometimes more or less ferruginous, the whole geniculation except the apical portion of the lower lobe black; hind tibiae pale greenish or pale glaucous, the spines black to their base, fourteen to fifteen in number in the outer series. Extremity of male abdomen considerably clavate, recurved, the supraanal plate clypeate with rectangulate tip, raised and sinuate lateral margins, a narrow, deep, percurrent, median sulcus, the walls of which are hardly elevated into ridges, and an apical pair of short, convergent, blunt ridges; furcula consisting of a pair of basally attingent, divergent, slender, tapering, acuminate fingers, crossing rather more than a fourth of the supraanal plate: cerci composed of a moderately broad, rapidly tapering, slightly tumid, basal portion, about one-third of the whole, and a very slender, subequal, gently arcuate, incurved, and apically faintly expanding portion, hardly more than a third as broad as the base, inferiorly angulate at tip and reaching about to the tip of the supraanal plate: subgenital plate small, greatly tapering, so as to be very narrow at tip, the apical margin considerably elevated to form a delicate tubercle.

Length of body, male, 17.5 mm.; tegmina, 4 mm.; hind femora, 9.5 mm. Two males. Dingo Bluff, North Carolina, November 15, Parker-Maynard.

In general appearance this insect has a strong resemblance to *M. attenuatus* from the same region.

17. FASCIATUS SERIES.

This group is not very homogeneous, comprising forms of considerable difference in appearance and structure, but which have a number of important points in common. It is composed in part of brachypterous and in part of macropterous forms. One species is dimorphic in this respect, and the others, whether macropterous (one only) or brachypterous (six in number), are exceptionally short-winged or exceptionally long-winged for their type. The antennae are very variable in length, being sometimes quite similar, sometimes quite dissimilar, in the two sexes and varying in the male from three-fifths as long as the hind femora to equal their length, and in the female from one-half to four-fifths the length of the hind femora. In size they range from very small to a little above the medium.

The prozona of the male varies from quadrate to longitudinal in both brachypterous and macropterous forms. The interspace between the mesosternal lobes in the same sex is also very variable in each set of forms, and in both together ranges from a little transverse to twice as long as broad. The tegmina in the brachypterous forms are usually comparable with the length of the pronotum and are well rounded, but in the dimorphic form they are apically subacuminate and twice as long as the pronotum (as in one of the brachypterous forms) or far surpass the hind femora and are broad and well rounded apically; while in the single macropterous form they barely reach the tip of the hind femora. The hind tibiae are likewise very variable in color, sometimes within the species, and have from nine to twelve, usually eleven, spines in the outer series.

The supraanal plate is generally rather long triangular, and rather flat, with but feebly elevated margins, except in one instance, where it is strongly compressed apically. The furcula is usually very feebly developed, but three species have slender fingers extending some distance over the supraanal plate. The cerci are rather large, compressed, generally incurved laminae, generally of considerable breadth, but in one instance exceptionally slender, generally more or less constricted mesially, in two species greatly, and, with a single exception, enlarged again apically, rounded and not acuminate (in one species emarginate) at tip. The subgenital plate again varies much, but is always longer than broad, generally moderately broad and nearly equal and usually a little elevated apically, the apical margin always entire.

The eight species have as little geographical as structural relation. One is known only from the extreme north in Labrador and Greenland;

two from Florida only; another only from Oregon and Washington; a fifth from Kentucky; a sixth from North Carolina; a seventh from Indiana, Texas, and, perhaps, Carolina; while the eighth occurs across the continent from Newfoundland and New Jersey in the east to Washington in the west, and from the Saskatchewan to Colorado.

The most aberrant member of the series is *M. borealis*. None of them are likely to be confounded.

71. MELANOPLUS ATTENUATUS, new species.

(Plate XVII, fig. 6.)

Of medium size and very slender, light ferrugineo-fuscous. Head rather prominent, flavo-testaceous, fuscous above, with a broad piceous postocular band; vertex moderately tumid, a little elevated above the pronotum, the interspace between the eyes about as broad as the first antennal joint; fastigium steeply declivent, distinctly but not deeply sulcate; frontal costa percurrent, subequal, faintly narrower above, slightly broader than the interspace between the eyes, faintly depressed at the ocellus, punctate throughout, biserially above; eyes large, very prominent, nearly twice as long as the infraocular portion of the genae; antennae fusco-testaceous, fully four-fifths as long as the hind femora. Pronotum subequal, faintly expanding on the metazona, ferrugineo-testaceous more or less infuscated above, flavous or fusco-flavous on the sides, with a broad, piceous, postocular band confined to the prozona, the disk gently convex, passing by a rather broadly rounded shoulder into the anteriorly tumid vertical lateral lobes; median carina distinct, percurrent, equal; front margin feebly convex, hind margin subtruncate; prozona very longitudinal, nearly twice as long as the sharply and densely punctate metazona. Prosternal spine rather long, feebly conical, very blunt, erect; interspace between mesosternal lobes somewhat longer than broad. Tegmina abbreviate, a little shorter than the pronotum, attingent or subattingent, elliptical, broadly rounded apically, a little less than twice as long as broad, fusco-testaceous. Fore and middle femora somewhat tumid in the male; hind femora slender, light ferruginous, dull flavous beneath, the genicular arc and a basal bar on the lower genicular lobes blackish fuscous; hind tibiae very pale green apically, pale ferrugineo-flavous basally, the spines black nearly to their base, twelve to fourteen in number in the outer series. Extremity of male abdomen clavate, considerably recurved, the supraanal plate long triangular, a little and narrowly compressed just beyond the base, the tip acutangulate but well rounded, the lateral margins somewhat elevated, the median sulcus lying between sharp but not high walls in the basal two-thirds of the plate, beyond which are a pair of more distant, short, subparallel, blunt, longitudinal ridges; furcula consisting of a pair of very slender, tapering and acuminate, divergent fingers, crossing scarcely the basal fourth of the supraanal plate; cerci very slender and

elongate, apically strongly incurved fingers, tapering uniformly to the middle so as to be there less than half as broad as at base, then slightly enlarging to form an apical rounded lobe a little more than half as broad as the base, expanding below more than above, the apical margin rounded but sometimes feebly emarginate so as to appear faintly bifid; subgenital plate rather small and very narrow, narrowing apically, the apical margin well rounded, faintly and broadly tuberculate.

Length of body, male, 19.5 mm.; antennae, 9.5 mm.; tegmina, 4.25 mm.; hind femora, 11 mm.

Three males. Smithville, Brunswick County, North Carolina, November 22, Maynard.

This can not be the *Pezotettix longicornis* of Saussure, described from Carolina, from its lack of distinct lateral carinae and its convex pronotal disk.

72. MELANOPLUS AMPLECTENS, new species.

(Plate XVII, fig. 7.)

A little above medium size, luteo-testaceous. Head a little prominent, luteo testaceous, above very broadly and feebly striped with fuscous, with a broad, piceous, postocular band; vertex somewhat tumid, somewhat elevated above the pronotum, the interspace between the eyes about half as broad again as the first antennal joint; fastigium steeply declivent, angularly sulcate throughout; frontal costa fading just before the clypeus, subequal, slightly broader than the interspace between the eyes, feebly sulcate at and below the ocellus, sparsely and finely punctate throughout; eyes large, very prominent, considerably longer than the infraocular portion of the genae; antennae luteous, a little infuscated apically, fully five-sixths as long as the hind femora. Pronotum subequal, the sides of the prozona with a broad fuscous postocular band, the disk broadly convex, passing by an abrupt rounded shoulder into the anteriorly feebly tumid, vertical, lateral lobes; median carina distinct and sharp on the metazona, feeble but tolerably sharp and equal on the prozona; front margin faintly convex and faintly and narrowly emarginate, narrowly flaring feebly, hind margin broadly obtusangulate; prozona distinctly longitudinal, more than half as long again as the sharply but not very closely punctate metazona. Prosternal spine rather long, conical, a little retrorse, the hinder face straight; interspace between mesosternal lobes nearly half as long again as broad. Tegmina abbreviate, but reaching nearly to the middle of the hind femora, slender lanceolate, the tip very bluntly subacuminate, brownish fuscous deepening above to blackish on the lateral face, cinereous on the dorsal face. Fore and middle femora somewhat tumid in the male; hind femora luteo-testaceous, broadly and almost completely bifasciate with blackish fuscous, which is angularly disposed on the outer face, the whole geniculation blackish fuscous, the inferior face luteous; hind tibiae luteo-flavous, infuscated at base, the spines black almost or quite to their very base, twelve to

fourteen in number in the outer series. Extremity of male abdomen clavate, considerably recurved, the supraanal plate long triangular, a little narrowed at the tip, with an acutangulate apex, the lateral margins elevated to the same height as the sharp and high parallel ridges bounding the median sulcus, which unite just beyond the middle of the plate, and are crossed at the middle by a straight transverse ruga which does not reach the margins; furcula consisting of a pair of minute black denticulations overlying the submedian ridges of the supraanal plate; cerci broad at base, rapidly narrowing to the middle, mainly by the excision of the inferior margin, beyond again expanding as rapidly and nearly as much, and at the same time curved abruptly inward, the apical flange broadly rounded at tip, compressed, and at extreme apex curved abruptly backward; subgenital plate moderately broad, the apical margin broadly and considerably elevated, entire.

Length of body, male, 19.5 mm.; antennae, 10.5 mm.; tegmina, 7.5 mm.; hind femora, 12.5 mm.

One male. Bee Spring, Edmonson County, Kentucky, June 14-15, F. G. Sanborn (Museum Comparative Zoology).

The specimen was formerly in alcohol, which has probably somewhat affected the colors. The clasping form of the cerci has suggested the specific name.

73. MELANOPLUS SALTATOR, new species.

(Plate XVII, fig. 8.)

Pezotettix borckii SCUDDER!, Rep. U. S. Ent. Comm., II (1881), App., p. 24, pl. XVII, fig. 17.—BRUNER!, Bull. Div. Ent. U. S. Dep. Agric., IV (1884), p. 58; Can. Ent., XVII (1885), p. 12.

Ferrugineo-fuscous. Head not prominent, almost wholly fuscous above, the face and genae luteo-testaceous, punctate and more or less marmorate with fuscous; vertex slightly tumid, feebly elevated above the pronotum, the interspace between the eyes broad, two (male) or three (female) times as broad as the basal antennal joint; fastigium considerably declivent, its lateral margins feebly (female) or considerably (male) elevated, but not otherwise sulcate; frontal costa subequal but feebly enlarging from above downward, slightly narrower than the interspace between the eyes, feebly sulcate (if at all) only at and below the ocellus, punctate; eyes moderate in size, not prominent, about as long as the infraocular portion of the genae; antennae ferruginous, often a little infuscated apically, fully two-thirds as long as the hind femora in both sexes. Pronotum subequal, feebly enlarging posteriorly at least in the female, the disk transversely convex and passing almost insensibly into the subvertical lateral lobes, the lower part of the latter of a little lighter color, and the upper part crossed on the prozona by a broad piceous yet often obscure band, which occasionally in the female passes, broadened and diffused, upon the metazona; median carina slight but distinct throughout, feebler on the prozona than on the metazona; front margin truncate or subtruncate, hind margin rotundato-obtusangulate: prozona

quadrate or subquadrate, slightly longer than the closely punctate metazona, the sulcus between them very broadly obtusangulate by wide emargination of the prozona. Prosternal spine long, subcylindrical, blunt, erect; interspace between mesosternal lobes twice as long as broad (male) or a little transverse, narrower than the lobes (female), the metasternal lobes subattingent (male) or tolerably distant (female). Tegmina slightly overlapping (male) or attingent (female), ovate, rather broad, shorter than the pronotum, uniform brownish fuscous. Femora rufescent or fusco-luteous, the fore pair and to some extent the middle pair tumescent in the male, the hind pair more or less but obscurely infuscated in premedian and postmedian bands, which are angulate on the outer face and generally more or less confused; their lower face, especially exteriorly, more or less ferruginous, the geniculation mostly fuscous; hind tibiae generally dull red, more or less feebly flecked or obscured basally with fuscous, sometimes plumbeo-glaucous, the spines rather short and black throughout, eleven to twelve, usually eleven, in number in the outer series. Extremity of male abdomen strongly clavate, much recurved, the supraanal plate abruptly and obliquely contracted laterally in the apical half so as to make the shape somewhat clypeate, the lateral margins raised only in the apical half and here forming between them a dorsal channel which nearly continues, but is a little wider than, the basal median sulcus, which is rather deeply impressed but between walls which rise but little above the otherwise nearly plane surface; furcula consisting of a pair of minute, sometimes scarcely perceptible, distant denticulations on the outer side of the submedian ridges of the supraanal plate; cerci large and stout, elongated, compressed laminae, mesially narrowed so that the apical portion is subspatulate though not so broad as the base, gently incurved, the tip rounded but distinctly produced inferiorly, reaching the tip of the supraanal plate; subgenital plate moderately broad, a little longer than broad, the lateral and apical margins slightly flaring, the latter elevated, well rounded and entire.

Length of body, male, 20 mm., female, 25.5 mm.; antennae, male, 8.5 mm., female, 10 mm.; tegmina, male, 5 mm., female, 5.75 mm.; hind femora, male, 12 mm., female, 13.75 mm.

Ten males, 14 females. Portland, Multnomah County, Oregon, Packard (U.S.N.M.—Riley collection; S. H. Scudder); Oregon City, Clackamas County, Oregon, July, W. G. W. Harford; Soda Springs, Yakima County, Washington, Wickham (L. Bruner); Loon Lake, Colville Valley, Washington, July 23, S. Henshaw (Museum Comparative Zoology).

It is stated by Bruner that this species is "to be met with in the mountains of Montana, Idaho, and Wyoming," and it "appears to abound only where two or three particular plants are met with, one of which is a species of geranium."

The female of this species closely resembles the same sex of *M. borckii*, but has relatively longer antennae, about as long as those of the male, and the tegmina are shorter and more strongly rounded at tip.

74. MELANOPLUS ROTUNDIPENNIS.

(Plate XVII, fig. 9.)

Pezotettix rotundipennis SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1877), pp. 86-87; Ent. Notes, VI (1878), pp. 27-28.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Head flavo-testaceous, the summit deeply infuscated, the whole more or less mottled with small fuscous spots; antennae dull brownish red, apically infuscated, at base paler, four-fifths as long as the hind femora. Pronotum above brownish fuscous mottled slightly with dusky yellow, the median carina black; lateral lobes brownish yellow below, above occupied by a broad piceous stripe, running from the eyes nearly to the middle of the abdomen, broader and with vague boundaries on the abdomen and partially interrupted by a slender, oblique, brownish yellow stripe on the crest of the metathoracic episterna. Tegmina but little longer than broad, hardly longer than the prozona, rotund, ovate, black concealed by profuse rufous veins. Legs dull yellowish brown, the middle and hind femora heavily spotted with black, the hind tibiae dull fusco-glaucous, pale at base, the spines black beyond the pallid base, twelve in number in the outer series.

Head not prominent; vertex slightly tumid, a little elevated above the pronotum, the interspace between the eyes scarcely so broad as the basal joint of the antennae; fastigium steeply declivent, shallowly and broadly sulcate in advance of the eyes; frontal costa moderately broad, as broad as the interspace between the eyes, shallowly sulcate throughout, slightly and regularly expanding below, obsolescent next the clypeus; eyes large and prominent, nearly twice as long as the infraocular portion of the genae. Pronotum broadening slightly and regularly throughout, the prozona distinctly longitudinal, almost twice as long as the metazona, its surface very faintly and very sparsely punctate, the median carina sharp but slight and equal; metazona with the median carina not sharp but rather inconspicuous, the surface of the lobe both above and on the sides delicately rugulose; lateral carinae wholly obsolete, the nearly plane disk passing by a well rounded angle into the lateral lobes; both front and hind margins subtruncate, the latter minutely emarginate in the middle. Prosternal spine not very long, appressed cylindrical, very blunt, a little retrorse; interspace between mesosternal lobes about twice as long as broad. Extremity of male abdomen tumid, strongly upcurved; supraanal plate triangular with subrectangulate apex, the sides gently convex, gently upturned, the median sulcus extremely broad, short and shallow; furcula consisting of the slightly produced inner angulation of the widely parted and diverging halves of the last dorsal segment; cerci rather stout but laminate, tapering at the very base, beyond nearly equal, moderately broad, directed inward and backward and bent obliquely a little down-

ward, at the tip slightly expanded, well rounded and scarcely thickened; subgenital plate very small, subpyramidal, a little longer than broad, of subequal breadth, the apical margin slightly elevated and a little full, entire.

Length of body, male, 15.5 mm.; antennae, 8 mm.; tegmina, 3 mm.; hind femora, 10 mm.

One male. Jacksonville, Duval County, Florida, May 6, J. H. Comstock.

75. MELANOPLUS OBOVATIPENNIS.

(Plate XVII, fig. 10.)

? *Pezotettix longicornis* SAUSSURE, Rev. Mag. Zool., 1861 (1861), p. 159; Orth. Nov.

Amer., II (1861), p. 9.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 150.—

BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

? *Podisma longicornis* WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 718.

Pezotettix rotundipennis BLATCHLEY!, Can. Ent., XXIII (1891), p. 80.

Pezotettix obovatipennis BLATCHLEY!, Can. Ent., XXVII (1894), pp. 241-243.

Brownish fuscous, with a ferruginous tinge. Head prominent, particularly in the male, varying from plumbeo-olivaceous to ferrugineo-testaceous, often much flecked with fuscous, and above almost wholly fusco-ferruginous or fuscous; vertex rather tumid, elevated a little above the pronotum, the interspace between the eyes rather broad, nearly twice (male) or more than twice (female) as broad as the first antennal joint; fastigium steeply declivent, plane (female) or broadly and shallowly sulcate, or at least with feebly raised lateral margins (male); frontal costa equal or subequal, slightly narrower than the interspace between the eyes, percurrent, very feebly (female) or distinctly (male) sulcate at and below the ocellus, punctate; eyes large, prominent at least in the male, much larger than the infraocular portion of the genae; antennae luteo-ferruginous, apically infuscated, as long (male) or more than three-fourths as long (female) as the hind femora. Pronotum rather long, faintly (male) or distinctly (female) enlarging posteriorly with much regularity, the disk blackish fuscous (male) or fusco-ferruginous (female), the lateral lobes below pallid¹ (male) or luteo-testaceous (female), and above with a broad piceous band which broadens and becomes feebler on the metazona; disk broadly convex transversely, passing by a distinct though smoothed angle into the subvertical lateral lobes; median carina equally distinct throughout, scarcely blunter on the prozona than on the metazona; front margin truncate, hind margin subtruncate (male) or truncate (female); prozona longitudinal (female) or very longitudinal (male), fully (male) or nearly (female) twice as long as the distinctly and closely punctate metazona. Prosternal spine moderately long, a little appressed conical, blunt, erect; interspace between mesosternal lobes about half as long again as broad (male) or distinctly transverse, only

¹ Ivory white, according to Blatchley, who has seen them in fresh condition.

a little narrower than the lobes themselves (female). Tegmina broad ovate, shorter than the pronotum, well rounded, varying from a little longer than broad to fully half as long again as broad, lateral, never attinent, uniform brownish fuscous. Mesothoracic epimera piceous and conspicuous from the light color of the thoracic episterna, which is that of the lower portion of the lateral lobes. Fore femora of male very feebly tumescent; hind femora ferruginous, more or less cinereous on the outer face and more or less infuscated on apical half, with feeble cloudy indications of bifasciate fuscous or deeper ferruginous markings on the upper face, the under surface luteo-rufous, the geniculation black or blackish; hind tibiae olivaceous, often more or less infuscated, occasionally red, with a subbasal pallid annulus, the spines black beyond the pallid base, nine to twelve in number in the outer series. Extremity of male abdomen a little clavate, well recurved, the supraanal plate long triangular with slightly convex sides, the margins broadly and feebly raised, the median sulcus percurrent but contracted beyond the middle, before that rather deep, with sharp but not greatly elevated walls; furcula consisting of a pair of approximate, somewhat diverging, cylindrical, tapering, slender, acuminate fingers, reaching a little more than one-third way across the supraanal plate; cerci rather slender, mesially contracted to nearly half the extreme basal width by the arcuation of the upper margin, the lower border being straight, beyond the middle somewhat enlarged again, the apex roundly truncate, the whole gently incurved, nearly reaching the tip of the supraanal plate; infracereal plate almost as long as the supraanal, apically broad; subgenital plate small, almost as broad as long, the apical margin not elevated, well rounded as viewed from above, entire.

Length of body, male, 16 mm., female, 29 mm.; antennae, male, 10 mm., female, 10.25 mm.; tegmina, male, 3.5 mm., female, 4.25 mm.; hind femora, male, 10 mm., female, 13.25 mm.

Twelve males, 14 females. Vigo County, Indiana, W. S. Blatchley (A. P. Morse; S. H. Scudder); High Bridge, Jessamine County, Kentucky, October 15, H. Garman; near Mammoth Cave, Kentucky, October 2, Putnam (Museum Comparative Zoology); St. Louis, Missouri (U.S.N.M.—Riley collection); Dallas, Texas (U.S.N.M.—Riley collection; L. Bruner).

Blatchley also reports it from Monroe County, Indiana, and if Sausure's species is the same it is also found in Carolina. Blatchley says "it reaches maturity about September 1, and frequents for the most part high, dry, open woods, especially those in which beech and oak trees predominate . . . In late October, if the season is dry, it is often found . . . among the reeds and tall rank grasses near the border of marshes."

76. MELANOPLUS JUVENCUS, new species.

(Plate XVIII, fig. 1.)

Pezotettix puer SCUDDER! (pars), Proc. Bost. Soc. Nat. Hist., XIX (1877), p. 87;
(pars), Ent. Notes, VI (1878), p. 28.

Brownish fuscous with a ferruginous tinge. Head not prominent, luteo-testaceous with an olivaceous tinge, flecked feebly with fuscous, above deeply infuscated; vertex feebly tumid, scarcely raised above the level of the pronotum, the interspace between the eyes no wider than the first antennal joint; fastigium steeply declivent, sulcate throughout; frontal costa narrow, no wider than the interspace between the eyes, equal, percurrent, distinctly sulcate excepting above, punctate; eyes large, prominent, much longer than the infraocular portion of the genae; antennae dull luteous at base, growing rufescent beyond, apically infuscated, about three-fifths as long as the hind femora. Pronotum subequal, the disk nearly plane but very broadly tectate, passing by an abrupt angle, forming a distinct lateral carina, into the slightly tumid, subvertical lateral lobes, which are marked above on the prozona by an exceptionally broad piceous belt, broader on the anterior than on the posterior section; median carina equally distinct throughout; front and hind margins truncate, the latter feebly emarginate in the middle; prozona longitudinal, very sparsely punctate, almost twice as long as the finely but obscurely ruguloso-punctate metazona. Prosternal spine short, lobate, appressed, very blunt, suberect; interspace between mesosternal lobes a little longer than broad, the metasternal lobes approximate. Tegmina obovate, well rounded, twice as long as broad, longer than the head and pronotum together, attingent, uniform dark castaneous. Fore femora feebly tumescent; hind femora rufo luteous, olivaceous on the outer face, rather broadly and transversely bifasciate with fuscous, the whole geniculation blackish; hind tibiae pale, rather dingy greenish, with a lutescent basal annulus, the spines black almost or quite to the base, ten in number in the outer series. Extremity of male abdomen slightly clavate, a little upturned, the supraanal plate rather long triangular, the lateral margins slightly elevated, a pair of short, distant, apical ridges, and the median sulcus rather deep and conspicuous between sharp and rather high walls extending beyond the middle of the plate; furcula consisting of a pair of slight denticulations overlying the bases of the submedian ridges of the supraanal plate; cerci long and rather slender, tapering in the basal third only, beyond equal nearly to the tip, which is rounded but unequally curved, forming a blunt angle inferiorly, the whole fully four times as long as the median breadth, yet scarcely surpassing the tip of the supraanal plate, gently incurved apically, the whole lower margin straight; subgenital plate small, considerably longer than broad, broader at base than at apex, the apical margin neither elevated nor prolonged, well rounded but feebly angulate, entire.

Length of body, male, 17 mm.; antennae, 4.75 mm.; tegmina, 4.75 mm.; hind femora, 8 mm.

One male. Fort Reed, Orange County, Florida, April 8, J. H. Comstock.

I carelessly included this in *Pezotettix puer* when originally described, but the description shows that it could not then have been examined carefully, for it differs obviously both in the male cerci and in the tegmina.

77. MELANOPLUS FASCIATUS.

(Plates I, fig. c; XVIII, figs. 2-4.)

Pezotettix borealis SCUDDER!, Can. Nat., VII (1868), p. 286; Bost. Journ. Nat. Hist., VII (1868), p. 464.—SMITH, Proc. Portl. Soc. Nat. Hist., I (1868), p. 149.—PACKARD, Guide Ins. (1869), p. 569.—THOMAS, Proc. Acad. Nat. Sc. Philad., 1870 (1870), p. 78; Ann. Rep. U. S. Geol. Surv. Terr., II (1871), p. 265; Rep. U. S. Geol. Surv. Terr., V. (1873), p. 153.—SCUDDER!, Hitche. Rep. Geol. N. H., I (1874), p. 374; Daws. Geol. Rec. 49th Par. (1875), p. 343.—BRUNER, Can. Ent., IX (1877), p. 144.—THOMAS, Bull. U. S. Geol. Surv. Terr., IV (1878), p. 484.—GIRARD, Traité Élém. d'Ent., II (1879), p. 246.—SCUDDER, Can. Ent., XII (1880), p. 75.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59; Rep. U. S. Ent., 1885 (1886), p. 307.—CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), p. 71; Can. Rec. Sc., II (1887), p. 401; Can. Orth. (1887), p. 13.—FERNALD, N. E. Orth. (1888), pp. 29, 30; Ann. Rep. Mass. Agric. C XV (1888), pp. 113, 114.—MORSE, Psyche, VII (1894), pp. 53, 106.

Acridium fasciatum BARNSTON, MS., vide WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 680.

Caloptenus fasciatus WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 680; Can. Ent., IV (1872), p. 30.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 224.—CAULFIELD, Can. Rec. Sc., II (1887), p. 401; Can. Orth. (1887), p. 14.

Melanoplus rectus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1878), pp. 284, 285; Ent. Notes., VI (1878), pp. 43, 44; Proc. Bost. Soc. Nat. Hist., XX (1879), p. 71; Cent. Orth. (1879), p. 60.—BRUNER, Rep. U. S. Ent. Comm., III (1888), p. 60.—FERNALD, Orth. N. E. (1888), pp. 31, 32; Ann. Rep. Mass. Agric. Coll., XXV (1888), pp. 115, 116.—MORSE, Psyche, VII (1894), p. 53.

Melanoplus curtus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 70-71; Cent. Orth. (1879), p. 59.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 61; Can. Ent., XVII (1885), p. 17; Publ. Nebr. Acad. Sc., III (1893), p. 28.—MORSE, Psyche, VII (1894), p. 53.

Melanoplus fasciatus CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), p. 71.

Melanoplus borealis BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI (1894), p. 308.

Of rather small size, dark fusco-plumbeous above, dark clay yellow below. Head not prominent, dull plumbeous flecked with griseous, above very dark fuscous with a broad postocular piceous band; vertex moderately tumid, distinctly elevated above the pronotum, the interspace between the eyes as broad (male) or nearly half as broad again (female) as the basal antennal joint; fastigium strongly declivent, shallowly depressed, but with distinct and somewhat abrupt though rounded bounding walls, which diverge a very little in front of the eyes and then converge; frontal costa as broad as the interspace between the eyes, scarcely contracted above where its face is plane (male) or feebly

tumid (female), at and below the ocellus rather narrowly sulcate, deeper in the male than in the female, percurrent, punctate; eyes rather small, not prominent, longer than the infraocular portion of the genae; antennae ferruginous, growing lutescent toward the base, dusky toward the tip, nearly or quite as long (male) or about two-thirds as long (female) as the hind femora. Pronotum subequal, feebly expanding posteriorly especially in the female, the disk plano-convex, separated by a well-rounded but distinct shoulder from the vertical lateral lobes, brownish fuscous, sometimes fusco-testaceous and then generally punctate with ferruginous, the upper part of the lateral lobes with a broad piceous band crossing the prozona and sometimes continued as a feeble dusky cloud on the metazona; front border truncate, hind border broadly obtusangulate, the angle rounded; median carina distinct only on the metazona and at the front of the prozona, elsewhere obsolete or sub-obsolete; prozona feebly longitudinal (male) or feebly transverse (female), a very little longer than the minutely rugulose metazona. Prosternal spine short, stout, blunt, conical, erect; interspace between mesosternal lobes nearly half as long again as broad (male) or considerably transverse but shorter than the lobes (female). Tegmina either abbreviated, being one and a half to two and a half times as long as the pronotum and not nearly reaching the tips of the hind femora, tapering considerably beyond the basal expansion, sublanceolate and bluntly subacuminate (*M. f. curtus*); or far surpassing the hind femora, broad and subequal, very feebly tapering in the apical half and well rounded at tip (*M. f. rotaticus*, Plate I, fig. *c*), wholly brownish fuscous or cinereo-fuscous, occasionally maculate to a greater or less degree, but generally slightly in the discoidal area, the anal area sometimes more cinereous than the rest, especially apically; wings in both forms hyaline with a scarcely perceptible yellowish tint, more or less densely but always feebly infumated at the tip, the veins and cross veins of the apical half blackish fuscous. Hind femora relatively longer in the female than in the male, dull luteo-testaceous, black at apex and at extreme base and bifasciate with black or blackish fuscous more or less broadly and obliquely, rarely transversely, the whole often confused and more or less blended on the outer face; beneath pale or dull reddish; hind tibiae red, usually growing paler toward the base and sometimes almost wholly pale greenish luteous, feebly reddening apically, the base generally pale or at least paler, with a small fuscous patellar spot, the spines black except at extreme base, nine to twelve, generally eleven, in number in the outer series. Extremity of male abdomen strongly clavate, well upturned, the supraanal plate long triangular with well rounded acutangulate apex, the apical half depressed to a slightly lower plane, with a broad, equal, deep, median sulcus, bounded by high and sharp walls in a little more than the basal half; furcula consisting of a pair of minute, parallel, distant, tubercular teeth, twice as long as broad, resting outside the ridges of the supraanal plate; cerci simple, straight, and subequal, being contracted a little in the

middle, about four times as long as the mean breadth, directed upward and backward, and the apical upper third incurved and externally tumid, the tip broadly rounded and often feebly downcurved; infracercal plates of the same length as the supraanal; subgenital plate pretty broad and subequal but longer than broad, the apical margin somewhat elevated, well rounded, entire. Basal tooth of lower valves of ovipositor sharp, prominent, triangular, but much longer than broad.

Length of body (*M. f. curtus*), male, 18.5 mm., female, 22 mm.; antennae, male, 10 mm., female, 8 mm.; tegmina, male, 10 mm., female, 9.75 mm.; hind femora, male, 10 mm., female, 11.75 mm. Length of body (*M. f. volaticus*), male, 19 mm., female, 20 mm.; antennae, male, 9.75 mm., female, 7.75 mm.; tegmina, male, 17.5 mm., female, 17 mm.; hind femora, male, 11 mm., female, 12 mm.

One hundred and thirty-five males, 192 females. Loon Lake, Colville Valley, Washington, July 23, S. Henshaw (Museum Comparative Zoology); Laggan, Alberta, Bean; The Pas, Saskatchewan River, Rapids of the Saskatchewan River and Point Wigwam, Lake Winnipeg, Scudder (Museum Comparative Zoology; S. H. Scudder); Custer, Black Hills, South Dakota, Bruner (U.S.N.M.—Riley collection); Harneys Peak, Black Hills, South Dakota, 7,000 to 8,000 feet, Bruner (same); Colorado, 5,500 feet, Morrison; Colorado, Alpine, September (U.S.N.M.—Riley collection); Eagle Lake, Missouri, Packard (Museum Comparative Zoology); Charlevoix, Michigan, July 25, Walcott (L. Bruner); Nain, Labrador, W. M. Reed; Salmonier, Newfoundland, in sphagnum swamps, August 11–15, R. Thaxter; Anticosti, A. E. Verrill, August 1 (Museum Comparative Zoology); Moosehead Lake, Maine; Norway, Oxford County, Maine, S. I. Smith; Speckled Mountain, Stoneham, Oxford County, Maine, August 15, 18 (A. P. Morse; Museum Comparative Zoology); Mount Sargent, Mount Desert Island, Maine, August; Bethlehem, Grafton County, New Hampshire, August 11–24 (S. Henshaw); White Mountain valleys, New Hampshire, late July (S. Henshaw; S. H. Scudder); Mount Kearsarge, New Hampshire, 2,000 feet (A. P. Morse); Lynnfield, Essex County, Massachusetts, August 11 (S. Henshaw); Winchendon, Worcester County, Massachusetts, July 4–5 (A. P. Morse); Warwick, Franklin County, Massachusetts, Miss A. M. Edmonds (Museum Comparative Zoology); Dover, Norfolk County, Massachusetts, June 26 (same); Dedham, Norfolk County, Massachusetts, June 14, July 17 (same); Milton and Blue Hills, Norfolk County, Massachusetts, August 14 (S. Henshaw); Concord, Middlesex County, Massachusetts; Waltham, Middlesex County, Massachusetts, July 24, September 5, 9 (A. P. Morse; S. Henshaw); Sherborn, Middlesex County, Massachusetts, June 25, July 12, 15, August 6 (A. P. Morse; Museum Comparative Zoology); Sudbury, Middlesex County, Massachusetts, July 10 (A. P. Morse); Belmont, Middlesex County, Massachusetts, August (same); Melrose, Middlesex County, Massachusetts, July 23 (S. Henshaw); Forest Hills, Suffolk County, Massachusetts, June 24 (same);

Jamaica Plain, Suffolk County, Massachusetts, August 13, 16 (S. Henshaw; S. H. Scudder); Cape Cod, Massachusetts; Provincetown, Barnstable County, Massachusetts, September 5 (A. P. Morse; Museum Comparative Zoology); West Chop, Marthas Vineyard, Massachusetts, July 4-30, August 2-6 (A. P. Morse); Thompson, Windham County, Connecticut, August 4 (same). A specimen (female) in the National Museum, from Alaska perhaps belongs here.

The species has also been reported from Montana (Thomas), northwest Nebraska (Bruner), Souris River, Assiniboia (Scudder), Lake of the Woods, Manitoba (Caulfield), Minnesota (Scudder), mountains east of Middle Park, Colorado (Thomas), and New Jersey (Beutenmüller). It therefore occurs in a broad belt along our northern border from the Atlantic nearly or quite to the Pacific.

As seen in the above description, the species occurs in two forms, a moderately short-winged form, to which the name *M. f. curtus* (Plate XVIII, figs. 2-3) may be given (it was once described as *curtus*); and a very long and broad winged form, which may be called *M. f. volaticus* (Plates I, fig. c; XVIII, fig. 4). The latter is known only from Michigan, and was brought to my attention by Professor Bruner.

During a recent visit to London, Mr. Samuel Henshaw, to whom I had given specimens of this species for the purpose, verified by comparison with the types in the British Museum their identity with Walker's *Caloptenus fasciatus*.

78. MELANOPLUS BOREALIS.

(Plates I, fig. d; XVIII, fig. 5.)

Gryllus grønlandicus KOLLAR, MS., Mus. Vien. (1853), fide FIEBER, Lotos, III, p. 120.

Caloptenus borealis FIEBER, Lotos, III (1853), p. 120; Syn. Eur. Orth. (1854), p. 20.—BRUNNER, Verh. Zool.-Bot. Gesellsch. Wien, 1861 (1861), p. 223; Orth. Stud. (1861), p. 3.—WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 678; Can. Ent., IV (1872), p. 30.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 227.—BRUNER, U. S. Ent. Comm., III (1883), p. 59.—CAULFIELD, Can. Rec. Sc., II (1887), p. 401; Can. Orth. (1887), p. 14.

Pezotettix septentrionalis SAUSSURE, Rev. Mag. Zool., 1861 (1861), p. 159; Orth. Nov. Amer., II (1861), p. 10.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 222.—SCUDDER, Can. Ent., XII (1880), p. 75.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 58.—CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), p. 71; Can. Rec. Sc., II (1887), p. 401; Can. Orth. (1887), p. 13.—MORSE, Psyche, VII (1894), p. 53.

? *Caloptenus arcticus* WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), pp. 681-682; Can. Entom., IV (1872), p. 30.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 226.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.—CAULFIELD, Can. Rec. Sc., II (1887), p. 401; Can. Orth. (1887), p. 14.

Podisma septentrionalis WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 718; Can. Ent., IV (1872), p. 30.

Melanoplus borealis CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), p. 71.—SCUDDER!, Psyche, VII (1895), p. 320.

? *Melanoplus arcticus* CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), p. 71.

Ferrugineo-fuscous. Head not at all prominent, very sparsely pilose, rufo testaceous, sparsely punctate over the whole face and genae and

feebly flecked with fuscous; vertex very feebly tumid, not elevated above the pronotum, the interspace between the eyes rather broad, half as broad again (male) or more than twice as broad (female) as the first antennal joint; fastigium moderately declivent, distinctly (male) or very feebly and broadly (female) sulcate throughout; frontal costa about as broad as the interspace between the eyes, subequal, percurrent, plane (male) or convex (female) above, the puncta biserially disposed, feebly sulcate at and below the ocellus; eyes not large nor prominent, barely exceeding in length the infraocular portion of the genae; antennae ferruginous, increasingly infuscated beyond the middle, nearly three fourths (male) or scarcely one-half (female) as long as the hind femora. Pronotum short, regularly and noticeably narrowing from behind forward by the gradual constriction of the upper portion, the lateral lobes being steeply and obliquely declivent on the prozona, vertical on the metazona, separated from the nearly plane disk by a tolerably sharp but rounded angle; median carina distinct and sharp on the metazona, indistinct and blunt on the prozona, subobsolete between the sulci; front margin faintly convex, hind margin obtusangulate, the angle rounded; prozona darker on the disk than the metazona, and on the lateral lobes furnished with a broad piceous postocular band, the disk quadrate (male) or transverse (female), scarcely (male) or not (female) longer than the subruguloso-punctate metazona. Prosternal spine moderately long, appressed conico-cylindrical, blunt, retrorse (male) or short, stout, strongly appressed cylindrical, blunt, suberect (female); interspace between mesosternal lobes feebly transverse, narrower than the lobes themselves in both sexes. Tegmina attaining the tips of the hind femora, moderately broad, tapering, well rounded apically, ruddy fuscous, with feeblest possible sparse maculation in the discoidal area; wings not very broad, pellucid, with apically fuscous veins. Fore femora of male scarcely tumescent; hind femora dull ferruginous, broadly bifasciate with blackish fuscous, often more or less confluent on the outer face, the genicular arc black; hind tibiae red, the spines black throughout, ten to eleven in number in the outer series. Extremity of male abdomen clavate, upturned, the supraanal plate long triangular, the apex acutangulate, the basal half of the sides turned upward and in the middle contracted, with a broad, deep, triangular sulcus in the basal half, bounded by high but rounded walls which unite in the middle of the plate; furcula consisting of a pair of adjacent, parallel, slender, tapering, acuminate, slightly depressed fingers, nearly reaching the middle of the supraanal plate; cerci feebly falciform, tapering a little in less than the basal half, the tip a little produced but rounded, the outer surface plane and rather coarsely punctate, not attaining the tip of the supraanal plate; subgenital plate moderately broad, but considerably longer than broad, apically elevated and prolonged, the apical margin broadly rounded, subtransverse, and entire.

Length of body, male, 18 mm., female, 24 mm.; antennae, male, 7.5

mm., female, 6 mm.: tegmina, male, 14 mm., female, 15 mm.; hind femora, male, 10.2 mm., female, 12.2 mm.

Seven males, 6 females. Coast of Labrador, beyond the timber line, at latitude 59° north, Jewell D. Sornberger (specimens collected in spirits).

Fieber also reports it from Greenland and North Cape, Norway. It is, however, not included in the European fauna either by H. Fischer or by Brunner von Wattenwyl; yet Fieber credits specimens to the Vienna Museum, in which city Brunner lives. Hofrath Brunner writes me that he possesses specimens from Labrador, Hudson Bay, and Valdivia, Chile. I can not forbear expressing a doubt about the accuracy of this last locality.

As *Melanoplus* and *Podisma* are the genera of Melanopli most abundant in forms and most widely spread, the former being especially true of *Melanoplus*, and as the present form is the species of *Melanoplus* most nearly allied to *Podisma*, and, like most of the species of the latter genus, is peculiar to high latitudes or altitudes, it seems proper to regard *M. borealis* as an archaic form, perhaps more nearly than any other resembling the original form from which the Melanopli as a whole have descended.

Mr. Samuel Henshaw recently compared for me a female specimen of this species from Labrador with Walker's type of *Caloptenus arcticus* in the British Museum. He found them to agree except in length of wings, which in Walker's specimen, a unique, "extend slightly beyond the abdomen;" the prosternal spine was the same. I have accordingly introduced it in the synonymy with a question mark; if it belongs here the range of the species should be extended to whatever point it may have been in "Arctic America" that Doctor Rae collected his specimen.

The specimens which I have seen were taken by Mr. Sornberger August 15-16 at the Esquimaux village of Rama. He tells me that they were all taken on the banks of a mountain brook fed by the melting snows of the summit near by. They were most abundant where the vegetation was most luxuriant at the borders of the brook; none were found below an elevation of 200 feet nor above 1,500 feet, at which altitude herbaceous plants became few and scattering. Mr. Sornberger can not say upon what it fed, but it was not found on any of the shrubby plants common there—*Betula*, *Vaccinium*, *Ledum*, *Salix*, *Empetrum*, etc., though he thinks he saw it on some of the Cyperaceae.

18. ALLENI SERIES.

In this small series the prozona of the male is slightly longitudinal, and the interspace between the mesosternal lobes in the same sex only a little longer than broad. The antennae are very long. The tegmina are always abbreviate, but vary considerably, being either elliptical, attingent, and about as long as the pronotum, or lanceolate, overlapping and reaching a little beyond the middle of the hind femora. The

latter are rather short, and the hind tibiae either red or glaucous, with nine to eleven spines in the outer series.

The supraanal plate is triangular, with raised margins; the furcula consists of a pair of slight and distant or very distant projections; the cerci are stout and heavy, two or three times as long as broad, mesially contracted and apically angulate; the subgenital plate is broad, broader than long by the greater or less elevation of the entire and well-rounded apical margin.

There are but two species known, of medium size, one from New Mexico and the other from Iowa and Dakota.

79. MELANOPLUS ALLENI, new species.

(Plate XVIII, fig. 6.)

Of medium size, blackish fuscous, with a ferruginous tinge. Head not prominent, ferrugineo-testaceous more or less infuscated, above with a broad, enlarging, median, fuscous stripe, and a broad piceous postocular band; vertex rather tumid, a little elevated above the pronotum, the interspace between the eyes fully half as broad again as the first antennal joint; fastigium rapidly declivent, very feebly and very broadly sulcate; frontal costa percurrent, subequal, a little narrower above, about as broad as the interspace between the eyes, feebly sulcate at and below the ocellus, biserially punctate above; eyes rather large and prominent, much longer than the infraocular portion of the genae; antennae ferruginous, almost as long as the hind femora. Pronotum subequal but slightly enlarging on the metazona, with a broad piceous postocular band confined to the prozona, but sometimes appearing very faintly on the metazona, the disk broadly convex and passing by a rounded shoulder nowhere forming lateral carinae into the anteriorly faintly tumid vertical lateral lobes; median carina distinct on the metazona, subobsolete or obsolete on the prozona; front margin truncate, hind margin very obtusangulate; prozona longitudinally subquadrate, about a third longer than the densely and finely punctate metazona. Prosternal spine short, stout, conical; interspace between mesosternal lobes slightly longer than broad. Tegmina moderately abbreviate, reaching a little beyond the middle of the hind femora, moderately broad at base, tapering distinctly and pretty uniformly to a strongly rounded tip, ferrugineo-fuscous. Fore and middle femora considerably tumid in the male; hind femora moderately short but not very stout, flavo-testaceous, obliquely bifasciate with fuscous, the under surface pale carmine, the whole geniculation fuscous; hind tibiae pale red, infuscated at base with a pale annulus beyond, the spines black beyond their base, ten to eleven in number in the outer series. Extremity of male abdomen clavate, strongly recurved, the supraanal plate triangular, with acutangulate apex, feebly and narrowly compressed mesially, with a transverse median plica, the margins broadly and considerably elevated, the median sulcus percurrent between moderately

high and rather sharp walls; furcula consisting of a pair of minute, distant denticulations; cerci moderately broad and stout at base, gradually narrowing to two-thirds the width in the middle, beyond very faintly enlarging, the tip rounded but slightly angulate, the whole suberect, feebly incurved, and only apically strongly compressed, fully as long as the supraanal plate; subgenital plate as broad as long by the considerable rounded elevation of the apical margin, which has a scarcely perceptible thickening, is entire, and, as seen from above, regularly and strongly arcuate, with no lateral angles, the base of the lateral margins rectangulate, slightly incurved.

Length of body, male, 17 mm.; antennae, 10 mm.; tegmina, 9 mm.; hind femora, 10.75 mm.

Two males. Crawford County, Iowa, July 13-24, J. A. Allen; explorations in Dakota under General Sully, S. M. Rothhammer.

This species is very closely related to *Mel. fasciatus*, but has an apically broader, less thickened, and regularly arcuate subgenital plate, and slightly different cerci, these being considerably broader at base than apically. It is named for my ornithological friend, Mr. J. A. Allen, of the American Museum of Natural History, who many years ago obtained for me much of the material on which this memoir is based.

80. MELANOPLUS SNOWII, new species.

(Plate XVIII, fig. 7.)

Of medium size, moderately stout, dark brownish fuscous. Head not prominent, pallid testaceous more or less begrimed with fuscous, above almost wholly fuscous, separated by a pallid testaceous streak from the broad piceous postocular band; vertex somewhat tumid, elevated slightly above the pronotum, the interspace between the eyes nearly (male) or fully (female) half as broad again as the first antennal joint; fastigium gently declivent, broadly and in the female slightly sulcate; frontal costa fading before the clypeus, equal, nearly (male) or quite (female) as broad as the interspace between the eyes, feebly sulcate at and briefly below the ocellus, punctate throughout; eyes moderately large, moderately and in the two sexes equally prominent, but little longer than the infraocular portion of the genae; antennae basally ferruginous. Pronotum feebly and gradually enlarging from in front posteriorly, the disk blackish fuscous with lateral stripes of pallid testaceous at least in the male, the lateral lobes testaceous or ferruginous, with a very broad piceous postocular band confined to the prozona; disk considerably convex, passing by a slight shoulder (better marked in the female than in the male and forming feeble lateral carinae) into the tumid but inferiorly vertical lateral lobes; median carina low but tolerably distinct, equal, percurrent; front margin truncate, hind margin rotundato-obtusangulate; prozona longitudinal (male) or quadrate (female), nearly a half (male) or about a fourth (female) longer than the shallowly but closely punctate metazona. Prosternal spine stout and not

very long, appressed conical, blunt, erect; interspace between mesosternal lobes a little longer than broad (male) or distinctly transverse but narrower than the lobes (female). Tegmina abbreviate, about as long as the pronotum, attingent, elliptical, but attenuate basally, well rounded apically, a little less than twice as long as broad, dark brownish fuscous. Fore and middle femora somewhat tumid in the male; hind femora not very slender, blackish fuscous on the upper two-thirds of the outer face inclosing a small median testaceous spot, fuscous on the upper face externally, with the outer carina dull flavous, the inner face and inner half of upper face flavous more or less broadly bimaculate or bifasciate with fuscous, the lower third of outer face flavous, becoming pale orange below like the lower face, the genicular arc black and the lower genicular lobe more or less infuscated; hind tibiae pale red or glaucous, pallid at extreme base, the spines black on the apical half, nine to eleven in number in the outer series. Extremity of male abdomen strongly clavate, strongly recurved, the supraanal plate concealed in the single specimen seen; furcula consisting of a pair of very distant, very slight, parallel spines, shorter than the last dorsal segment; cerci large and broad, wholly inbent, subequal laminae, somewhat and not very broadly constricted in the middle, the apical portion as broad as and longer than the basal, and broadly and angularly sulcate, apically angulate, the whole somewhat more than twice as long as broad; subgenital plate somewhat longer than the basal breadth, subequal except for the elevation of the apical margin, which, as seen from above, is transverse, entire, and makes the apical breadth equal to the length.

Length of body, male, 17.5 mm., female, 22.5 mm.; tegmina, male and female, 4.5 mm.; hind femora, male and female, 11 mm.

One male, 1 female. Magdalena, Socorro County, New Mexico. July, F. H. Snow (University of Kansas).

The antennae of both specimens are imperfect. The species is named for Chancellor F. H. Snow, of the University of Kansas, and Mr. W. A. Snow, of the same institution, father and son, entomologists of note.

19. FEMUR-RUBRUM SERIES.

This is a dominant and homogeneous group of medium or rather small-sized species, in which the male prozona varies from slightly transverse to slightly longitudinal, and the interspace between the mesosternal lobes in the same sex is as in the *spretus* series. The tegmina are always fully developed or a little abbreviated (so as to fall a little short of the tip of the hind femora), immaculate or slightly maculate along the middle line. The hind tibiae are normally red and have ten to fourteen spines in the outer series.

The supraanal plate is clypeate, longer than broad and mesially constricted. The furcula consists of a pair of parallel or nearly parallel, long or moderately long, generally separated, slender, tapering, subcylindrical fingers or spines. The cerci are compressed subfalcate

laminae, the apical half generally about half as broad as the base, arcuate and with the upper inner portion of the tip produced. The subgenital plate is peculiar for being very broad at base and narrowing so as to be at apex only about half as broad as at base (which does not show in the figures), the whole lower margin nearly straight while the upper is sinuous, the apical margin not elevated, entire (in one species very broadly and shallowly emarginate, or rather laterally tuberculate) and, as viewed above, broadly rounded.

The species, five in number, are spread all over the continent from Atlantic to Pacific, from central Labrador to central Florida, and from central Alaska, the Mackenzie River and Hudson Bay to Texas and central Mexico; they also extend to high altitudes above the forest line. No other series of *Melanoplus* has quite so wide an area of distribution, the *bivittatus* series, however, approaching it closely.

31. MELANOPLUS PLUMBEUS.

(Plate XVIII, fig. 8.)

Caloptenus plumbum DODGE!, Can. Ent., IX (1877), p. 112.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 42.—BRUNER, *ibid.*, III (1883), p. 60.

Melanoplus plumbeus BRUNER, Bull. Div. Ent. U. S. Dep. Agric., XVIII (1893), pp. 32-33, fig. 16; Publ. Nebr. Acad. Sc., III (1893), p. 28.

Of medium size, very dark fusco-olivaceous, with bright luteous or flavous markings. Head feebly prominent, mostly luteous or flavous, more or less infuscated above and especially clouded or flecked with fuscous along the lateral margins of the fastigium and posterior to them, and with a blackish postocular band; vertex somewhat tumid, the interspace between the eyes nearly (male) or more than (female) half as broad again as the first antennal joint; fastigium steeply declivent, feebly expanding anteriorly, shallowly sulcate throughout; frontal costa somewhat prominent above, slightly contracted between the antennae, otherwise subequal and as wide as the interspace between the eyes, hardly reaching the clypeus, feebly sulcate at and below the ocellus, biserially punctate throughout; eyes moderately large, not very prominent, distinctly longer, especially in the female; than the infraocular portion of the genae; antennae more or less ferruginous, apically infuscated, less than three-fourths (male) or hardly more than one-half (female) as long as the hind femora. Pronotum subequal, very feebly and uniformly expanding posteriorly, especially in the female, the disk dark fusco-olivaceous, with a slender, median, flavous stripe and more or less distinct lateral stripes of the same upon the carinae, expanding upon the metazona, the lateral lobes mostly flavous (sometimes obscured with fuscous), the prozona marked above with a broad piceous band; disk nearly plane, passing by abruptly rounded shoulders, hardly forming true carinae, into the vertical lateral lobes; median carina distinct but slight throughout, hardly less elevated on the prozona; front margin truncate, hind margin obtusangulate; prozona

quadrate or feebly longitudinal (male) or a little transverse (female), scarcely or not longer than the closely punctate metazona. Prosternal spine moderately long, erect, cylindrical, in the female slightly appressed, blunt; interspace between mesosternal lobes fully half as long again as broad (male) or feebly transverse (female). Tegmina generally surpassing a little the hind femora, of moderate breadth, distinctly tapering, olivaceo-fuscous, immaculate or with a feeble line of minute maculations along the discoidal area; wings hyaline, glistening and iridescent, with pale fuscous veins darker next the apex. Fore and middle femora scarcely tumid in the male; hind femora blackish olivaceous on the outer face excepting sometimes on the lower margin, elsewhere flavous or luteo-flavous, with two broad blackish olivaceous maculations above, especially on the inner side; hind tibiae feebly valgate, red, the spines black excepting at base, eleven to thirteen in number in the outer series. Extremity of male abdomen considerably clavate, somewhat recurved, the supraanal plate subclypeate but mesially contracted, apically rectangulate, the margins considerably elevated, forming deep valleys between them and the opposite curved ridges bordering the median sulcus; the latter is deep, gradually contracts toward the middle and then rapidly expands and shallows (in the specimen chosen for illustration the apical portion is concealed); furcula consisting of a pair of basally adjacent, apically tapering, parallel, acuminate fingers, nearly half as long as the supraanal plate, lying in the valleys of the same; cerci subfalceiform lamellae, which taper rapidly in the basal half and beyond are less than half as broad, slightly incurved and upcurved, apically tapering by the curve of the lower margin, the tip blunt and falling short of the extremity of the supraanal plate; subgenital plate broad at base, narrowing rapidly, the extremity hardly more than half as broad as the base, the lateral margins strongly arcuate, the apical margin even, entire, well rounded.

Length of body, male 20 mm., female 25 mm.; antennae, male 8.5 mm., female 6.75 mm.; tegmina, male 17 mm., female 17.5 mm.; hind femora, male 12 mm., female 13.25 mm.

Fifteen males, 29 females. Colorado, 5,500 feet, Morrison (S. Henshaw; S. H. Scudder; U.S.N.M.—Riley collection); Pueblo, Colorado, 4,700 feet, August 30–31; Colorado Springs, El Paso County, Colorado, August, E. S. Tucker (University of Kansas); Manitou, El Paso County, Colorado (L. Bruner); Topeka, Shawnee County, Kansas, October 31; Nebraska, Dodge.

Dodge originally described it from Glencoe, Dodge County, Nebraska, and it has since been recorded by Bruner from Canyon City, Fremont County, Colorado, and the plains of Wyoming.

This species, especially in life, is strikingly different from the next two in coloring, though the male abdominal appendages are exceedingly similar. According to Bruner it is more clumsy in its movements than *M. femur-rubrum*.

82. MELANOPLUS FEMUR-RUBRUM.

(Plates I, fig. *h*; XIX, figs. 1-4.)

- Acridium femur-rubrum* DE GEER!, Mém. Hist. Ins., III (1773), p. 498, pl. XLII, fig. 5.—GOEZE, De Geer, Gesch. Ins., III (1780), p. 324, pl. XLIII, fig. 5.—HARRIS, Hitche. Rep. Mass. (1833), p. 583; *ibid.*, 2d ed. (1835), p. 576; Cat. Anim. Mass. (1835), p. 56; Treat. Ins. Inj. Veg. (1841, 1842), p. 141; *ibid.*, 2d ed. (1852), p. 151; *ibid.*, 3d ed. (1862), p. 174.
- Gryllus (Locusta) femur-rubrum* GOEZE, Ent. Beytr., II (1778), p. 115.
- Gryllus (Locusta) erythropus* GMELIN, Linn., Syst. Nat., I, Pt. IV (1788), p. 2086.
- Acridium femorale* OLIVIER, Enc. Méth., VI (1791), p. 228.
- Gryllus erythropus* TURTON, Syst. Nat. Linn., II (1806), p. 568.
- Caloptenus femur-rubrum* BURMEISTER, Handb. Entom., II (1838), p. 638.—PACKARD, Rep. Nat. Hist. Me., 1861 (1861), p. 374.—SCUDDER, Can. Nat., VII (1862), p. 287; Bost. Journ. Nat. Hist., VII (1862), p. 464.—WALSH, Trans. Ill. St. Agric. Soc., V (1865), p. 497; Pract. Ent., II (1866), p. 1.—GLOVER, Rep. U. S. Dep. Agric., 1867 (1867), p. 65.—PACKARD, Amer. Nat., I (1867), p. 330.—SCUDDER, Proc. Bost. Soc. Nat. Hist., XII (1868), p. 87.—SMITH, Proc. Portl. Soc. Nat. Hist., I (1868), p. 150.—WALSH, Rep. Ins. Ill., I (1868), p. 99.—WALSH, RILEY, Amer. Ent., I (1868), p. 16.—PACKARD, Guide Ins. (1869), p. 569.—R[ATHVON], Amer. Ent., II (1869-70), p. 88.—WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 678.—GLOVER, Rep. U. S. Dep. Agric., 1870 (1870), p. 76, fig. 32; *ibid.*, 1871 (1871), p. 78, fig. 12.—KÖPPEN, Peterm. Geogr. Mitth., 1871 (1871), p. 361.—THOMAS, Ann. Rep. U. S. Geol. Surv. Terr., II (1871), p. 265; (pars), *ibid.*, V (1872), p. 451.—DODGE, Can. Ent., IV (1872), p. 15.—SMITH, Rep. Conn. Bd. Agric., 1872 (1872), pp. 362, 381, fig.—WALKER, Can. Ent., IV (1872), p. 30.—LEBARON, Ann. Rep. Nox. Ins. Ill., II (1872), p. 158.—SCUDDER, Fin. Rep. U. S. Geol. Surv. Nebr. (1872), pp. 250, 252, 253-257.—GLOVER, Ill. N. A. Ent., Orth. (1872), pl. v, fig. 11, pl. VIII, fig. 2; Rep. U. S. Dep. Agric., 1872 (1872), p. 121; *ibid.*, 1873 (1873), p. 136, fig. 6.—THOMAS (pars), Rep. U. S. Geol. Surv. Terr., V (1873), p. 163.—PACKARD, Amer. Nat., VIII (1874), p. 502.—RILEY, Ann. Rep. Ins. Mo., VII (1875), p. 126, figs. 26, 29.—BETHUNE, Ann. Rep. Ent. Soc. Ont., 1874 (1875), fig. 33.—THOMAS, Key Ill. Orth. (1875), p. 3; Proc. Dav. Acad. Sc., I (1876), p. 260; Bull. Ill. Mus. Nat. Hist., I (1876), p. 68.—WHITMAN, Grasshopper (1876), pp. 18-19, 2 figs.—RILEY, Rep. Ins. Mo., VIII (1876), pp. 114-118, 153; *ibid.*, IX (1877), p. 86; Loc. Plague (1877), pp. 14-17, 27, figs. 1, 4.—BESSEY, Bienn. Rep. Iowa Agric. Coll., VII (1877), p. 209.—PACKARD, Amer. Nat., XI (1877), p. 422.—RILEY, *ibid.*, XI (1877), p. 665.—BRUNER, Can. Ent., IX (1877), p. 144.—THOMAS, Rep. Ent. Ill., VI (1877), p. 45; Bull. U. S. Geol. Surv. Terr., IV (1878), p. 499; Rep. U. S. Ent. Comm., I (1878), pp. 50-52; Ann. Rep. Chief Eng., 1878 (1878), p. 1845.—PACKARD, Rep. U. S. Ent. Comm., I (1878), pp. 77, 135, [141-144].—RILEY, *ibid.*, I (1878), pp. 220, 224, 225, 226, 284, 299, 444-446, 447, 458, pl. II; Amer. Nat., XII (1878), p. 285.—THOMAS, Rep. Ent. Ill., VII (1878), pp. 35, 38-40, figs. 5, 7.—GIRARD, Traité élém. d'ent., II (1879), p. 248.—RILEY, Amer. Ent., III (1880), p. 220.—THOMAS, Rep. Ent. Ill., IX (1880), pp. 91, 95-96, 124-126, figs. 22-23; Rep. U. S. Ent. Comm., II (1881), pp. 106-107.—PACKARD, Amer. Nat., XV (1881), pp. 285-302, 372-379, pl. I; Nat. Leis. Hour, V (1881), No. 4, p. 8, figs.—BOWLES, Ann. Rep. Ent. Soc. Ont., 1880 (1881), p. 29, fig. 11.—LINTNER, Ins. Clover (1881), p. 5; Ann. Rep. Ins. N. Y., I (1882), p. 7, fig. 3b.—GRATACAP, Amer. Nat., XVI (1882), p. 1022.—BRUNER, Rep. U. S. Ent. Comm., III (1883), pp. 10, 14, 54.—SAUNDERS, Ins. Inj. Fruit (1883), p. 157, fig. 164.—OSBORN, Bull. Iowa Agric. Coll., Dept. Ent., II (1884), p. 83.—BRUNER, Rep. U. S. Ent., 1884 (1885), p. 399.—CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), pp. 66, 67, fig. 20.—COOK, Ent. Amer., I (1886), p. 209; Beal's Grasses N. A., I

(1887), pp. 373, 396, 409, fig. 157.—RILEY, *Ins. Life*, I (1888), p. 87.—WEED, *Bull. Ohio Exp. St., Techn. Ser.*, I (1889), p. 40.—LUGGER, *Rep. Agric. Exp. St. Minn.* (1889), p. 339, figs. 12, 14; *Bull. Agric. Exp. St. Minn.*, VIII (1889), pp. 32, 33, pl. II.—MANN, *Proc. Ent. Soc. Wash.*, II (1890), p. 73.—PACKARD, *Ins. Inj. For.* (1890), p. 513.—RILEY, *Bull. Div. Ent. U. S. Dep. Agric.*, XXV (1891), pp. 27-28, fig. 5.—OSBORN, *Goss, Bull. Iowa Exp. St.*, XIV (1891), p. 175.—HOWARD, *Ins. Life*, VII (1895), p. 274.—WILLCOX, *Bull. Mus. Comp. Zool.*, XXVII (1895), pp. 9-28, pls. III-V; *ibid.*, XXIX (1896), pp. 193-203, pls. I-III.

Acridium (Caloptenus) femur-rubrum DE HAAN, *Bijdr. Kenn. Orth.* (1842), p. 143.—RATHVON, *Rep. U. S. Dep. Agric.*, 1862 (1862), p. 384, pl., fig. 23.

Pezotettix (Melanoplus) femur-rubrum STÅL, *Rec. Orth.*, I (1873), p. 79.

Melanoplus femur-rubrum SCUDDER!, *Hitchc. Rep. Geol. N. H.*, I (1874), p. 375; *Proc. Bost. Soc. Nat. Hist.*, XIX (1878), pp. 285, 287; *Ent. Notes*, VI (1878), pp. 44, 46; *Rep. U. S. Ent. Comm.*, II (1881), App., p. 24.—BRUNER, *ibid.*, III (1883), p. 60; *Can. Ent.*, XVII (1885), p. 17; (pars), *Bull. Washb. Coll.*, I (1885), p. 137.—FLETCHER, *Rep. Ent. Can.*, 1885 (1885), p. 10, fig. 2.—CAULFIELD, *Can. Ent.*, XVIII (1886), p. 212.—RILEY, *Rep. U. S. Ent.*, 1885 (1886), p. 233.—BRUNER, *ibid.*, 1885 (1886), pp. 303, 307; *Bull. Div. Ent. U. S. Dep. Agric.*, XIII (1887), p. 33; *Rep. Ent. Soc. Ent. U. S. Dep. Agric.*, 1888 (1888), p. 88, fig. 5.—CAULFIELD, *Rep. Ent. Soc. Ont.*, XVIII (1888), p. 71.—COMSTOCK, *Intr. Ent.* (1888), pp. 108, 110, figs. 83, 98.—FERNALD, *Orth. N. E.* (1888), pp. 31, 33; *Ann. Rep. Mass. Agric. Coll.*, XXV (1888), pp. 115, 117.—FLETCHER, *Rep. Exp. Farms Can.*, 1888 (1889), p. 63, fig. 6; *Ann. Rep. Ent. Soc. Ont.*, XIX (1889), p. 10, fig. 7.—RILEY, *Ins. Life*, II (1889), p. 87.—DAVIS, *Ent. Amer.*, V (1889), p. 81.—SMITH, *Cat. Ins. N. J.* (1890), p. 412.—LINTNER, *Rep. Ins. N. Y.*, VI (1890), pp. 151-153, fig. 23.—KOEBELE, *Bull. Div. Ent. U. S. Dept. Agric.*, XXII (1890), p. 94.—TOWNSEND, *Proc. Ent. Soc. Wash.*, II (1891), p. 43.—BLATCHLEY, *Can. Ent.*, XXIII (1891), p. 98.—BRUNER, *ibid.*, XXIII (1891), p. 194; *Ins. Life*, III (1891), p. 229; *ibid.*, IV (1891), p. 22; *Rep. Ent. Soc. Ont.*, XXII (1891), pp. 48-49.—SOUTHWICK, *Ins. Life*, IV (1891), p. 24.—COOK, *ibid.*, IV (1891), p. 24.—WEBSTER, *ibid.*, IV (1891), p. 24.—SOUTHWICK, *Rep. Ent. Soc. Ont.*, XXII (1891), p. 5.—COOK, *ibid.*, XXII (1891), p. 5.—WEBSTER, *ibid.*, XXII (1891), p. 5.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, XXIII (1891), p. 59.—MCNEILL, *Psyche*, VI (1891), p. 74.—OSBORN, *Goss, Bull. Iowa Agric. Exp. St.*, XV (1891), p. 267.—BRUNER, *Ann. Rep. St. Bd. Agric. Nebr.*, 1891 (1891), pp. 243, 306, fig. 80; *Bull. Div. Ent. U. S. Dep. Agric.*, XXVII (1892), pp. 24, 33.—OSBORN, *Proc. Iowa Acad. Sc.*, I, Pt. II (1892), p. 118.—KELLOGG, *Inj. Ins. Kans.* (1892), pp. 41-42.—SMITH, *Bull. N. J. Exp. St.*, XC (1892), pp. 4, 6, 31, fig. 4f.—SCUDDER, *Rep. Ent. Soc. Ont.*, XXIII (1893), p. 75.—BRUNER, *Publ. Nebr. Acad. Sc.*, III (1893), p. 28; *Rep. Nebr. St. Bd. Agric.*, 1893 (1893), pp. 458-459, fig. 98.—OSBORN, *Ins. Life*, V (1893), pp. 323-325; *ibid.*, VI (1893), pp. 80-81; *Papers Iowa Ins.* (1893), p. 57, fig. 27.—SMITH, *Ent. News*, IV (1893), p. 48.—TOWNSEND, *Ins. Life*, VI (1893), p. 31.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, XXVIII (1893), pp. 30-32, fig. 15; *ibid.*, XXX (1893), p. 35; *Rep. St. Agric. Soc. Nebr.*, 1894 (1894), pp. 163, 205, fig. 68.—ASHMEAD, *Ins. Life*, VII (1894), p. 26.—MORSE, *Psyche*, VII (1894), pp. 53, 106.—BEUTENMÜLLER, *Bull. Amer. Mus. Nat. Hist.*, VI (1894), p. 306, pl. VIII, fig. 7.—COCKERELL, *Trans. Am. Ent. Soc.*, XX (1894), p. 337.—BRUNER, *Nebr. St. Hort. Rep.*, 1895 (1895), p. 69.—COMSTOCK, *Elem. Ins. Anat.* (1895), pp. 8-27; *Man. Study Ins.* (1895), p. 110, fig. 120.—LINTNER, *Rep. St. Mus. N. Y.*, XLVIII (1895), pp. 440-443, fig. 19.—WILLCOX, *Observer*, VII (1896), pp. 184-192, figs. 1-4, 6-9, 11-16.

Caloptenus decorator SCUDDER!, *Proc. Bost. Soc. Nat. Hist.*, XVII (1875), pp. 474-475; *Ent. Notes*, IV (1875), pp. 73-74; *Cent. Orth.* (1879), pp. 18-19.—THOMAS, *Rep. U. S. Ent. Comm.*, I (1878), p. 42.

Caloptenus sanguinolentus PROVANCHER!, Nat. Can., VIII (1876), p. 109.

Caloptenus atlantis PROVANCHER!, Faune Ent. Can., II (1877), p. 35.

Pezotettix femur-rubrum STÅL, Bih. K. Sv. Vet.-Akad. Handl., V (1878), No. 9, p. 13.—FORBES, Rep. Ins. Ill., XIII (1884), pp. 62, 87, pl. x, fig. 1; *ibid.*, XIV (1885), p. 23.—WEED, Misc. Ess. Econ. Ent. Ill. (1886), p. 48.—HUNT, *ibid.* (1886), pp. 119, 126.—WEED, Rep. Ent. Ill., XV (1889), p. 40.—GARMAN, Orth. Ky. (1894), pp. 3, 8.

Melanoplus interior SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 71-72; Cent. Orth. (1879), pp. 60-61.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 61.

Melanoplus devorator SCUDDER, Cent. Orth. (1879), p. 84.

Caloptenus (Melanoplus) femur-rubrum CAULFIELD, Can. Rec. Sc., II (1887), p. 401; Can. Orth. (1887), p. 17.

Of medium size, brownish fuscous, often with a more or less feeble ferruginous tinge, particularly in the female. Head a little prominent, olivaceo-plumbeous, above much infuscated, especially in a pair of widening stripes behind the lateral margins of the fastigium, and with a piceous postocular stripe; interspace between the eyes distinctly wider than (male) or fully twice as wide as (female) the first antennal joint; fastigium strongly declivent, considerably (male) or shallowly (female) sulcate, but variable; frontal costa just failing to reach the clypeus, subequal, as broad as the interspace between the eyes, sulcate at and below the ocellus, biserially punctate above; eyes moderately prominent in the male, not at all so in the female, much longer, especially in the male, than the infraocular portion of the genae; antennae ferruginous or luteo-ferruginous, often a little infuscated apically, about four-fifths (male) or three-fifths (female) as long as the hind femora. Pronotum feebly and rather regularly expanding posteriorly, the disk faintly convex and passing by a well-rounded shoulder (somewhat abruptly on the metazona) into the anteriorly tumid vertical lateral lobes, the disk generally darker than the lower portion of the lateral lobes (occasionally by a darker punctation) sometimes irregularly marked with luteous, the upper part of the lateral lobes crossed by a broad piceous band on the prozona, the lower portion more or less closely copying the coloring of the face but usually a little darker; median carina slight, percurrent, a little (rarely much) less distinct on the prozona than on the metazona; front margin subtruncate, very faintly and very narrowly flaring, at least in the male; hind margin obtusangulate, more obtusely in the female than in the male; prozona quadrate or feebly longitudinal (male) or feebly transverse, rarely quadrate (female), slightly or not longer than the closely but shallowly punctate metazona. Prosternal spine rather large, appressed cylindrical, very blunt, often mesially constricted a little, feebly retrorse; interspace between mesosternal lobes nearly twice as long as broad (male) or a little longer than broad (female). Tegmina (Plate I, fig. *h*) almost invariably surpassing, sometimes but slightly, more often considerably, the hind femora, of moderate breadth, distinctly though very gradually tapering, brownish fuscous, sometimes immaculate, sometimes sprinkled

with fuscous dots of greater or less depth and distinctness throughout the greater part of the discoidal area, but rarely to any considerable extent or conspicuousness beyond the middle; wings moderately broad, hyaline, glistening, with fuscous veins and cross veins darkest apically and anteriorly. Thoracic pleura piceous or blackish fuscous, the metathoracic episterna with a mesial streak of flavous of greater or less clarity. Fore and middle femora distinctly but not greatly tumid in the male; hind femora olivaceo-testaceous, more or less heavily and very variably obscured or clouded with fuscous, the fuscous coloring generally confined to the upper half, and above generally concentrated in two fasciae, which sometimes extend partly in an oblique direction on the outer face, but generally in a very obscure fashion, if at all, while the whole under surface and at least the basal half of the inner surface is more or less impure flavous, sometimes deepening, especially beneath, to ferruginous or even carmine; hind tibiae normally red, sometimes with a slight fuscous patellar spot, occasionally more or less tinged with yellowish, very rarely pale green with a yellowish tinge, the spines black nearly to their base, ten to thirteen, usually eleven, in number in the outer series. Extremity of male abdomen rather strongly clavate, well recurved, the supraanal plate clypeate, strongly and rather abruptly contracted mesially, the apex subrect-angulate, the lateral margins elevated, the apical portion more or less deflexed, the median sulcus rather large, not very deep, bounded by moderate but rather abrupt walls, apically expanding and obsolescent; furcula consisting of a pair of subparallel or sometimes feebly divergent, tapering, subacuminate, apically well separated, more or less feebly depressed fingers, falling a little short of the middle of the supraanal plate, and except at extreme base lying on the outer side of the ridges bounding its median sulcus; cerci rudely subfalceiform, compressed laminae, tapering considerably and rather rapidly from base to middle, beyond that subequal but apically very obliquely truncate, so that the upper angle is considerably produced but blunt, the whole somewhat incurved and failing to reach the tip of the supraanal plate; infracercal plates exceedingly broad at base, extending laterally far beyond the sides of the cerci, as long as the supraanal plate; subgenital plate very short apically so as to be less than half the breadth of the base, the lower margin straight, the lateral margin very sinuous, the apical margin not elevated, strongly rounded, entire.

Length of body, male, 23.5 mm., female, 24.5 mm.; antennae, male, 10 mm., female, 8.5 mm.; tegmina, male, 21.5 mm., female, 19.75 mm.; hind femora, male, 13 mm., female, 14.25 mm.

Five hundred and seven males, 556 females. Halifax, Nova Scotia, H. Piers; Montreal, Canada, Caulfield; Grand Manan Island (Museum Comparative Zoology); Eastport, Washington County, Maine, Verrill (same); Moosehead Lake, Maine; Norway, Oxford County, Maine, Smith (Museum Comparative Zoology); Bridgton, Cumberland County,

Maine (S. Henshaw); York, Maine (same); Bethlehem, Grafton County, New Hampshire. L. Agassiz (Museum Comparative Zoology; S. Henshaw); White Mountains, New Hampshire, the subalpine region and valleys (S. H. Scudder; S. Henshaw; A. P. Morse); Hancock, Hillsboro County, New Hampshire (S. Henshaw); Mount Kearsarge, 2,000 to 3,251 feet (A. P. Morse); Sudbury, Rutland County, Vermont; Bridport, Addison County, Vermont, Miss A. M. Edmands (Museum Comparative Zoology); Chateaugay Lake, Adirondacks, New York, 2,000 feet, F. C. Bowditch; summit of Greylock, Berkshire County, Massachusetts (A. P. Morse; S. H. Scudder); Williamstown, Berkshire County, Massachusetts; Adams, Berkshire County, Massachusetts (A. P. Morse); Springfield, Hampden County, Massachusetts, Allen (Museum Comparative Zoology); Warwiok, Franklin County, Massachusetts, Miss A. M. Edmands (same); North Andover, Essex County, Massachusetts, Emerton (same); Salem, Essex County, Massachusetts, Kingsley (same); numerous localities in the vicinity of Boston, Massachusetts (Museum Comparative Zoology; A. P. Morse; S. Henshaw; S. H. Scudder); Provincetown, Barnstable County, Massachusetts; Nantucket, Massachusetts (S. Henshaw; S. H. Scudder); Penikese Island, Massachusetts (Museum Comparative Zoology); Canaan and South Kent, Litchfield County, Connecticut (A. P. Morse); Long Island, New York; Maryland, Uhler; Washington, D. C. (Museum Comparative Zoology; U.S.N.M.; S. Henshaw); Pattonville, Cambria County, Pennsylvania, Shaler (Museum Comparative Zoology); Vigo County, Indiana (W. S. Blatchley); Agricultural College, Mississippi, H. E. Weed; Michigan, M. Miles; Detroit, Michigan, H. Gillman; Illinois, Thomas (U.S.N.M.—Riley collection); northern Illinois, Kennicott; Ogle County, Illinois, Allen; Chicago, Cook County, Illinois; West Northfield, Cook County, Illinois, Kennicott (Museum Comparative Zoology); Moline, Rock Island County, Illinois, McNeill; southern Illinois, Barnes (Museum Comparative Zoology); Newport, Campbell County, Kentucky, Willard (Museum Comparative Zoology); Minnesota; Winnipeg, Manitoba, Kennicott; Muscatine, Iowa, Witten (U.S.N.M.—Riley collection); Dallas County, Iowa, Allen, "rather common;" Crawford County, Iowa, Allen; Brookfield, Linn County, Missouri, E. P. Austin; Bushberg, Jefferson County, Missouri (U.S.N.M.—Riley collection); St. Louis, Missouri (same; S. H. Scudder); New Madrid, Missouri, Kennicott; Boone County, Missouri (U.S.N.M.—Riley collection); Topeka, Kansas; West Point, Cuming County, Nebraska (U.S.N.M.—Riley collection); Nebraska City, Otoe County, Nebraska, Hayden; Platte River, Nebraska, Hayden; Fort Robinson, Dawes County, Nebraska (U.S.N.M.—Riley collection); Colorado (same); Denver, Colorado; Garden of the Gods, El Paso County, Colorado; Pueblo, Colorado, 4,700 feet; Garland, Costilla County, Colorado, 8,000 feet; Colorado, latitude 38°, Lieutenant Beckwith; Fruita, Mesa County, Colorado (U.S.N.M.); White River, Rio Blanco County, Colorado; Dakota, Rothhammer; Yellowstone, Hayden; Yellowstone, Montana (U.S.N.M.—Riley collection);

Montana (same); Yellowstone National Park; Salmon City, Lemhi County, Idaho (U.S.N.M.—Riley collection; L. Bruner); British Columbia and Vancouver Island, Crotch; Portland, Multnomah County, Oregon, H. Edwards (S. H. Scudder; U.S.N.M.—Riley collection); Sissons, Siskiyou County, California, Packard (same); Sierra Nevada, Wheeler's Expedition, 1876; Camp Hallock, Nevada, E. Palmer; Glenbrook, Douglas County, Nevada (U.S.N.M.—Riley collection); Utah (L. Bruner); Utah, Packard (Museum Comparative Zoology); Salt Lake Valley, Utah, 4,300 feet (S. H. Scudder; U.S.N.M.—Riley collection); Spring Lake Villa, Utah County, Utah, E. Palmer (same); Provo, Utah County, Utah; Wahsatch Mountains, near Beaver, Utah, Palmer; Fort Whipple, Yavapai County, Arizona, E. Palmer; Las Cruces, Donna Ana County, New Mexico, Cockerell (L. Bruner); Texas, Bel-fragre, Lincecum; Dallas, Texas, Boll (S. H. Scudder; U.S.N.M.—Riley collection); San Antonio, Bexar County, Texas (U.S.N.M.—Riley collection); Carrizo Springs, Dimmit County, Texas, A. Wadgymar (L. Bruner); Mexico, Botteri, Sumichrast; Guanajuato, Mexico (U.S.N.M.); Queretaro, Mexico (L. Bruner); Otoyac, Vera Cruz, Mexico, 2,700 feet (same).

It has also been reported from Arctic America¹ (Walker); Great Bear Lake¹ (Scudder); Labrador¹ (Packard); Canada (Bethune, Caulfield, Fletcher); Quebec (Provancher); Mount Ktaadn, Maine (Packard); New Jersey (Smith); Pennsylvania (De Geer); Ohio and West Virginia (Glover); Kentucky (Glover, Garman); Tennessee (De Haan), and Wyoming (Thomas). Specimens from Florida which I formerly referred to this species probably belong to the next.

It therefore appears to inhabit the entire United States and the settled parts of Canada, excepting only Alaska and also the southeastern United States (where it is replaced by the next species), and occurs south of our border as far as central Mexico.

The species described by me as *M. interior* was based upon specimens from Utah and other parts of the interior of the western country, which seem to differ from those found elsewhere in having cerci which taper more gradually and show less contrast in the width of the basal and apical halves, and at tip are blunter and less manifestly truncate, in which also the forks of the furcula are relatively longer and more strictly parallel, the tegmina rather shorter and generally lacking any maculation whatever; the prosternal spine also is more frequently compressed before the tumid tip; but on comparing a large series of specimens from these western regions I find it impossible to draw any line of demarcation, some specimens having some but not other of these characteristics, so that I can only regard the species as in a state of flux in this region, preparing, as it were, to divide into distinct races not yet clearly enough defined to distinguish them.

¹ The first three references are doubtful; they probably belong to *M. extremus*.

M. devorator was founded upon specimens of strikingly contrasted coloration found in Texas, which I have since seen from many other places; but as they are united with the type by complete series of intergrades, I am forced to conclude them to be only extreme colorational variations, which can not be dignified even as races.

Specimens with green or greenish hind tibiae have been seen by me from the alpine region of the White Mountains, New Hampshire, Cape Cod, Nantucket, Great Island, and Cambridge, Massachusetts, Utah, Carrizo Springs, Texas, and Querataro, Mexico.

There can be no doubt that this is the true *femur-rubrum* of De Geer, since Stål has described the anal cerci of the male from the type of De Geer's description, and I myself made direct comparisons with varied material when in Sweden, nearly thirty years ago.

In Hayden's report on the survey of Nebraska (1872), I collected several accounts, printed and unpublished, of the injury to crops attributed to this species in the eastern United States. As up to that time *M. atlantis* had not been distinguished from *M. femur rubrum*, it is possible, and I am now inclined to think it probable, that all the serious injury done to crops in the East is done by *M. atlantis*; for although almost everywhere less common than *M. femur-rubrum*, *M. atlantis* has been shown to have the capacity for immense multiplication, and has been directly proved to be the culprit in some instances; as it is also much more closely and indeed very closely related to the destructive locust of the West, *M. spretus*, it is far more likely to have been the actual pest in all the records of the past. At least until direct provable charges are made against it, *M. femur-rubrum* should be looked upon as less injurious than *M. atlantis*; it is especially doubtful whether it ever migrates in aerial swarms; as a general rule the tegmina and wings are longer in *M. atlantis* than in *M. femur-rubrum*, though both species vary considerably and intergrade in that particular. From measurements made on Missouri specimens, Riley found that the tegmina in the present species extended beyond the abdomen as follows: In 28 males, 0-2 mm., average, 0.8 mm.; in 54 females, 0-3 mm., average, 1.1 mm.

Bruner excellently expresses the fact when he says that the immediate distribution of this insect "appears to be controlled altogether by climatic conditions, the chief of which is the presence of a certain amount of humidity. . . . It is a frequenter of low grounds, cultivated fields, shady margins of woods, etc., where vegetation is rank and tender." It is rarely found upon dry hillsides when meadows close at hand may swarm with them, while the opposite is true of other species, *M. collinus* for instance; yet such specimens as do so occur will be found to differ from those inhabiting more favored localities, in being lighter colored and more uniformly grayish in tone, with slighter contrasts; those from drier stations appear also to have on the average rather shorter wings.

There is but a single annual brood which begins to appear full fledged in New England late in July. According to Riley, the eggs are not laid in a single mass, but at intervals in several; he has twice obtained four successive pods from a single female, covering a period of nearly two months and containing eggs amounting in all to from ninety-six to one hundred and ten. The eggs have a quadrilinear arrangement in the pods.

At Andover, Massachusetts, on October 5 many years ago I observed a pair of this species, male and female, near together alternately signaling to each other with a slight quick movement of the hind legs upon the tegmina, as if stridulating. I made no note of whether any sound was actually produced and do not now recall any.

Many interesting notes regarding this species will be found in the first report of the United States Entomological Commission.

83. MELANOPLUS PROPINQUUS, new species.

(Plate XVIII, fig. 9.)

Caloptenus femur-rubrum SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1877), p. 86; Ent. Notes, VI (1878), p. 27; Psyche, II (1878), p. 154.

Pezotettix propinquus McNEILL!, MS.

Of medium size, closely resembling the preceding species in coloration, but generally of a somewhat lighter tint. Head a little prominent, flavo-testaceous, generally more or less infuscated above, with a postocular band; vertex tumid, the interspace between the eyes scarcely broader than (male) or half as broad again as (female) the first antennal joint; fastigium steeply declivent, distinctly (male) or rather shallowly (female) sulcate; frontal costa just failing to reach the clypeus, subequal, of the width of the interspace between the eyes, sulcate at and (especially in the male) below the ocellus, biserially punctate above; eyes moderately prominent in both sexes, much longer, in the female very much longer, than the infraocular portion of the genae; antennae ferruginous, feebly infuscated apically, five-sixths (male) or less than two-thirds (female) as long as the hind femora. Pronotum slightly and regularly enlarging from in front backward, the disk feebly convex and passing into the anteriorly feebly tumid, vertical, lateral lobes by a well-rounded but abrupt shoulder, the disk brownish fuscous, more or less feebly ferruginous, the lateral lobes dull luteo-testaceous, with a broad postocular band on the prozona; median carina slight and percurrent, feebler on the prozona than on the metazona; front margin subtruncate, very faintly flaring at least in the male, hind margin obtusangulate, the angle well rounded; prozona feebly longitudinal (male) or feebly transverse (female), scarcely if any longer than the closely but shallowly punctate metazona. Prosternal spine rather long, suberect, appressed cylindrical, blunt, rather longer and less appressed in the male than in the female; interspace between the mesosternal lobes twice as long (male) or less than half as long

again (female) as broad. Tegmina considerably surpassing the hind femora, rather slender, subequal, brownish fuscous, minutely flecked with fuscous throughout the discoidal area; wings not very broad, hyaline, iridescent, the veins pale fuscous apically and anteriorly. Fore and middle femora a little tumid in the male; hind femora brownish testaceous, more or less infuscated (generally by longitudinal clouds) on the upper half, but on the inner side above bimaculate with blackish fuscous, the geniculation mostly black and with a pregenicular slender black annulus, the under side of the femora flavous inclining to orange; hind tibiae usually bright red with a slight fuscous patellar spot, but sometimes pale yellowish red, or rarely pale yellowish green, the spines black almost to their base, ten to twelve, usually eleven, in number in the outer series. Extremity of male abdomen rather strongly clavate, well recurved, the supraanal plate subelypeate, but very strongly and roundly compressed in the basal half, the apex roundly and rather bluntly rectangulate, the lateral margins strongly and abruptly elevated, the median sulcus deep, percurrent and apically expanded, bounded by rather high but rounded walls; furcula composed of a pair of greatly extended, somewhat depressed, straight fingers, tapering by the narrowing of their inner margins, lying outside the ridges of the supraanal plate, reaching much beyond the middle of the same, and slightly out-curved at their rather blunt tips; cerci rather broad at base, rapidly narrowing beyond so as to be hardly half as wide in the middle, beyond subequal, incurved and blunt-tipped, externally punctate throughout and not reaching the tip of the supraanal plate; subgenital plate hardly half as wide at apex as at base, the lateral margin rapidly declivent, the apical margin not elevated, strongly rounded, entire.

Length of body, male, 21 mm., female, 25 mm.; antennae, male, 10 mm., female, 8.5 mm.; tegmina, male and female, 20 mm.; hind femora, male, 12 mm., female, 13.25 mm.

Seventy-seven males, 87 females. North Carolina, Uhler, Morrison; Dingo Bluff, North Carolina, November 15, Maynard; Smithville, North Carolina, Maynard; Georgia, Morrison (S. Henshaw; S. H. Scudder; U.S.N.M.—Riley collection); Georgia, King (Museum Comparative Zoology); Macon, Bibb County, Georgia, September 18 (U.S.N.M.—Riley collection); Wilmington Island, Georgia, A. Oemler; Florida, Neal (U.S.N.M.—Riley collection); Jacksonville, Duval County, Florida, May 6, J. H. Comstock; Fernandina, Nassau County, Florida, E. Palmer; St. Augustine, St. John County, Florida, E. Palmer; Sanford, Orange County, Florida, G. B. Frazer; Fort Reed, Orange County, Florida, April 8-23, J. H. Comstock; Appalachicola, Franklin County, Florida, R. Thaxter.

This species takes in our Southern Atlantic States the place of *M. femur-rubrum*, which it closely resembles; it is most quickly distinguished from it by the form and sculpture of the supraanal plate and the much greater length of the furcula.

84. MELANOPLUS EXTREMUS.

(Plates I, figs. *f*, *g*; XVIII, fig. 10.)

- ? *Locusta leucostoma* KIRBY, Faun. Bor. Amer., IV (1837), p. 250.—BETHUNE, Can. Ent., VII (1875), p. 129; Ins. Brit. Amer. (1884), pp. 120-121.
- ? *Acridium (Locusta) leucostomum* DE HAAN, Bijdr. Kenn. Orth. (1842), p. 142.
- Caloptenus extremus* WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 681; Can. Ent., IV (1872), p. 30.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 225.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.—CAULFIELD, Can. Rec. Sc., II (1887), p. 401; Can. Orth. (1887), p. 14.
- Pezotettix junius* DODGE!, Can. Ent., VIII (1876), p. 9.—BRUNER, *ibid.*, IX (1877), p. 144; Rep. U. S. Ent. Comm., III (1883), p. 59.
- Caloptenus parvus* PROVANCHER!, Nat. Canad., VIII (1876), p. 110; Faune Ent. Can., II (1877), p. 36.
- Melanoplus junius* SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1878), p. 286; Ent. Notes, VI (1878), p. 45.—MORSE, Psyche, VI (1892), p. 262.—OSBORN, Proc. Iowa Acad. Sc., I, Pt. II (1892), p. 118.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 28.—MORSE, Psyche, VII (1894), p. 106.
- Caloptenus junius* SCUDDER!, Can. Ent., XII (1880), p. 75.
- Melanoplus extremus* CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), p. 71.
- Melanoplus parvus* CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), p. 71.
- Caloptenus (Melanoplus) parvus* CAULFIELD, Can. Rec. Sc., II (1887), p. 401; Can. Orth. (1887), p. 14.

Of rather small or medium size, brownish fuscous, generally rather dark, often with a ferruginous tinge. Head a little prominent, dark testaceous often somewhat infuscated, above much infuscated, the added infuscation sometimes confined to the fastigium and two divergent, enlarging streaks behind it; vertex gently tumid, feebly elevated above the level of the pronotum, the interspace between the eyes nearly (male) or more than (female) twice as wide as the first antennal joint; fastigium steeply declivent, not very deeply (male) or broadly and very shallowly (female) sulcate throughout; frontal costa failing to reach the clypeus, slightly narrower than the interspace between the eyes, subequal but faintly and very gradually broadening downward, depressed at and sometimes sulcate below the ocellus, biserially punctate; eyes moderately prominent especially in the male, not very large, but little longer than the infraocular portion of the genae; antennae ferruginous, fully four-fifths (male) or from three-fifths to two-thirds (female) as long as the hind femora. Pronotum subequal or enlarging a little on the metazona (in the female throughout), the lateral lobes lighter, sometimes considerably lighter than the disk, with a broad, equal, piceous, postocular band crossing the prozona, the disk often luteo-ferruginous punctate with fuscous, very broadly convex, and passing by an abrupt but smoothed shoulder simulating a lateral carina into the anteriorly tumid vertical lateral lobes; median carina slight, percurrent, distinctly feebler but rarely subobsolete on the prozona; front margin subtruncate with feeblest possible indications of a median emargination, hind margin very obtusangulate, the angle rounded in

the female; prozona distinctly longitudinal (male) or quadrate or transverse (female), distinctly (male) or scarcely (female) longer than the closely punctate metazona, the principal sulcus bent angularly forward slightly in the middle. Prosternal spine moderately long, cylindrical, blunt, erect (male) or short, conical, feebly appressed, blunt, erect (female); interspace between mesosternal lobes quadrate (male) or distinctly transverse but much narrower than the lobes (female). Tegmina either falling distinctly short of the tips of the hind femora, generally about as long as the abdomen in the male, rather broad at base, but rapidly tapering and at apex bluntly subacuminate (*M. e. junius*, Plate I, fig. *g*), or surpassing the hind femora, generally considerably, rather broad, subequal, and at apex rather broadly rounded (*M. e. scandens*, Plate I, fig. *f*), brownish fuscous, generally immaculate, but sometimes with rather a feeble and obscure narrow line of maculation in the discoidal area; wings considerably (*M. e. junius*) or a very little (*M. e. scandens*) shorter than the tegmina, moderately broad, hyaline, with brownish fuscous veins in the anterior half. Fore and middle femora a little tumid in the male; hind femora ferrugineo-luteous, the outer face often longitudinally infuscated, the inner side of the upper face bimaculate with fuscous often obscurely, the geniculation blackish and the under surface generally pale orange; hind tibiae bright red, pale red, or pale dull citron, the spines black beyond their base, nine to twelve, usually eleven, in number in the outer series. Extremity of male abdomen clavate, a little recurved, the supraanal plate subtriangular, longer than broad, feebly compressed in the middle, apically slightly acutangulate, the lateral margins elevated basally, the median sulcus moderately deep and narrow, apically expanding and obsolescent, its bounding walls rounded and not very high; furcula consisting of a pair of parallel or subparallel, slender, tapering, acuminate, somewhat depressed spines, somewhat less than half as long as the supraanal plate and resting upon the ridges bordering the median sulcus; cerci feebly subfalciform lamellae lying in a slightly oblique vertical plane, a little incurved throughout, feebly tapering in the basal third or more, beyond subequal to the obliquely truncate and well-rounded tip, the whole gently arcuate and much shorter than the supraanal plate; infracercal plates very broad at base, rapidly narrowing and not attaining the tip of the supraanal plate; subgenital plate about half as broad at apex as at base, regularly narrowing by the declivity of the feebly sinuous lateral margin, the apical margin not elevated, well rounded, entire.

Length of body (*M. e. junius*), male, 16 mm., female, 19 mm.; antennae, male, 8 mm., female, 6.75 mm.; tegmina, male, 11 mm., female, 10.75 mm.; hind femora, male, 10 mm., female, 10.75 mm. Length of body (*M. e. scandens*), male, 18 mm., female, 19.5 mm.; antennae, male, 8.75 mm., female, 7 mm.; tegmina, male, 16.25 mm., female, 17.25 mm.; hind femora, male, 10.25 mm., female, 10.5 mm.

Eighty-four males, 131 females. Norway, Oxford County, Maine, August 16 (A. P. Morse); Alpine regions of White Mountains, New Hampshire, Mount Washington and Madison, July, August; Mount Washington 5,000 feet, and Pinkham Notch, New Hampshire, (A. P. Morse); Tuckerman's Ravine, White Mountains, (A. P. Morse); Jackson, Carroll County, New Hampshire, July 3 (A. P. Morse); North Conway, Carroll County, New Hampshire, July 30 (same); Jay, Troy, and Newport, Orleans County, Vermont, July 12-15 (same); Hyde Park, Lamoille County, Vermont, July 20 (same); Montgomery, Franklin County, Vermont, July 18 (same); Summit of Greylock, Berkshire County, Massachusetts, 3,500 feet, August 17 (same); Winchendon, Worcester County, Massachusetts, June 29-July 6 (same); Bloomington, Monroe County, Indiana, Bollman (U.S.N.M.); Chicago, Illinois; Nebraska, Dodge (U.S.N.M.—Riley collection; S. H. Scudder); West Point, Cuming County, Nebraska (L. Bruner); Dallas County, Iowa, August, Allen; Jefferson, Green County, Iowa, July 20-24, Allen; Crawford County, Iowa, prairies, July 13-24, Allen; Denison, Crawford County, Iowa, July 20, Allen; Big Horn Mountains, Wyoming, 8,000 to 9,000 feet (L. Bruner); Arctic America, Kennicott; Great Bear Lake, Kennicott; Upper Mackenzie River, Kennicott; Yukon River, at mouth of Porcupine River, Alaska, Kennicott; Banff, Alberta, Bean (S. Henshaw).

It has also been reported from Quebec (Provancher, Scudder), Dodge County, Nebraska (Dodge), and the Mackenzie River, British America, at latitude 65° (Kirby); the last, however, is uncertain, depending on the determination of Kirby's species. It probably occurs throughout the larger part of Canada and the northernmost United States.

As indicated in the description, this insect appears in two forms: a short winged (*M. e. junius*), in which the tegmina at rest do not reach the tips of the hind femora; and a long-winged (for which I propose the name *M. e. scandens*), in which they surpass them, generally considerably. The latter has also a slightly slenderer body, though the difference is not marked. It appears to affect high latitudes and altitudes, being found in all the localities in the high north where Kennicott collected, on the Big Horn Mountains in Wyoming, and on the summits of Greylock in Massachusetts, and the White Mountains in New Hampshire, in all of which (unless in Wyoming, whence I have only seen two specimens) it is the prevailing or exclusive form. The short-winged form, however, occurs in all these places excepting the Alpine region of the White Mountains, where it has not been taken; and the long winged occurs also at lower levels in New England, as at North Conway, New Hampshire, Jay and Montgomery, Vermont, and Winchendon, Massachusetts, but it is only found in these places exceptionally, to judge from the specimens seen. The two specimens from the Big Horn Mountains, the male *scandens*, the female *junius*, are of exceptional size, and Arctic American specimens are also distinctly larger than those from New England or Nebraska.

It will probably be impossible ever to determine definitely Kirby's *Locusta leucostoma*, as the description is altogether inadequate and the British Museum does not contain the type; at least I could not find it by special search for it in 1865, and it is not mentioned in Walker's catalogues; Walker, following my earlier but probably wrong determination, placed it as a synonym of *M. bivittatus*, but none of his specimens included Kirby's.

Mr. Samuel Henshaw, during a recent visit to the British Museum, examined the types of Walker's *Caloptenus extremus* and found them to agree with specimens of the present species coming from Kennicott's collection on the upper Mackenzie, which he took with him; they differed "only in having slightly shorter wings," in which respect Walker's specimens agree with others of Kennicott's collection belonging to this species.

85. MELANOPLUS MONTICOLA, new species.

(Plate XIX, fig. 5.)

Platyphyma montana SCUDDER!, Appal., I (1878), p. 263.

Melanoplus monticola BRUNER!, MS. (pars).

Rather below the medium size, blackish fuscous. Head feebly prominent, dark testaceous, greatly infuscated especially in the female, above wholly or almost wholly blackish fuscous, the piceous postocular band hardly distinguishable in darkest examples; vertex gently tumid, a little elevated above the pronotum, the interspace between the eyes half as broad again (male) or more than twice as broad (female) as the first antennal joint; frontal costa rather prominent, percurrent, equal, as broad as the interspace between the eyes, impressed at the ocellus and sometimes sulcate below, punctate throughout, above biserially; eyes not prominent, of moderate size, as long as (female) or much longer than (male) the infraocular portion of the genae; antennae castaneous, apically infuscated, nearly four-fifths (male) or nearly three-fifths (female) as long as the hind femora. Pronotum enlarging slightly and pretty regularly from in front backward, wholly blackish fuscous, more or less ferruginous in the male, occasionally the position of the lateral carinae faintly marked on the prozona with dull flavous, sometimes the lateral lobes a little lighter inferiorly and then showing a piceous postocular band on the prozona, the disk gently convex and passing by an abruptly rounded shoulder sometimes forming feeble lateral carinae into the anteriorly tumid but otherwise vertical lateral lobes; median carina percurrent, feebler and sometimes subobsolete on the prozona; front margin truncate, hind margin strongly obtusangulate; prozona longitudinal (male) or quadrate or feebly transverse (female), generally slightly longer than the closely and shallowly punctate metazona. Prosternal spine short (female) or rather short (male), appressed cylindrical, very blunt, erect; interspace between mesosternal lobes quadrate (male) or feebly transverse (female), the metasternal

lobes rather approximate (male) or moderately distant (female). Tegmina failing a little (male) or considerably (female) of reaching the tips of the hind femora, moderately broad, distinctly tapering, strongly rounded at apex, fusco-ferruginous, immaculate; wings not broad, impure hyaline with reddish fuscous veins. Fore and middle femora considerably tumid in the male; hind femora varying from dark testaceous to dark plumbeo-fuscous, the inner half of the upper face dull flavous, with the base, geniculation, and two large intermediate spots black, the under surface deep red; hind tibiae deep red, often much infuscated but then with a narrow, red, subbasal annulus, the spines black throughout, eleven to twelve, usually eleven, in number in the outer series. Extremity of male abdomen strongly clavate, somewhat recurved, the supraanal plate long clypeate, with sides strongly compressed in the middle, the lateral margins strongly elevated, the apex acutangulate, the median sulcus very narrow and deep, being a mere slit between moderately high but rounded walls, apically obsolete; furcula consisting of a pair of basally attingent, basally expanded, and depressed fingers, which beyond are straight, parallel, acuminate thorns, more than a third as long as the supraanal plate and overlying its ridges; cerci coarse and heavy subfalciform laminae, their plane obliquely vertical and nearly straight, considerably shorter than the supraanal plate, tapering considerably on the basal half, feebly on the apical half, which is considerably more than half as broad as the extreme base, obliquely truncate at apex, the upper angle very blunt; subgenital plate narrowing from base to apex, somewhat longer than broad, the lateral margins gently sinuate, the apical margin elevated by slight tubercles at its somewhat angular junction with the lateral margins, so that it is broadly notched, as viewed posteriorly.

Length of body, male, 17.5 mm., female, 23 mm.; antennae, male, 8.25 mm., female, 6.75 mm.; tegmina, male, 12.25 mm., female, 11.5 mm.; hind femora, male, 10.5 mm female, 11.5 mm.

Two males, 2 females. Above timber line on Sierra Blanca, Colorado, 12,000 to 13,000 feet (S. H. Scudder; L. Bruner). All the specimens, besides two pupae, taken by me August 29, 1877.

The species is very closely allied to the last, but differs from it distinctly in the character of the subgenital plate.

20. CINEREUS SERIES.

In this more than usually homogeneous group, the male prozona is quadrate or slightly longitudinal, and the interspace between the mesosternal lobes of the same sex varies from a little longer than broad to twice as long as broad. The tegmina are always fully developed, surpassing somewhat the hind femora, and at most are feebly maculate, the flecking not always confined closely to the discoidal area. The hind tibiae are blue or green (in one instance apparently reddish yellow) and have ten to twelve spines in the outer series.

The supraanal plate is generally rather simple, triangular with convex sides and a generally produced apex, but is sometimes strongly and abruptly compressed apically. The furcula is developed to an extreme as a pair of parallel, flattened, pointed plates, usually more than half as long as the supraanal plate. The cerci are rather slender or only moderately broad, apically spatulate or subspatulate, incurved or inbent, of variable length relative to the supraanal plate. The subgenital plate is moderately broad apically, but distinctly narrower than long, the apical margin entire and not elevated, or only slightly elevated.

The species, six in number, are of medium or slightly above the medium size and with the exception of the typical species are found only in the extreme Southwestern States—Southern California, Arizona, and Texas, and in Lower California and Sonora, but the typical species extends the range on the north to Washington, Idaho, and Wyoming, and eastward to Louisiana and western Nebraska. It is a western type.

86. *MELANOPLUS BISPINOSUS*, new species.

(Plate XIX, fig. 6.)

Cinereo-fuscous, more or less ferruginous. Head slightly prominent in the male only, warm testaceous, infuscated above, with a postocular piceous band; vertex gently tumid, raised but slightly above the level of the pronotum, the interspace between the eyes rather broad, much broader than (male) or fully twice as broad as (female) the first antennal joint; fastigium steeply declivent and plane (female) or broadly and shallowly sulcate (male); frontal costa fading next the clypeus, a little narrowed above, but otherwise fully as broad as (male) or slightly narrower than (female) the interspace between the eyes, feebly sulcate at and below the ocellus, biserially punctate above; eyes rather large, somewhat prominent, a little longer than the infraocular portion of the genae; antennae ferruginous, apically infuscated, in the male more than four-fifths as long as the hind femora. Pronotum subequal, but with distinctly flaring metazona, the feebly convex disk passing by a broad angle into the subvertical and feebly tumid lateral lobes, leaving no trace of lateral carinae except slightly on the metazona; lateral lobes with a distinct though sometimes broken broad piceous band crossing the upper part of the prozona, broadest on its posterior lobe; median carina distinct on the metazona, inconspicuous and blunt (male) or subobsolete (female) on the prozona; front margin truncate, hind margin obtusangulate, the angle well rounded; prozona quadrate, only a little longer than the finely punctate metazona. Prosternal spine moderately long, stout, cylindrical, very blunt, erect; interspace between mesosternal lobes fully twice as long as broad (male) or subquadrate (female). Tegmina surpassing the hind femora, of moderate width, gently tapering, apically well rounded, fusco-testaceous more or less ferruginous basally, flecked somewhat obscurely with fuscous and

cinereous in the discoidal area, and often very feebly dotted with obscure fuscous outside of it; wings hyaline, the apical and anterior veins testaceous. Hind femora luteo-ferruginous, obliquely bifasciate on the upper half with brownish or blackish fuscous, and with a small basal spot of the same, the genicular arc black, but the inferior genicular lobe light colored with only a basal fleck of fuscous; under half luteous or rosaceous, externally more pallid than the rest; hind tibiae dull green becoming lutescent at the extremities, with a more or less obscure fuscous postbasal annulus, the spines black beyond their pallid base, eleven to twelve in number in the outer series. Extremity of male abdomen clavate, somewhat upturned, the supraanal plate strongly compressed apically so as to give the sides a very tortuous course and so as to be composed of two parts: the larger basal part nearly plane, broader than long, longer laterally than mesially, the immediate margins elevated slightly and a little overhanging by expansion, the median sulcus moderately deep and not broad, uniform; and an apical narrow triangular tip with strongly elevated margins forming the sides of the very deep median sulcus, fully two-thirds as long as the basal portion, the tip strongly acutangulate but blunt; furcula consisting of a pair of parallel, flattened, regularly tapering, rather bluntly acuminate fingers, except at extreme base lying wholly outside the median sulcus, nearly half as long as the entire plate; cerci slender, regularly and considerably incurved throughout, narrowing gently and then as gently enlarging to a regular and rounded spatulate tip not quite so wide as the extreme base, the whole fully five times as long as the narrowest breadth and reaching to about halfway between the lateral angle and the tip of the supraanal plate; infracercal plates slightly shorter than the supraanal; subgenital plate haustrate, moderately broad but considerably longer than broad, of subequal breadth, but the lateral margins slightly and roundly elevated at base, and the apical margin feebly elevated, well rounded, entire.

Length of body male, 24.5 mm., female, 31.5 mm.; antennae, male (estimated), 12 mm.; tegmina, male, 21.5 mm., female, 23 mm.; hind femora, male, 14.5 mm., female, 16 mm.

Three males, two females. Texas, Schaupp (S. Henshaw); Tiger Mill, Burnet County, Texas (L. Bruner); San Antonio, Bexar County, Texas, M. Newell (L. Bruner).

The name is given from the prominence of the furcula.

87. MELANOPLUS TERMINALIS, new species.

(Plate XIX, fig. 7.)

Brownish fuscous, more or less ferruginous. Head hardly prominent, lighter or darker castaneous, often much flecked with fuscous, the mouthparts paler, above darker being much infuscated, and especially the lateral margins of the fastigium are marked in black, and there is a piceous postocular band often streaked with testaceous; vertex gently

tumid, slightly elevated above the pronotum, the interspace between the eyes not broad, but much broader than the first antennal joint; fastigium very steeply declivent, deeply sulcate throughout; frontal costa failing to reach the clypeus, slightly contracted above, elsewhere fully as broad as, if not broader than, the interspace between the eyes, sulcate at and below the ocellus, biserially punctate above; antennae luteo-ferruginous, nowhere infuscated, except sometimes at extreme tip, about three-fourths as long as the hind femora. Pronotum subequal, scarcely expanding on the metazona, the lateral lobes with a somewhat obscure, piceous band, crossing the prozona above; disk feebly convex, passing by a rounded shoulder, becoming almost a lateral carina on the metazona, into the tumid, vertical, lateral lobes; median carina distinct on the metazona, feeble and blunt on the prozona; front margin feebly convex, hind margin almost rectangulate; prozona quadrate or feebly longitudinal, scarcely or slightly longer than the densely punctate metazona. Prosternal spine rather long, erect, cylindrical, rather blunt; interspace between mesosternal lobes about half as long again as broad. Tegmina surpassing the hind femora, rather slender, gently tapering, well rounded apically, brownish fuscous, with very slight, obscure signs of sparse maculation in the discoidal area; wings hyaline, with the anterior and apical veins testaceous. Hind femora ferruginous or luteo-ferruginous, sometimes with an olivaceous tinge, bifasciate above with blackish fuscous, generally obscurely, and with a basal spot of the same, the under surface luteous or ferruginous, the genicular arc black; hind tibiae pale glaucous green, a little pallid at the base, with an obscure, fuscous, post-basal annulus, the spines black beyond their pallid base, eleven in number in the outer series. Extremity of male abdomen clavate, somewhat upturned, the supraanal plate and furcula as in *M. bispinosus*; cerci also shaped as there, but smaller and slenderer, fully six times as long as the narrowest breadth; subgenital plate narrowing regularly from base to apex, much longer than broad, subconical, the apical margin with a hardly perceptible elevation, entire, as viewed from above acutangulate, the angle blunt and a little thickened.

Length of body, male, 21 mm.; antennae, 9 mm.; tegmina, 17.5 mm.; hind femora, 12.25 mm.

Five males. Gulf coast of Texas, Aaron; Carrizo Springs, Dimmit County, Texas, Wadgymar, November (L. Bruner).

This species is exceedingly close to *M. bispinosus*, but is smaller, darker, a more southern form, and differs by its slightly smaller and slenderer cerci, the general characters of the subgenital plate and in minor peculiarities of its structure. It can be confounded with no other species.

88. MELANOPLUS CYANIPES, new species.

(Plate XIX, fig. 8.)

Melanoplus cyanipes BRUNER!, MS.—COQUILLET, Ins. Life, I (1889), p. 227.—
BRUNER, Rep. St. Hort. Soc. Nebr., 1894 (1894), p. 163—undescribed.

Varying from light ferrugineo-testaceous through cinereo-fuscous to dark brownish fuscous with a ferruginous tinge, thinly pilose. Head slightly prominent, plumbeo-testaceous, more or less infuscated, sometimes flecked profusely and minutely with fuscous, above darker and generally more uniform than elsewhere, often blackish fuscous, with a postocular piceous band; vertex gently tumid, slightly elevated above the pronotum, the interspace between the eyes moderate, a little broader than (male) or twice as broad as (female) the first antennal joint; fastigium rather strongly declivent, sulcate throughout; frontal costa rather prominent above, but not contracted, just failing to reach the clypeus, feebly broadening below, fully as broad as the interspace between the eyes, shallowly sulcate at and generally below the ocellus, punctate above; eyes large, prominent, particularly in the male where they rise above the level of the vertex, very much longer than the infraocular portion of the genae; antennae luteo-fulvous, four-fifths (male) or about two-thirds (female) as long as the hind femora. Pronotum subequal, scarcely enlarging on the metazona, the very gently convex disk passing, with a pronounced but well-rounded shoulder, nowhere forming a lateral carina, into the inferiorly vertical lateral lobes; the latter are marked above with a broad, equal, rarely broken, piceous band crossing the prozona and sometimes indicated on the metazona by a slight darkening; median carina distinct on the metazona, obsolete or subobsolete on the prozona, always obsolete between the sulci; front margin truncate; hind margin broadly obtusangulate, the angle generally broadly rounded in the female; prozona quadrate or feebly longitudinal (male) or quadrate or feebly transverse (female), only a little longer than the closely punctate metazona. Prosternal spine short, conical, very blunt, erect; interspace between mesosternal lobes twice as long as broad (male) or considerably longer than broad (female). Pleura with a distinct flavo-testaceous stripe bordered with black following the metathoracic episterna. Tegmina surpassing the hind femora, sometimes considerably, slender, tapering feebly, well rounded apically, brownish fuscous, sometimes immaculate but generally rather sparsely sprinkled with minute fuscous spots throughout the discoidal area almost or quite to the tip; wings rather narrow, hyaline, often with a very feeble citron tint, most of the veins black or fuscous. Fore and middle femora but little tumescent in the male; hind femora slender and elongate, testaceous or ferruginous, obscurely bifasciate with fuscous, often reduced to a fuscous cloud on the outer face, most of the geniculation black, the inferior surface and most of the interior varying from luteous to carmine; hind tibiae light green or glaucous, sometimes blue, with a postbasal fuscous spot or annulus, clothed with sparse pile twice as long as the spines, the spines pallid in basal, black

in apical half, ten to eleven in number in the outer series. Extremity of male abdomen a little clavate, a little upturned, the supraanal plate long triangular, the sides bent a little beyond the middle, before which they are broadly elevated a little, the apex acutangulate, the surface more than usually plane, the median sulcus slight and hardly perceptible except apically; furcula consisting of a pair of large, broad, greatly flattened, parallel, strongly and rather regularly tapering and acuminate fingers, reaching more than halfway across the supraanal plate; cerci elongate, compressed, rather slender, subequal laminae, a little obliquely vertical at the base, in the middle bent abruptly inward and then at once again backward, but here completely vertical by a slight twist in the bend, the apex roundly truncate, the basal half gradually tapering and beyond again enlarging to somewhat less than the basal width, the whole extending to the tip of the supraanal plate; infracercal plates broad and subtruncate apically, just shorter than the supraanal plate; subgenital plate broad, but a little longer than broad, flaring, the apical margin scarcely elevated, thickened, entire, as viewed from above strongly rounded.

Length of body, male, 21.5 mm., female, 23.5 mm.; antennae, male, 9.5 mm., female, 9 mm.; tegmina, male, 17 mm., female, 19 mm.; hind femora, male, 11.5 mm., female, 14.5 mm.

Fifteen males, 9 females. California (U.S.N.M.—Riley collection); California, H. Edwards (Museum Comparative Zoology); Los Angeles, California, July, Coquillett (U.S.N.M.; L. Bruner); Pasadena, Los Angeles County, California, October 23; San Diego, California, October 26.

This species is certainly very closely allied in structure to the next, *M. cinereus*, and may prove to be a variety of it, found in different stations. It wholly lacks, however, the cinereous speckling so characteristic of typical examples of the latter species, with the rusty hue of the pronotum.

Some individuals are much smaller than, hardly more than half as large as, others; the measurements are taken from the larger and apparently commoner forms.

89. MELANOPLUS CINEREUS.

(Plate XIX, fig. 9.)

Melanoplus cinereus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1878), pp. 288, 290; Ent. Notes, VI (1878), pp. 47, 49; Rep. U. S. Ent. Comm., II (1880), App., p. 24, pl. XVII, figs. 1, 4, 5.—BRUNER, *ibid.*, III (1883), p. 60; Bull. Div. Ent. U. S. Dep. Agric., IV (1864), p. 58; Can. Ent., XVII (1885), p. 17; Rep. U. S. Ent., 1885 (1886), p. 307.—COQUILLET, *ibid.*, 1885 (1886), pp. 291–293, 295, 297.—KOEBELE, Bull. Div. Ent. U. S. Dep. Agric., XXII (1890), p. 94.—RILEY, *Ins. Life*, II (1889), p. 27.—BRUNER, *Publ. Nebr. Acad. Sc.*, II (1893), p. 28; *Rep. Nebr. St. Bd. Agric.*, 1893 (1893), p. 460; *Rep. St. Hort. Soc. Nebr.*, 1894 (1894), p. 163; *ibid.*, 1895 (1895), p. 69.

Caloptenus cinereus RILEY, *Stand. Nat. Hist.*, II (1884), p. 195.—MILLIKEN, *Ins. Life*, VI (1893), p. 19.

Cinereo-fuscous, the upper surface of head and pronotum frequently rust-colored. Head somewhat prominent, dull pale testaceous, flecked

above with fuscous in a pair of parallel longitudinal streaks; vertex moderately tumid, somewhat elevated above the pronotum, the interspace between the eyes not very broad, a little broader than (male) or half as broad again as (female) the first antennal joint; fastigium moderately declivent, sulcate broadly throughout, more deeply in the male than in the female; frontal costa rather prominent above, equal, just failing to reach the clypeus, as broad as the interspace between the eyes, feebly sulcate at and below the ocellus, biserially punctate above; eyes large, moderately prominent, very much longer than the infraocular portion of the genae; antennae luteous or fulvous, almost as long (male) or fully two-thirds as long (female) as the hind femora. Pronotum subequal, feebly expanding on the metazona, the disk feebly convex and passing, by a broadly rounded shoulder occasionally feebly indicating a lateral carina, into the vertical lateral lobes, which are marked above on the prozona by an often partially broken piceous band, followed beneath by irregular quadrate patches of sallow luteous; median carina distinct on the metazona, almost or quite obsolete on the prozona; front margin truncate, hind margin slightly obtusangulate; prozona longitudinal (male) or quadrate (female), scarcely if any longer than the rather closely-punctate metazona. Prosternal spine short, conico-cylindrical, blunt, erect; interspace between mesosternal lobes more than twice as long as broad (male) or a little longer than broad (female). Tegmina surpassing, generally to a considerable degree, the hind femora, slender, gently tapering, apically well rounded, brownish fuscous, finely speckled throughout with cinereous and with a slender line of alternate pale and dark bars and dots in the discoidal area and sometimes a second line along the upper edge of the anal area; wings ample, very delicate, glistening hyaline with glauco-fuscous veins. Fore and middle femora somewhat tumescent in the male, all the femora luteo ferruginous flecked with fuscous, the hind pair bifasciate with fuscous, which is transverse on the upper face, very oblique and confined to the upper half on the outer face, the lower face a little ruddy; hind tibiae pale blue, rarely with a luteous tinge, the spines pallid in their basal, black in their apical half, ten to twelve, usually ten, in number in the outer series. Extremity of male abdomen considerably clavate, well rounded, not greatly recurved, the supraanal plate rather long triangular with feebly acutangulate apex and scarcely elevated lateral margins, nearly plane, feebly depressed, the median sulcus only apparent at tip where it passes between two slight lateral bosses; furcula consisting of a pair of basally adjacent, very broad, flattened, tapering fingers, apically produced as slender aciculate extensions, reaching fully three-fourths of the way across the supraanal plate; cerci moderately narrow, basally tapering, compressed laminae, which at the middle are abruptly bent inward at right angles but with a rounded curve, and then bent at extreme tip backward again, all the while broadening feebly, the whole outer side of the bent portion broadly

sulcate, the apex roundly truncate, sometimes feebly and roundly emarginate, the lower apical angle usually a little produced, giving the whole, which reaches nearly to the tip of the supraanal plate, a twisted appearance; infracercal plates broad, apically rounded, as long as the supraanal plate; subgenital plate of subequal breadth, narrowing a little apically, longer than broad, slightly flaring, the lateral and apical margins in the same plane, except that the latter, which is well rounded and entire, is feebly elevated at the extreme apex.

Length of body, male, 23 mm., female, 26 mm.; antennae, male, 11 mm., female, 9.75 mm.; tegmina, male, 19 mm., female, 20.5 mm.; hind femora, male, 12.5 mm., female, 14 mm.

Thirty males, 57 females. Wallula, Wallawalla County, Washington, September 1, Packard (U.S.N.M.—Riley collection; S. H. Scudder); Lone Tree, Yakima River, Washington, July 18, S. Henshaw (Museum Comparative Zoology); Salmon City, Lemhi County, Idaho (U.S.N.M.—Riley collection; L. Bruner); Wyoming, Morrison (U.S.N.M.—Riley collection); California (same); California, H. Edwards; Sierra County, California, J. G. Lemmon (U.S.N.M.—Riley collection); Los Angeles County, California, August (same); Salt Lake Valley, Utah, 4,300 feet, August 1-4; American Fork Canyon, Utah County, Utah, 9,500 feet, August 2-3; Fort Grant, Graham County, Arizona (U.S.N.M.—Riley collection); Albuquerque, Bernalillo County, Arizona (same); Texas, Belfrage (same); Pecos River, Texas, July, Captain Pope; Baton Rouge, Louisiana, June 8, F. J. Bird (U.S.N.M.—Riley collection).

It has also been reported from the Yellowstone region and Sioux County, Nebraska (Bruner), Reno, Washoe County, Nevada (Scudder), and the San Joaquin Valley, California (Coquillett).

I have found this insect only upon the sage brush (*Artemisia*), and so completely do its gray and rusty colors harmonize with its surroundings that it is extremely difficult to detect when at rest. This has also been noticed by Bruner, who remarks that the resemblance extends to the earlier stages of the insect.

Coquillett remarks upon the ease of its flight, describing it as in a straight line, for a distance of from 5 to 20 feet from the ground. He found it devouring the ripe kernels of rye in California, and Riley reports it as injuring cotton in Louisiana. Coquillett regards it as a migrating species, but his specific statements refer only to short flights from the fields to the tree tops or the reverse, fifty to one hundred yards being the usual distance. In the San Joaquin Valley he found specimens pairing at the last of July.

90. *MELANOPLUS COMPLANATIPES*, new species.

(Plate XIX, fig. 10.)

Nearly uniform light testaceous. Head slightly prominent in the male, hardly darker above than elsewhere, with no trace or but feeblest trace of any postocular band; vertex very gently tumid, hardly elevated

above the pronotum even in the male, the interspace between the eyes rather narrow, scarcely wider than (male) or about half as wide again as (female) the first antennal joint; fastigium rapidly declivent, sulcate throughout; frontal costa percurrent, subequal, not contracted above, as wide as the interspace between the eyes, sulcate at and below the ocellus, biseriately sulcate above; eyes pretty large, rather prominent, much longer than the infraocular portion of the genae; antennae testaceous, almost as long (male) or about two-thirds as long (female) as the hind femora. Pronotum equal on the prozona, expanding a little and gradually on the metazona, more in the female than in the male, the disk feebly convex and passing by a strongly rounded shoulder (the shoulder hardly noticeable on the prozona) into the vertical lateral lobes, which have feeble and broken or no indications of a fuscous band on the upper part of the prozona; median carina distinct on the metazona, quite or almost wholly obsolete on the prozona; front margin faintly convex, hind margin obtusangulate; prozona quadrate in the male, transverse or quadrate in the female, feebly emarginate in the middle posteriorly, scarcely or no longer than the metazona. Prosternal spine short, conical, blunt, erect; interspace between mesosternal lobes much more than twice as long (male) or half as long again (female) as broad. Tegmina much surpassing the hind femora, exceptionally slender, scarcely tapering, apically well rounded, testaceous with a mesial line of exceedingly feeble and sparse fuscous spots; wings narrow and pointed, hyaline with light testaceous veins and with scarcely perceptible infumation at the extreme tip. Hind femora strongly compressed, the outer face so flattened as hardly to show any convexity, testaceous, immaculate, the outer face sometimes feebly infuscated, the genicular arc fuscous; hind tibiae luteo-testaceous, the spines black on apical half, ten to eleven, usually ten, in number in the outer series. Extremity of male abdomen clavate, a little upturned, the supraanal plate long triangular, rather strongly contracted just beyond the base, the lateral margins narrowly elevated, the apex acutangulate, the median sulcus consisting of a basal triangular portion, beyond which it is interrupted and again appears apically as a channel between two lateral bosses; furcula consisting of a pair of basally attingent, broad, flattened plates which taper very rapidly and then are continued as cylindrical, parallel needles, reaching at least two-thirds way across the supraanal plate; cerci slender, mesially contracted, apically spatulate, compressed laminae, as viewed laterally straight, as viewed from above apically incurved and then feebly returning to their original direction at extreme tip and there externally sulcate, the whole almost reaching the tip of the supraanal plate, and the apex as broad as the base; infracercal plates well rounded apically, slightly longer than the supraanal plate; subgenital plate much longer than broad, of moderate breadth, a little broader basally than apically, the apical margin slightly and gradually elevated, well rounded, entire. (The drawing is made from a specimen somewhat distorted by preservation in spirits.)

Length of body, male, 15.25 mm., female, 23 mm.; antennae, male, 10 mm., female, 8.5 mm.; tegmina, male, 19.5 mm., female, 20.5 mm.; hind femora, male, 11 mm., female, 12.25 mm.

Two males, 3 females. Cape St. Lucas, Lower California, J. Xantus; Sonora, Mexico, C. A. Schott.

91. *MELANOPLUS CANONICUS*, new species.

(Plate XX, fig. 1.)

Luteo-testaceous with a distinct ferruginous tinge. Head a little prominent, flavo-luteous, below with a slight olivaceous tinge, above a little streaked with fuscous and, in the male at least, with a dark fuscous postocular band; vertex a little tumid, a little elevated above the pronotum, the interspace between the eyes rather narrow, equal to (male) or a little exceeding (female) the width of the basal antennal joint; fastigium rather strongly declivent, deeply (male) or shallowly (female) sulcate throughout; frontal costa rather prominent above, straight on a side view, just failing to reach the clypeus, equal, a little broader than the interspace between the eyes, feebly sulcate at and below the ocellus, punctate above, biseriately in the male; eyes pretty large, rather prominent in the male, distinctly longer than the infra-ocular portion of the genae; antennae luteous, as long as the hind femora in the male. Pronotum subequal, feebly expanding on the metazona, the disk feebly convex and passing by a broadly rounded shoulder into the subvertical lateral lobes, which in the male are marked on the upper half of the prozona by a slightly mottled, glistening, brownish fuscous band; median carina distinct on the metazona, obsolete on the prozona; front margin subtruncate, hind margin obtusangulate; prozona feebly longitudinal (male) or quadrate (female), slightly longer than the closely punctate metazona. Prosternal spine rather short, conical, erect, anteriorly appressed; interspace between mesosternal lobes more than twice (male) or nearly twice (female) as long as broad. Tegmina a little surpassing the hind femora, moderately slender, gently tapering, brownish fuscous, sometimes with a ferruginous tinge, more or less feebly flecked with obscure maculae in the discoidal area; wings pellucid, very faintly infumated, the veins black or blackish fuscous. Fore and middle femora of male feebly tumescent; hind femora luteo-testaceous, bifasciate with pale fusco ferruginous above, the outer face feebly infuscated, the lower face luteous, the genicular arc blackish fuscous; hind tibiae very pale glaucous, pallescent basally, the spines black in their apical half, ten to twelve in number in the outer series. Extremity of male abdomen a little clavate and recurved, the supraanal plate longer than broad, tapering at first slightly then rapidly, the apex obtusangulate except for a slight production, the surface nearly plane, the median sulcus slight and inconspicuous; furcula consisting of a pair of adjacent flattened plates, very broad on basal third, then rapidly contracted, and continuing on

apical third as parallel, cylindrical but tapering, acuminate needles, reaching to the distal end of the middle third of the supraanal plate; cerci slender feebly compressed laminae, rapidly narrowing on basal third, the middle third equal, hardly compressed and half as broad as extreme base, then expanding to a nearly equal extent to form a compressed, spatulate, incurved tip, the apical portion of which is very strongly compressed and not incurved; infracercal plates broadly rounded apically, as long as the supraanal plate; subgenital plate moderately broad, subequal in breadth, considerably longer than broad, feebly flaring, the apical margin very broadly and feebly elevated, well rounded but feebly angulate, entire.

Length of body, male, 25 mm., female, 28 mm.; antennae, male, 12.5 mm.; tegmina, male, 19? mm., female, 21 mm.; hind femora, male, 12.75 mm., female, 14.25 mm.

One male, 1 female. Grand Canyon of the Colorado, Arizona, July 10 (L. Bruner).

This species is rather closely allied to the last, *M. complanatipes*, but is easily distinguished from it by its less strongly compressed hind femora with their bifasciate markings. The differences in the abdominal appendages are slight, but are found at every point.

21. ANGUSTIPENNIS SERIES.

A very homogeneous group (and one very closely allied to the preceding), in which the prozona of the male is variable, and the interval between the mesosternal lobes in the same sex varies from a little longer to several times longer than broad. The tegmina are always fully developed and reach or somewhat surpass the tips of the hind femora. The hind tibiae are red or glaucous and have from nine to thirteen spines in the outer series.

The supraanal plate is long and rounded triangular, and preapically contracted somewhat conspicuously. The furcula consists of a pair of slender, tapering, acuminate fingers of considerable length, generally extending over a third of the supraanal plate. The cerci are rather short and rather slender, incurved or inbent apically, spatulate, not nearly reaching the tip of the supraanal plate. The subgenital plate is large, fully as broad as long, not or but little elevated apically and there usually feebly notched.

The species, only four in number, are of medium or rather small, occasionally rather large size, and occur from Iowa to Utah, and from Montana and Manitoba to Texas, though one species ranges as far east as Sudbury, Ontario—the only one found east of the Mississippi. They occur mostly in the region between the Rocky Mountains and the Mississippi.

92. MELANOPLUS COMPTUS, new species.

(Plate XX, fig. 2.)

Of small size and brownish fuscous color. Head dull brownish luteous somewhat uniformly infumated, above much infuscated with only a feeble mottling of luteous; vertex feebly tumid, only slightly elevated above the level of the pronotum, the interspace between the eyes as broad as the first antennal joint; fastigium strongly declivent, rather deeply sulcate throughout; frontal costa equal, as broad as the interspace between the eyes, shallowly sulcate at and below the ocellus, biserially punctate; eyes rather large and prominent, much longer than the infraocular portion of the genae; antennae fulvous, more than three-fourths as long as the hind femora. Pronotum brownish fuscous above, luteo-testaceous on lateral lobes, the latter marked above on the prozona by a broad dull piceous stripe sometimes tinged with smoky olivaceous; disk scarcely expanding on the metazona, very broadly convex and passing into the inferiorly vertical lateral lobes by a well rounded shoulder nowhere forming distinct lateral carinae; median carina obsolete on the prozona; front margin transverse, almost imperceptibly emarginate in the middle, hind margin obtusangulate, the angle rounded; prozona subquadrate or feebly longitudinal, distinctly longer than the closely punctate metazona. Prosternal spine short, conico-cylindrical, compressed, erect, very blunt; interspace between mesosternal lobes of male at least three times as long as broad, the metasternal lobes attingent for some distance. Tegmina brownish fuscous, immaculate or very obscurely and feebly maculate in the discoidal area, slender, subequal, scarcely expanded on the costa, surpassing a little the hind femora; wings rather narrow, pellucid, glistening, the veins pale blue on the lower, fuscous or blackish on the upper half. Fore and middle femora but little tumid, luteo-testaceous blotched with fuscous; hind femora luteo-ferruginous, obscured with fuscous above and on outer face, above interruptedly, so as to cause feeble signs of dusky fasciation, beneath chrome yellow, the genicular arc dull luteous, edged only with fuscous; hind tibiae red, narrowly pallid at extreme base, the spines black on apical half, ten to eleven in number in the outer series. Extremity of male abdomen a little clavate, somewhat upturned, the supraanal plate long triangular, the basal three-fifths with well rounded uptilted sides, beyond which the plate is laterally notched and contracted, the apex produced and very acutangulate, the tip blunt, the median sulcus broad and not very deep, terminating with the basal portion; furcula consisting of a pair of depressed, uniformly tapering, acuminate, slightly divergent fingers less than a third as long as the supraanal plate; cerci rather short and not very broad, regularly spatulate by the regular, slight and gradual mesial contraction, the apical half rather strongly incurved, externally hollowed, the apex well

rounded, not nearly reaching the tip of the supraanal plate; infracercal plates well developed, laterally twice as broad as the cerci, well rounded, distinctly shorter than the supraanal plate; subgenital plate scoop-shaped, but slightly angulate behind laterally, the apical margin scarcely elevated and most feebly notched.

Length of body, male, 19 mm.; antennae, 9 mm.; tegmina, 15.75 mm.; hind femora, 11.25 mm.

Two males. Northern Minnesota; Sidney, Cheyenne County, Nebraska, August 25 (L. Bruner).

93. MELANOPLUS COCCINEIPES, new species.

(Plate XX, figs. 3-5.)

Caloptenus minor SCUDDER!, Bull. U. S. Geol. Surv. Terr., II (1876), p. 261.

Melanoplus devastator SCUDDER! (pars), Proc. Bost. Soc. Nat. Hist., XIX (1878), pp. 285-286, 287-288; (pars), Ent. Notes, VI (1878), pp. 46-47, 48-49.

Of medium or small size, dark fuscous, often with a ferruginous tinge. Head slightly prominent, luteo-testaceous, sometimes flecked or irrorate with fuscous on the face, above much infuscated often with a ferruginous tinge, and a more or less distinct piceous or subpiceous postocular stripe; vertex gently tumid, raised a little above the level of the pronotum, the interspace between the eyes moderately broad, half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium rapidly declivent, slightly (male) or scarcely (female) sulcate throughout; frontal costa just failing to reach the clypeus, equal or feebly broader below, scarcely narrower than the interspace between the eyes, feebly sulcate at and below the ocellus, biserially punctate; eyes moderately large and prominent, as long as the infraocular portion of the genae; antennae more than three-fourths (male) or a little more than three-fifths (female) as long as the hind femora, fulvous, sometimes feebly infuscated. Pronotum dark fuscous, occasionally ferruginous, the disk sometimes with a distinct, broad, equal, piceous band crossing the prozona above and occasionally vaguely continued across the metazona, usually marked beneath by luteous, or the whole lower portion luteous; disk very broadly convex, passing by an abruptly rounded shoulder, nowhere forming lateral carinae, into the vertical lateral lobes, which are slightly tumid anteriorly; median carina subobsolete on the prozona; front margin faintly convex, hind margin not very obtusely angulate; prozona longitudinal (male) or quadrate (female), a little (male) or scarcely (female) longer than the closely but somewhat obscurely punctate metazona. Prosternal spine not very long, cylindrical, erect, very blunt; interspace between mesosternal lobes twice (female) or four times (male) as long as broad, the metasternal lobes attingent for some distance (male) or subattingent (female). Tegmina reaching or a little surpassing the tips of the hind femora (varying in both sexes), tapering gently, brownish fuscous more or less indistinctly maculate with fuscous, sometimes

blackish fuscous, and pallid; wings hyaline, iridescent, the veins brownish fuscous anteriorly and apically. Fore and middle femora but very little tumid in the male; hind femora varying from luteo-testaceous to ferruginous, the inner half of the upper face bifasciate with fuscous, which sometimes crosses also the outer half of the same and rarely extends upon the upper portion of the outer face, and is occasionally subobsolete altogether, the lower face and lower half of the outer face nearly always luteous or lutescent, the outer face often streaked with blackish fuscous along its upper margin; hind tibiae bright red, the spines black except at base, ten to thirteen in number in the outer series. Extremity of male abdomen a little clavate and upturned, the supraanal plate ovate with an apical ovate extension, the sides well rounded and broadly elevated, the apical portion about a fifth of the whole and a miniature of the base, the median sulcus rather large, with well-rounded walls, percurrent but interrupted in the depressed zone beyond the middle; furcula consisting of a pair of strongly divergent, arcuate, somewhat depressed but rounded, regularly tapering, acuminate fingers, less than a third as long as the supraanal plate; cerci rather small, compressed, incurved plates, gradually constricted in the middle and well rounded apically, the apical half broadly depressed or sulcate exteriorly, not nearly reaching the tip of the supraanal plate; infracercal plates similar to those of *M. comptus*, but a little less broad and almost as long as the supraanal plate; subgenital plate forming a regular, well-rounded, hardly flaring scoop, the apical margin very feebly elevated and broadly and faintly notched.

Length of body, male, 22.5 mm., female, 25 mm.; antennae, male, 9.75 mm., female, 8.5 mm.; tegmina, male, 16.5 mm., female, 17 mm.; hind femora, male, 12.75 mm., female, 13.5 mm.

Twenty-eight males, 31 females. Sudbury, Ontario, July; Nebraska, Dodge; Sand Hills, Nebraska, July (L. Bruner); Fort Robinson, Dawes County, August 21, Gordon, Sheridan County and Valentine, Cherry County, Nebraska, Bruner (U.S.N.M.—Riley collection); Barbour County, Kansas, Cragin (L. Bruner); Lakin, Kearny County, Kansas, 3,000 feet, September 1; Colorado, 5,500 feet, Morrison; Rocky Mountains, Colorado, August (University of Kansas); Denver, Colorado, October 5; Beaver Brook, Jefferson County, Colorado, Uhler; Garden of the Gods, El Paso County, Colorado, October 6; Manitou, El Paso County, Colorado, August 9; Colorado Springs, El Paso County, Colorado, August, E. S. Tucker (University of Kansas); Garland, Costilla County, Colorado, 8,000 feet, August 28–29; Salt Lake, Utah, July 21, Packard.

Specimens sometimes occur, probably only in sandy stations, in which the insects are of a nearly uniform flavous color, often tinged slightly with ferruginous, giving a very different general appearance from the normal.

94. MELANOPLUS ANGUSTIPENNIS.

(Plate XX, fig. 6.)

Caloptenus angustipennis DODGE, Can. Ent., IX (1877), p. 111.—BRUNER, *ibid.*, IX (1877), p. 145.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 43.—BRUNER, *ibid.*, III (1883), p. 60.

Melanoplus angustipennis BRUNER, Bull. Washb. Coll., I (1885), p. 138; Bull. Div. Ent. U. S. Dep. Agric., XIII (1887), p. 11.—OSBORN, Proc. Iowa Acad. Sc., I, Pt. II (1892), p. 118.—BRUNER, Bull. Div. Ent. U. S. Dep. Agric., XXVIII (1893), pp. 24–25, fig. 12; Publ. Nebr. Acad. Sc., III (1893), p. 27.

Of medium size, dark-fuscous. Head feebly prominent, plumbeo- or ferrugineo-testaceous, often mottled with fuscous, above much infuscated, except at the margins of the eyes, and with a postocular piceous band; vertex gently tumid, slightly elevated above the pronotum, the interspace between the eyes considerably broader than (male) or nearly twice as broad as (female) the first antennal joint; fastigium strongly declivent, distinctly (male) or feebly (female) sulcate throughout; frontal costa equal, percurrent, as broad as the interspace between the eyes, faintly sulcate at and below the ocellus, biserially punctate; eyes moderately large and prominent, as long as the infraocular portion of the genae; antennae fulvous, about five-sixths (male) or two-thirds (female) as long as the hind femora. Pronotum dark fuscous, lighter on the lateral lobes, with a subluteous median streak, bordering a broad postocular piceous band on the prozona; disk feebly enlarging posteriorly, very broadly convex, passing into the vertical lateral lobes by a roundly angulated shoulder, forming tolerably distinct lateral carinae on the posterior half of the pronotum; median carina distinct on the metazona, obsolete (male) or subobsolete (female) on the prozona; front margin subtruncate, hind margin obtusangulate; prozona longitudinal (male) or quadrate (female), distinctly (male) or scarcely (female) longer than the closely punctate metazona. Prosternal spine not very long, erect, conico-cylindrical, blunt; interspace between mesosternal lobes more than twice as long as broad (male) or quadrate (female), the metasternal lobes attingent over a brief space (male) or approximate (female). Tegmina reaching or slightly surpassing the tips of the hind femora, slender, tapering, brownish-fuscous, immaculate or with very obscure and feeble maculation along the middle line; wings moderately narrow, hyaline, iridescent, with relatively few dark veins and these not so dark as usual. Fore and middle femora distinctly but not greatly tumid in the male; hind femora olivaceo-luteous, more or less infumated or infuscated excepting below, the inner half of the upper face feebly bifasciate with fuscous, and the geniculation more or less infuscated; hind tibiae glaucous, apically growing feebly lutescent, the spines black apically, pallid basally, nine to twelve in number in the outer series. Extremity of male abdomen a little clavate but scarcely recurved, the supraanal plate long triangular with broadly upturned basally convex

sides, laterally compressed just before the apex and the margin a little tortuous, the apex itself strongly acutangulate but blunt, the median sulcus percurrent, but nearly effaced at the constriction; furcula consisting of a pair of slender, subcylindrical, pretty strongly divergent, arcuate, regularly tapering, acuminate fingers, not a third as long as the supraanal plate; cerci consisting of spatulate incurved pads, hardly three times as long as the basal breadth, gently and slightly tapering from base to middle, beyond well rounded, nearly as broad as at base, exteriorly hollowed, and reaching only to the compressed part of the supraanal plate; infracercal plates forming broad tapering cushions for the cerci to rest upon, as long as the supraanal plate; subgenital plate forming a feebly flaring quadratic scoop, the apical margin feebly elevated laterally and between these elevations feebly notched.

Length of body, male, 20 mm., female, 22.5 mm.; antennae, male, 10 mm., female, 8.75 mm.; tegmina, male, 16 mm., female, 16.5 mm.; hind femora, male, 11.5 mm., female, 13 mm.

Three males, 3 females. Fort Robinson, Dawes County, Nebraska, August (L. Bruner); West Point, Cuming County, Nebraska, July (U.S.N.M.—Riley collection); Yellowstone, Montana, August (L. Bruner). Since description, Mr. W. S. Blatchley has sent me specimens from Lake County, Indiana.

Bruner states that this species feeds on *Artemisia* and prefers "to jump from plant to plant rather than to alight upon the ground." "It occurs both on high and low lands, but appears to be somewhat partial to old breakings and well-fed pastures of many years' use."

I suspect that the insect from Minnesota, described by Thomas¹ as a variety of *Caloptenus occidentalis*, may belong to this species.

95. MELANOPLUS IMPIGER, new species.

(Plate XX, figs. 7, 8.)

Of moderately large size, above rather light brownish fuscous with a ferruginous tinge, below luteo-testaceous. Head slightly prominent, dull luteo-testaceous, often punctate with olivaceous, with a postocular piceous band, and above much mottled or marmorate with fuscous; vertex gently tumid, considerably elevated above the level of the pronotum, the interspace between the eyes fully half as broad again (male) or fully twice as broad (female) as the first antennal joint; fastigium steeply declivent, shallowly and broadly sulcate, sometimes feebly in the female; frontal costa percurrent (male) or scarcely percurrent (female), feebly contracted above but otherwise subequal, as broad as the interspace between the eyes, and so distinctly broader in the female than in the male, feebly but variably sulcate at and a little below the ocellus, punctate throughout; eyes rather large, not very prominent, distinctly longer than the infraocular portion of the genae; antennae

¹Rep. U. S. Geol. & Geogr. Surv., V., p. 162.

fulvous or flavous, more (male) or less (female) than two-thirds as long as the hind femora. Pronotum subequal, feebly enlarging posteriorly, with a very broad postocular piceous band, occasionally maculate especially in the female, rarely surpassing the prozona and then broadening and decidedly weakening on the metazona; disk very broadly convex, passing by a blunt shoulder nowhere forming distinct lateral carinae into the vertical, anteriorly feebly tumid, lateral lobes; median carina distinct on the metazona, subobsolete on the prozona, sometimes wholly obsolete between the sulci; front margin subtruncate, hind margin obtusangulate, the angle rounded; prozona longitudinal (male) or quadrate (female), distinctly (male) or scarcely (female) longer than the ruguloso-punctate metazona. Prosternal spine conical, bluntly pointed (male) or appressed cylindrical, very blunt (female), moderately long, erect; interspace between mesosternal lobes about three times as long as (male) or a little longer than (female) broad, the metasternal lobes attingent over a considerable space (male) or approximate (female). Thoracic pleura luteous, the incisures black and the mesothoracic epimera darker than the ground, often blackish or even black. Tegmina surpassing considerably the hind femora, of normal breadth, feebly tapering, brownish fuscous, with usually very distinct and prominent maculation of quadrate blackish spots, interrupting a median luteous or pallid stripe in the basal half, becoming a sprinkling of blackish dots beyond, sometimes found also more or less obscurely in the other areas; wings moderately broad, hyaline, sometimes very feebly infumated at the edge near the tip, the veins bluish fuscous apically and anteriorly. Fore and middle legs only a little tumid in the male, luteo-testaceous flecked with fuscous; hind femora luteo-testaceous, twice barred above with blackish fuscous besides a basal spot, and more or less deeply infuscated geniculation, the bars liable on the middle of the outer face to fuse more or less completely into a median stripe, which sometimes suffuses the whole face; lower face sometimes feebly roseate; hind tibiae very feebly valgate, glaucous, occasionally feebly infuscated, the base and tip feebly lutescent, with a narrow postbasal fusco-glaucous annulus, the spines rather short, black beyond their pallid bases, ten to eleven in number in the outer series. Extremity of male abdomen slightly clavate, upturned but scarcely recurved, the supraanal plate ovate-triangular, broadest at some distance beyond the base, the sides broadly and gently uplifted, the elevation abruptly broken by a preapical lateral transverse sulcation, the apex acutangulate, the median sulcus occupying only the basal half, and very shallow and equal, except when, as sometimes, the apical portion is much compressed; furcula consisting of a pair of long and slender, equally tapering and acuminate, more or less flattened, slightly divergent and very feebly arcuate fingers, somewhat less than half as long as the supraanal plate; cerci small, compressed, subequal, incurved, lateral plates, gradually and rather slightly contracted mesially, the tip

well rounded, subspatulate, and exteriorly broadly sulcate or depressed, reaching only the break in the lateral margin of the supraanal plate; infracereal plates extending laterally distinctly beyond the cerci, and apically to the tip of the supraanal plate; subgenital plate pretty regularly scoop-shaped, scarcely flaring, the apical margin almost entire, or emarginate only by a feeble lateral elevation of the margin as seen from behind.

Length of body, male, 26.5 mm., female, 27 mm.; antennae, male, 11 mm., female, 10.5 mm.; tegmina, male, 22 mm., female, 21 mm.; hind femora, male, 15.5 mm., female, 16 mm.

Sixteen males, 36 females. Texas, Lincecum, Belfrage, Schaupp (S. H. Scudder; L. Bruner); Dallas, Texas, Boll (S. H. Scudder; L. Bruner; Museum Comparative Zoology); Bosque County, Texas, October 3, November 1, Belfrage; Uvalde, Texas, last of July, E. Palmer; San Antonio, Bexar County, Texas, June, M. Newell, (L. Bruner); Carrizo Springs, Dimmit County, Texas, November, A. Wadgymer (L. Bruner); Corpus Christi Bay, Nueces County, Texas, December 11-20, E. Palmer; Gulf Coast of Texas, Aaron; Barber County, Kansas, Cragin (L. Bruner).

I had formerly mistaken this species for *Cal. occidentalis* Thomas, and distributed specimens under that name. This note may serve to correct the error. The longer furcula serves somewhat readily to distinguish this species from the preceding, smaller and less heavily maculate species.

22. PACKARDII SERIES.

This is a group in which the prozona of the male is usually quadrate or subquadrate, and the interval between the mesothoracic lobes of the same sex varies from quadrate to fully twice as long as broad. The prosternal spine is usually rather short, often appressed. The tegmina are always fully developed and reach or surpass a little the tips of the hind femora; the hind tibiae are generally red, sometimes blue, and have nine to twelve spines in the outer series.

The supraanal plate is as in the collinus series. The furcula is slightly developed, consisting of moderately slender denticulations, not longer than the last dorsal segment. The cerci are generally moderately broad, gently spatulate, the apical portion generally incurved, sometimes merely incurved, often externally sulcate. The subgenital plate is never very broad, ordinarily rather narrow, subequal or apically narrowed, the apical margin neither elevated nor prolonged, and generally well rounded and entire.

The five species are of rather large or medium size, and comprise two tolerably distinct sets: one, of two species, of ordinary form, with short, apically truncate cerci, not nearly attaining the tip of the supraanal plate, and with strongly divergent forks to the furcula; and a second, of three species, of very robust form, cerci which though short

reach or nearly reach the tip of the supraanal plate and are apically sulcate, with parallel or subparallel distant forks to the furcula.

The species are all found west of the Mississippi, ranging from British Columbia and Assiniboia to Central Mexico, but are not known in California except in the north.

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96. MELANOPLUS PACKARDII.

(Plate XXI, figs. 1-4.)

Caloptenus fasciatus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XVII (1875), p. 477; Ent. Notes, IV (1875), p. 76; Bull. U. S. Geol. Surv. Terr., II (1876), p. 261.—BRUNER, Can. Ent., IX (1877), p. 144.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 42.—SCUDDER!, Cent. Orth. (1879), p. 21.

Melanoplus packardii SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1878), p. 287; Ent. Notes, VI (1878), p. 46; Rep. U. S. Ent. Comm., II (1881), App., p. 24, pl. XVII, figs. 7-8.—BRUNER, *ibid.*, III (1883), p. 60; Can. Ent., XVII (1885), p. 18; Bull. Washb. Coll., I (1885), p. 139; Rep. U. S. Ent., 1885 (1886), p. 307.—CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1888), p. 71.—KOEBELE, Bull. Div. Ent. U. S. Dep. Agric., XXII (1890), p. 94.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 27.

Melanoplus packardii rufipes COCKERELL, Entom., XXII (1889), p. 127.

Pezotettix arkansana MCNEILL!, MS.

Of tolerably large size, brownish yellow. Head a little prominent, luteo-testaceous; a broad dark brown or blackish median band extends from the vertex between the eyes to the posterior extremity of the pronotum, broadest on the latter and occupying about one-third of it, but sometimes, and especially in southern examples, wholly absent from the pronotum; besides this, another band runs from behind the eye to the anterior margin of the metazona; generally this is comparatively narrow and often obscure, but often sends off streaks of blackish fuscous down the incisures, and is sometimes tolerably distinct and uniformly deep in tint; vertex considerably tumid, well raised above the level of the pronotum, the interspace between the eyes fully half as broad again (male) or more than twice as broad (female) as the first antennal joint; fastigium strongly declivent, slender, with parallel sides, and rather deeply sulcate; frontal costa as broad as the interspace between the eyes, equal, scarcely sulcate below the ocellus, biserially punctate above; eyes large, not very prominent even in the male, elongate but no longer than the infraocular portion of the genae; antennae yellow, somewhat infuscated apically, fully three-fourths (male) or but little more than two-thirds (female) as long as the hind femora. Pronotum slightly expanding posteriorly, the disk broadly convex and passing by a well rounded shoulder, which only posteriorly forms the semblance of lateral carinae, into the vertical lateral lobes; median carina scarcely perceptible except on the metazona, where it is distinct but not prominent; transverse sulci distinct;

front margin subtruncate, hind margin obtusangulate; prozona longitudinal (male) or quadrate (female), only a little longer than the densely punctate metazona. Prosternal spine rather long, erect, subpyramidal, not very blunt, its anterior face vertical; interspace between mesosternal lobes fully twice as long as broad (male) or a little longer than broad (female). Tegmina surpassing a little the hind femora, rather broad, tapering considerably in the apical half, brownish fuscous, with a row of dusky quadrate spots down the proximal half of the discoidal area, but sometimes wholly immaculate. Wings hyaline, glistening, the veins in the apical and anterior regions fuscous. Legs yellow, tinged with dull orange, the hind femora faintly bifasciate above internally, and with the upper exterior carina black; hind tibiae normally glaucous, paler and dull at the apex, sometimes uniform red, the spines pallid, black apically, ten to eleven, rarely twelve, in number in the outer series. Extremity of male abdomen distinctly clavate, but little recurved; supraanal plate triangular, with thickened feebly upraised edges and a coarse percurrent median sulcus; furcula consisting of a pair of short, divergent, flattened, tapering, often unequally tapering fingers, extending over the supraanal plate by hardly more than the length of the last dorsal segment; cerci rather small, strongly compressed, bent inward, nearly equal throughout but smallest mesially, truncate at tip; subgenital plate moderately broad, subequal, longer than broad, with nearly even lateral margins, entire and subtuberculate at tip, broadly rounded as viewed from above.

Length of body, male 28.5 mm., female 26 mm.; antennae, male 12.5 mm., female 10.5 mm.; tegmina, male 24.5 mm., female 23 mm.; hind femora, male 16 mm., female 15 mm.

Seventy males, 106 females. British Columbia, Crotch (Museum Comparative Zoology; S. H. Scudder); La Chapples, Yakima River, Washington, July 16, S. Henshaw (Museum Comparative Zoology); Little Spokane, Washington, July 24, S. Henshaw (same); Camp Umatilla, Washington, June 27, Henshaw (same); Ellensburg, Kittitas County, Washington, July 14-15, Henshaw (same); Wallula, Wallawalla County, Washington, Packard (U.S.N.M.—Riley collection; S. H. Scudder); Umatilla, Oregon, June 24, Henshaw (Museum Comparative Zoology; L. Bruner); Siskiyou County, California (U.S.N.M.—Riley collection); Boise City, Ada County, Idaho (same); Salmon City, Lemhi County, Idaho (same); Henry Lake, Idaho, August (L. Bruner); Soda Springs, Bannock County, Idaho (same); Montana (U.S.N.M.—Riley collection); Yellowstone, Montana (same); Fort Benton, Choteau County, Montana, July (same); Glendive, Dawson County, Montana, Bruner (same); Fort McKinney, Johnson County, Wyoming, July (same); Crawford County, Iowa, July 13-24, J. A. Allen; Denison, Crawford County, Iowa, July 20, Allen; Dallas County, Iowa, August, Allen; Jefferson, Greene County, Iowa, July 20-24, *in coitu*, Allen; Nebraska, Dodge (S. Henshaw; S. H. Scudder); Pine Ridge, Nebraska, July (L. Bruner). Valentine, Cherry County, Nebraska, Bruner (U.S.N.M.—

Riley collection; L. Bruner); Gordon, Sheridan County, Nebraska, Bruner (same); Fort Robinson, Dawes County, Nebraska, August 22, Bruner (same); West Point, Cuming County, Nebraska (L. Bruner); Cheyenne County, Kansas, Cragin (same); Lakin, Kearny County, Kansas, 3,000 feet, September 1; Finney County, Kansas, H. W. Menke (University of Kansas); Pine Bluff, Jefferson County, Arkansas, September 1 (J. McNeill); Salt Lake Valley, Utah, 4,300 feet, August 1-4; American Fork Canyon, Utah County, Utah, 9,500 feet, August 2-3; Salt Lake, Utah, July 26, common, A. S. Packard; Spring Lake Villa, Utah County, Utah, August 1-4, E. Palmer; Ruby Valley, Nevada, R. Ridgway; Colorado, 5,500 feet, Morrison (S. Henshaw; S. H. Scudder); Colorado, July (U.S.N.M.—Riley collection); Garden of the Gods, El Paso County, Colorado, July, October (University of Kansas; S. H. Scudder); Colorado Springs, El Paso County, Colorado, July, August, E. S. Tucker (University of Kansas); Florissant, El Paso County, Colorado, 8,000 feet, August 17-22; Pueblo, Colorado, 4,700 feet, July 8-9, August 30-31; Poudre River, Colorado, (L. Bruner); Santa Fe, New Mexico, June, T. D. A. Cockerell; Texas, Belfrage, June-September (U.S.N.M.—Riley collection; S. H. Scudder); Dallas, Texas, Boll (same).

It has also been reported from Garden City, Kansas (Bruner), Regina, Assiniboia (Caulfield), and northern California, abundant (Koebele).

This species bears a close general resemblance to *M. bivittatus*, from which it is nevertheless very distinct. Bruner says, with regard to it, that "it never leaves the open country for timbered or low localities where the vegetation is rank," as that and other species do. It is a prairie species.

Cockerell has given the variety with red hind tibiae a distinctive name. I have seen it from British Columbia, Washington, Oregon, northern California, Idaho, Montana, Nebraska, Kansas, Utah, Nevada, Colorado, and New Mexico. It appears to be the prevailing if not exclusive form in some northern parts of its range. Specimens before me from Wyoming, Iowa, and Texas have blue legs only; both forms occur in Montana, Nebraska, Utah, and Colorado.

In coloring and markings it is one of the most variable species of *Melanoplus* known to me, but I have been unable to find grounds for specific distinctions between the various forms, which seem to run into each other completely.

97. MELANOPLUS FOEDUS.

(Plate XX, fig. 9.)

Melanoplus foedus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), p. 69; Cent. Orth. (1879), p. 58.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 61; Ins. Life, IV (1891), p. 146; Bull. Div. Ent. U. S. Dep. Agric., XXVII (1892), p. 29; *ibid.*, XXVIII (1893), pp. 21-22, fig. 9 a b; Publ. Nebr. Acad. Sc., III (1893), p. 27; Rep. Nebr. St. Bd. Agric., 1893 (1893), p. 460.

Of medium or rather large size. Head rather large, not elevated, slightly arched; eyes pretty large, but not prominent; interspace

between the eyes as broad (male) or half as broad again (female) as the first antennal joint; fastigium shallow (female) or moderately sulcate (male) with low, stout, nearly parallel, bounding walls and scarcely expanding in front; frontal costa stout, well advanced, subequal, scarcely enlarging downward, above flat, at the ocellus and below it a little and broadly sulcate. Pronotum simple, the metazona coarsely and faintly punctate, expanding very slightly and a little depressed above anteriorly, on either side; prozona narrowed a little in front but above only; transverse sulci distinct and continuous; median carina slight and confined to the metazona, lateral carinae subobsolete. Prosternal spine not very long, erect, appressed conical, blunt; interspace between mesosternal lobes thrice (male) or nearly twice (female) as long as broad. Tegmina extending a little (female) or considerably (male) beyond the abdomen. Extremity of male abdomen clavate, hardly recurved, the supraanal plate triangular, considerably longer than broad, bluntly pointed, the sides nearly straight, slightly puckered in the middle; furcula consisting of a pair of sinuous, depressed, conical, pointed projections, diverging at right angles, about half as long as the cerci; cerci forming very simple compressed laminae, the basal three-fifths straight, tapering a little and directed backward and upward, the apical two-fifths also straight, enlarging slightly, keeping the same direction but bent a little inward, the outer surface a little hollowed, the extremity truncate, its corners rounded; subgenital lobe scoop-shaped but slightly produced at the apex, the margin entire. Basal tooth of the lower valves of the ovipositor sharp, triangular, but much broader than long.

The general color is a dirty cinereous above, a dingy clay yellow below; antennae dull testaceous, becoming somewhat ferruginous toward the tip; a pretty broad and usually distinct, blackish brown or piceous band extends from behind the eye along the upper portion of the lateral lobes across the prozona, and sometimes as a blurred and expanded continuation of it across the metazona also. Tegmina brownish cinereous, the anal area sometimes a little lighter, the discoidal area enlivened to a greater or less extent, but seldom conspicuously, by an alternation of blackish and pallid longitudinal rectangular spots. Hind femora dirty clay brown with dusky incisures, above with median and subapical dusky or dark fuscous patches; hind tibiae red with black-tipped spines, ten to twelve in number in the outer series.

Length of body, male, 24 mm., female, 30 mm.; antennae, male, 13.5 mm., female, 12 mm.; tegmina, male, 21 mm., female, 24 mm.; hind femora, male, 14 mm., female, 16.5 mm.

Twelve males, 11 females. Pueblo, Colorado, August 30-31.

The original types of this species are all that I have seen, but it is said by Bruner to be found also in "Kansas, Nebraska, Wyoming, Utah, Nevada, Idaho, Montana, and the Dakotas, along with New

Mexico." As all the specimens seen from these regions which might be referred to this species (and in some instances have been so labeled) prove to belong to *M. packardii*, I think it probable that some at least of these localities may be wrongly given. The species indeed differs but slightly from *M. packardii*, and may prove to be merely a varietal form of it dependent upon station, which in this species is in the dank vegetation of river bottoms where *M. packardii* occurs but rarely. I took a few specimens of the latter, however, in company with the former.

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98. MELANOPLUS CORPULENTUS, new species.

(Plate XX, fig. 10.)

Melanoplus corpulentus BRUNER!, MS.

A heavy-bodied form, somewhat above the medium size, fusco-testaceous, tinged with ferruginous. Head not prominent, olivaceo-testaceous, often much blotched with fuscous, above always much infuscated, generally in longitudinal streaks, the lateral edges of the fastigium more or less blackened, and with a generally distinct postocular stripe; vertex gently tumid, slightly elevated above the pronotum, the interspace between the eyes nearly half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium steeply declivent, considerably (male) or shallowly (female) sulcate; frontal costa failing by some distance to reach the clypeus, slightly contracted above, at its widest as broad as the interspace between the eyes, sulcate at, and in the male below, the ocellus, punctate throughout; eyes not very large, feebly prominent in the male, anteriorly truncate (female) or subtruncate (male), about as long as the infraocular portion of the genae; antennae red, sometimes a little infuscated apically, somewhat more than four-fifths (male) or than two-thirds (female) as long as the hind femora. Pronotum stout, distinctly enlarging posteriorly, especially in the female, more or less and irregularly clouded with fuscous on the disk, often with a ferruginous tinge especially on the metazona, the lateral carinae occasionally marked obscurely with flavous, the lateral lobes generally but obscurely infuscated at the upper half of the prozona, often broken by lighter tints; disk broadly convex, passing into the subvertical lateral lobes by a rounded shoulder occasionally forming distinct carinae; median carina distinct on the metazona, less distinct (female) or subobsolete especially between the sulci (male) on the prozona; front margin subtruncate, hind margin obtusangulate, the angle generally very broadly rounded; prozona slightly longitudinal (male) or quadrate or feebly transverse (female), distinctly (male) or scarcely (female) longer than the rather obscurely punctate metazona; transverse sulci of prozona tolerably distinct, feebly arcuate, opening forward. Prosternal

spine moderately long, appressed cylindrical, rather stout, a little retrorse; interspace between mesosternal lobes about twice as long as broad (male) or distinctly transverse but narrower than the lobes (female), the metasternal lobes attingent (male) or moderately distant (female). Tegmina usually a little surpassing, sometimes hardly attaining the tips of the hind femora, moderately broad, distinctly tapering in the distal half, blackish fuscous with pallid cross-veins, and heavily though rather delicately maculate, especially but not exclusively in the discoidal area; wings ample, hyaline with the feeblest possible bluish flush, the apical and anterior venation fuscous or blackish fuscous. Fore and middle femora of male somewhat tumid; hind femora very stout, with prominent inferior carina, brownish fuscous with superior cloudy, rather broad, dark fasciation, the exterior face more or less testaceous clouded irregularly with fuscous, the lower face and lower half of inner face bright deep red, including sometimes a part of the lower genicular lobes, the rest of the geniculation infuscated; hind tibiae slightly valgate, stout, bright deep red, sometimes feebly infuscated at the extreme tip, the spines short, black to the base, ten to eleven, usually eleven, in number in the outer series. Extremity of male abdomen strongly clavate, considerably recurved, the supraanal plate subtriangular with broadly angulate sides and subrectangulate apex, the surface nearly plane, a little depressed in the apical half, with a rather shallow and broad, apically narrowing, percurrent median sulcus; furcula consisting of a pair of very slight, short, distant, diverging denticulations lying on the outer side of the ridges bordering the median sulcus of the supraanal plate; cerci compressed, considerably incurved or mesially bent laminae, hardly three times as long as broad, gradually constricted mesially, the apex well rounded but subangulate below, the whole apical portion rather deeply sulcate exteriorly, not reaching the tip of the supraanal plate; infracercal plates broad, exposed on either side of the base of the cerci, narrowing rapidly and extending to the tip of the supraanal plate; subgenital plate moderately broad, subequal, the apical margin well rounded, hardly flaring, mesially subangulate, not elevated, entire.

Length of body, male, 24 mm., female, 28 mm.; antennae, male, 11.75 mm., female, 11 mm.; tegmina, male, 16.5 mm., female, 22.5 mm.; hind femora, male, 14 mm., female, 15 mm.

Nineteen males, 15 females. Tlalpan, Mexico, November (L. Bruner); hills about San Luis Potosi, Mexico, October 15, E. Palmer; mountains twelve leagues east of San Luis Potosi, Mexico, Palmer; Sierra de San Miguelito, San Luis Potosi, Mexico, Palmer; Zacatecas, Mexico, November (U.S.N.M.—Riley collection); Sonora, Mexico, Schott; Silver City, Grant County, New Mexico, C. H. Marsh (L. Bruner).

99. MELANOPLUS CONSPERSUS, new species.

(Plate XXI, fig. 5.)

A stout, medium-sized or rather less than medium sized species, brownish fuscous above, testaceous beneath. Head a little prominent, luteo-testaceous clouded with plumbeous, broadly striped above with blackish fuscous, and with a subpiceous postocular band; vertex gently tumid, slightly elevated above the pronotum, the interspace between the eyes considerably broader than (male) or nearly twice as broad as (female) the first antennal joint; fastigium steeply declivent, distinctly sulcate throughout; frontal costa percurrent, subequal, almost (female) or quite (male) as broad as the interspace between the eyes, distinctly sulcate at and below the ocellus, biserially punctate above; eyes moderate, slightly prominent in the male, hardly so long as the infraocular portion of the genae; antennae red, becoming more or less infuscated apically, about four-fifths (male) or about three-fourths (female) as long as the hind femora. Pronotum stout, distinctly enlarging from in front backward, especially in the female, feebly tinged with ferruginous, the upper half of the lateral lobes of the prozona glistening brownish fuscous, the disk very broadly convex, passing into the subvertical lateral lobes by a well-rounded shoulder, hardly forming lateral carinae except feebly on the metazona; median carina percurrent, more distinct on the metazona than on the prozona, alike in the two sexes; front margin truncate, hind margin obtusangulate; prozona feebly transverse, of the same length as the rather obscurely punctate metazona. Prosternal spine not very high, stout, considerably appressed, tapering as seen from in front, blunt; interspace between mesosternal lobes almost twice as long as broad (male) or feebly transverse (female), the metasternal lobes attingent (male) or approximate (female). Tegmina reaching as far as the hind femora, of moderate breadth, tapering from the basal fourth, brown, heavily sprinkled with fuscous dots most abundant in but not confined to the discoidal area, where in the female they alternate with pallid dashes; wings moderate, hyaline with pale greenish veins, which become rather feebly infuscated anteriorly and apically. Fore and middle femora a little tumid in the male; hind femora very stout, testaceous or pallid testaceous, the upper face slightly ferruginous, except the lower third twice very obliquely and very broadly fasciate with blackish fuscous, the inferior third flavous, the genicular arc blackish fuscous; hind tibiae feebly valgate, bright red, the spines black to their base except on their inner side, ten in number in the outer series. Extremity of male abdomen somewhat clavate, slightly recurved, the supraanal plate subtriangular with basally angulate sides and acutangulate tip, the surface nearly flat but stepped, the apical half or less at a lower level and the lateral margins slightly crenate in consequence, the median sulcus rather slender, percurrent but slight in the apical half; furcula consist-

ing of a pair of slight, distant, slightly divergent, slender denticulations on the outer side of the ridges bounding the median sulcus of the supraanal plate; cerci consisting of two parts—a straight, slightly tapering, punctate, compressed lamina about twice as long as broad, and a more strongly compressed apical flange bent at a tolerably strong angle with it, a little expanded, apically rounded angulate, externally deeply sulcate, scarcely falling short of the tip of the supraanal plate; infracereal plates apparently as in *M. corpulentus*; subgenital plate moderately broad, subequal, the apical margin not elevated, very feebly flaring, strongly rounded, not mesially angulate, entire.

Length of body, male, 20 mm., female, 23.5 mm.; antennae, male, 8.5 mm., female, 9 mm.; tegmina, male, 14.5 mm., female, 16 mm.; hind femora, male, 10.5 mm., female, 12.5 mm.

One male, 1 female. Southwest Nebraska (L. Bruner).

This species looks like a diminutive form of the preceding, but differs from it in many points of structure and in coloring, besides those mentioned in the table.

100. MELANOPLUS COMPACTUS. new species.

(Plate XXI, fig. 6.)

Melanoplus compactus BRUNER!, MS.

A medium-sized species, blackish fuscous in coloring, more or less tinged with ferruginous. Head not prominent, rufo-luteous more or less clouded with fuscous, with a median blackish fuscous stripe above and a postocular piceous band; vertex gently tumid, feebly elevated above the pronotum, the interspace between the eyes considerably broader than (male) or nearly twice as broad as (female) the basal antennal joint; fastigium steeply declivent, sulcate throughout, more deeply in the male than in the female; frontal costa just failing to reach the clypeus, feebly narrowed above but otherwise subequal, as broad as the interspace between the eyes, sulcate at and below the ocellus, biserially punctate above; eyes not prominent nor large, about as long as the infraocular portion of the genae; antennae red, gradually infuscated apically, in the female more than three-fourths as long as the hind femora. Pronotum stout, gradually enlarging posteriorly, the lateral lobes of the prozona with a more or less distinct piceous postocular band, the disk passing into the vertical lateral lobes by a distinctly though slightly angulated shoulder, forming feeble lateral carinae; median carina percurrent but much feebler on the prozona than on the metazona; front margin truncate, hind margin obtusangulate; prozona feebly (male) or distinctly (female) transverse, no longer than the closely punctate metazona. Prosternal spine rather short and rather stout, much appressed, tapering, very blunt; interspace between mesosternal lobes a little longitudinal (male) or a little transverse (female), the metasternal lobes attingent (male) or moderately distant (female). Tegmina surpassing a little the hind femora, moderately broad, brownish fuscous

punctate with fuscous, especially in the discoidal area where the puncta are aligned with lutescent marks; wings moderately ample, hyaline, the veins pale fuscous, becoming darker anteriorly and apically. Fore and middle femora considerably tumid in the male; hind femora stout, dull testaceous, very obliquely bifasciate with blackish fuscous, except beneath, which is flavous; hind tibiae feebly valgate, bright red, the short black spines with pallid bases, nine to eleven in number in the outer series. Extremity of male abdomen somewhat clavate, a little recurved, the supraanal plate subtriangular with acutangulate apex, nearly plane surface, apically stepped by a distinct transverse ridge just beyond the middle, the median sulcus broad and shallow in the basal portion, narrow beyond; furcula consisting of a pair of slight, distant, parallel denticulations lying outside the ridges bounding the median sulcus of the supraanal plate; cerci and infracercal plates entirely as in *M. conspersus*; subgenital plate rather narrow, equal, not at all flaring, the apical margin not at all elevated, well rounded, entire.

Length of body, male, 21 mm., female, 22.5 mm.; antennae, female, 10 mm.; tegmina, male, 16.25 mm., female, 17.25 mm.; hind femora, male, 11 mm., female, 12.5 mm.

Two males, 2 females. Dakota (U.S.N.M.—Riley collection); Gordon, Sheridan County, Nebraska, L. Bruner (same).

This species is closely related to the preceding, from which it differs in the narrowness of the subgenital plate of the male and the difference in the interspace between the mesosternal lobes. Its general resemblance is very close.

23. TEXANUS SERIES.

In this not altogether homogeneous group, the prozona of the male is longitudinal, generally distinctly longitudinal, and the interspace between the mesosternal lobes in the same sex is almost, or fully, or even more than, twice as long as broad. With the exception of the first species, the hind margin of the pronotum is obtusangulate. The antennae are variable. The tegmina are also variable though always abbreviate, and in most of the species are longer than the pronotum and overlap, but in the first they are shorter and distant. The hind tibiae are red or glaucous and have nine to thirteen spines in the outer series.

The supraanal plate is triangular with more or less elevated margins and distinct median sulcus; the furcula is reduced to small or even minute denticulations; the cerci are large, constricted in the middle and again expanded, more or less incurved and sometimes again apically bent in the original direction; the subgenital plate is broad, generally produced or elevated apically, the margin entire.

There are five species, all occurring west of the Mississippi, except one which is found in the upper Mississippi region; of the others two occur in Texas (and one of them in Kansas also), a fourth east of the

Sierra Nevada in central California, and the last in central Mexico. I have also in my collection another species (No. 351) from Mexico, allied to one of the Texan species, but of which I know only the female, and therefore do not describe.

This series represents to a certain extent, in brachypterous forms, the robustus series of macropterous species.

§

101. MELANOPLUS DUMICOLA.

(Plate XXI, fig. 7.)

Pezotettix dunicolus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 76-77; Cent. Orth. (1879), pp. 65-66.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Of small size, smooth and glistening. Head not prominent, the vertex feebly tumid, scarcely elevated above the pronotum, the interspace between the eyes very narrow, much less than (male) or scarcely equaling (female) the width of the first antennal joint; fastigium steeply declivent, shallow, slender, subspatulate with rather coarse bounding walls; frontal costa moderate, equal except in being very slightly and roundly contracted above, wider than the interspace between the eyes, sulcate at and below the ocellus, sparsely punctate; eyes rather large, rather prominent especially in the male, very much longer than the infraocular portion of the genae; antennae four-fifths (male) or two-thirds (female) as long as the hind femora. Pronotum very simple, uniformly and very slightly expanding posteriorly, the front border truncate or scarcely convex, the hind border slightly and broadly mesially emarginate; lateral carinae completely obsolete and uniform, the disk passing insensibly into the lateral lobes; median carina faint, very blunt, equal throughout; prozona distinctly (female) or very (male) longitudinal, sparsely and rather faintly punctate, the metazona more distinctly and abundantly but with minuter puncta. Prosternal spine rather small, erect, conical, in the female a little appressed; interspace between mesosternal lobes more than twice as long as broad (male) or quadrate (female). Tegmina lateral, minute, considerably shorter than the pronotum, bluntly rounded apically, the inner margin nearly straight, the costal very convex, the whole twice as long as broad. Fore and middle femora considerably tumid in the male. Extremity of male abdomen considerably clavate, strongly recurved, the supraanal plate triangular, a very little longer than broad, the sides nearly straight, the extreme tip blunt; fureula reduced to a pair of broad, lamellate, triangular teeth, their angle projecting but little at the middle of either half of the supraanal plate; cerci broad, compressed-laminate, subequal but somewhat and broadly constricted in the middle, straight and directed upward, the apical half also incurved, the apex excised and produced a little above; subgenital plate quadrate, tumid, the apical margin semicircu-

lar, entire, the pallium projecting over it as a backward directed, stout, subdepressed, blunt process.

The general color is dark umber above, yellowish testaceous below; face dull olivaceous, in the female apparently darker by infuscation; antennae testaceous, more or less infuscated at the apical half; on the summit of the head a clay-colored band, which partly encircles the eyes and extends backward over the pronotum, on which it is very slightly arched; a similar but much broader and rather paler belt borders the lower margin of the lateral lobes, while a median line of the same color occurs on the abdomen, a mere line in front, broadening as it passes backward, extending over the whole dorsum and apically confluent with the lighter color of the under surface, leaving on either side between the upper and lower surfaces a broad but narrowing black belt. Hind femora with the outer face dark green, more or less infuscated, sometimes nearly black, especially on the upper half, the upper face ferruginous and the lower greenish yellow; hind tibiae rather dull green, occasionally obscured at either extremity, the spines with their apical half black, nine, rarely ten, in number in the outer series.

Length of body, male, 14 mm., female, 18.5 mm.; antennae, male, 7.25 mm., female, 7 mm.; tegmina, male, 2.8 mm., female, 3 mm.; hind femora, male, 9 mm., female, 10.5 mm.

Two males, 3 females. Bosque County, Texas, Belfrage.

Found in woods on plants and bushes in the latter half of September and the first half of October. Pairs were taken October 11. It is an aberrant member of the present group.



102. MELANOPLUS VARIABILIS, new species.

(Plate XXI, fig. 8.)

Pezotettix variabilis BRUNER!, MS.

Of medium size, green, more or less infuscated, the male the darker. Head a little longer than common but not otherwise prominent, olivaceous green, sometimes feebly suffused with ferruginous, above in darker examples more or less infuscated and always darker than below, with a brownish fuscous postocular band, sometimes broad, sometimes confined to its upper limits, margined above by lighter tints, the beginning of a subflavous stripe behind the upper part of the eyes; vertex gently tumid, faintly elevated above the pronotum, the interspace between the eyes twice (male) or more than thrice (female) as broad as the first antennal joint; fastigium very gently declivent, broadly and shallowly (male) or very shallowly (female) sulcate; frontal costa faintly narrowed above, as broad as (male) or much narrower than (female) the interspace between the eyes, expanding and evanescent next the clypeus, sulcate at and below the ocellus, sparsely punctate throughout, above biserially; eyes moderate in size, rather prominent in the male, a little longer than the infraocular portion of the

genae; antennae pale rufous or dark olivaceous, apically infuscated, two-thirds (male) or scarcely more than half (female) as long as the hind femora. Pronotum feebly (male) or gently (female) enlarging posteriorly, olivaceous green, more or less infuscated in the male, with a broad greenish-fuscous (female) or brownish-fuscous (male) postocular band confined to the prozona, the lateral carinae above it sometimes marked with dull flavous; disk nearly plane but subtectate, passing by an abrupt but rounded angulation, forming distinct percurrent lateral carinae, into the slightly tumid but otherwise vertical lateral lobes; median carina distinct, sharp, equal, percurrent; front margin subtruncate, hind margin very obtusangulate, sometimes rotundato-obtusangulate; prozona longitudinal (male) or longitudinally subquadrate (female), but little longer than the densely but shallowly punctate metazona. Prosternal spine very long, cylindrical or feebly conical, blunt, somewhat retrorse; interspace between mesosternal lobes more than half as long again as broad (male) or transversely subquadrate (female). Tegmina abbreviate, about as long as the pronotum, overlapping, short lanceolate, subacuminate and brownish fuscous (male) or green more or less suffused with fusco-ferruginous (female). Fore and middle femora considerably tumid in the male; hind femora green (female) or brownish fuscous (male), the outer face more or less ferruginous (female) or testaceous (male), the under surface sanguineous and the genicular arc black; hind tibiae green, in the male more or less infuscated, apically growing very pale ferruginous, the spines pallid, black-tipped, ten to twelve in number in the outer series. Extremity of male abdomen clavate, considerably recurved, the supraanal plate triangular, acutangulate at apex, the lateral margins and the sharp submedian ridges equally and feebly elevated, forming between them a broad shallow sulcus, the median sulcus moderately broad, percurrent, not very deep; furcula consisting of a pair of slight approximate triangular denticulations; cerci large, stout, fully twice as long as broad, much narrowed in the middle by the strong areuation of the upper margin, apically expanded into a subtriangular lobe, the whole nearly straight but slightly upcurved as seen from the side, sinuate as seen from above (though not so strongly as represented in the figure), being first curved inward and then slightly outward; subgenital plate subconical, the sides not vertical but inclined inward so that the free margins unite in an acute angle, while at the same time the apex is produced and elevated to form a conical marginal tubercle.

Length of body, male, 17.5 mm., female, 22 mm.; antennae, male and female, 6.75 mm.; tegmina, male, 6 mm., female, 6.25 mm.; hind femora, male, 10.5 mm., female, 13 mm.

Two males, 2 females. City of Mexico, Mexico, November, L. Bruner; Queretaro, Mexico, November (L. Bruner).

103. MELANOPLUS LEPIDUS, new species.

(Plate XXI, fig. 9.)

Slightly below medium size, blackish fuscous, with a feeble ferruginous tinge. Head not prominent, testaceous, very heavily flecked and punctate and often suffused with fuscous, above almost wholly blackish fuscous, with a slender testaceous stripe separating the dark vertex from the broad, piceous, postocular band; vertex gently tumid, distinctly elevated above the pronotum, the interspace between the eyes scarcely broader than (male) or nearly twice as broad as (female) the first antennal joint; fastigium steeply declivent, deeply (male) or moderately (female) sulcate throughout; frontal costa percurrent, faintly narrowed above in the male, otherwise equal, as broad as the interspace between the eyes, sulcate at and below the ocellus, punctate throughout, above biserially; eyes moderately large, rather prominent, especially in the male, somewhat longer than the infraocular portion of the genae; antennae castaneous, nearly five-sixths (male) or hardly three-fifths (female) as long as the hind femora. Pronotum subequal, faintly expanding posteriorly throughout (female) or only on the metazona (male), the lower portion of the lateral lobes ferrugineo-testaceous, the upper piceous, at least on the prozona, and sometimes obscurely so on the metazona, the disk broadly convex and passing by a scarcely angulate well-rounded shoulder, nowhere with a semblance of lateral carinae, into the vertical lateral lobes; median carina very slight, on the prozona subobsolete; front margin truncate, hind margin obtusangulate; prozona longitudinal (male) or quadrate (female), sparsely, coarsely, and very shallowly punctate, about half as long again as the finely and closely punctate metazona. Prosternal spine rather long, conical, erect, very blunt, feebly appressed, a little shorter and coarser in the female than in the male; interspace between mesosternal lobes nearly half as long again as broad (male) or quadrate (female). Tegmina abbreviate, about as long as the pronotum, attingent or feebly overlapping, broad ovate, nearly or somewhat less than twice as long as broad, apically angulate, blackish fuscous. Fore and middle femora somewhat tumid in the male; hind femora slender, particularly in the female, dull ferrugineo-testaceous, generally very broadly bifasciate with fuscous, and the whole geniculation fuscous, but these markings often more or less suffused and confused, the lower face warm testaceous; hind tibiae glaucous or dark glaucous, generally paler at the base, with a glaucous or fusco-glaucous patellar annulus, the spines black beyond the pallid base, eleven to thirteen in number in the outer series. Extremity of male abdomen considerably clavate and recurved, the supraanal plate triangular, with feebly angulate sides and subacutangulate apex, the margins gently elevated, the median sulcus equal, percurrent, moderately broad, rather deep, between sharp but little elevated walls, with a straight median transverse plica; furcula

consisting of a pair of distant slight denticulations, lying well outside the base of the submedian ridges of the supraanal plate; cerci broad at base, rapidly tapering to the middle, where they are about half as broad as at base, beyond again expanding wholly by the triangular production of the inferior apical portion, the apical margin truncate, the whole about two and a half times the basal breadth, feebly incurved; subgenital plate about as broad as long, the apical margin slightly elevated above the lateral, the two together, as seen from above, well rounded, entire.

Length of body, male, 17.5 mm., female, 21 mm.; antennae, male, 8 mm., female, 6 mm.; tegmina, male and female, 4 mm.; hind femora, male, 9.25 mm., female, 10.5 mm.

Six males, 7 females. Humboldt River, Nevada, August, S. W. Gorman (Museum Comparative Zoology); mountains near Lake Tahoe, California, October 14, H. W. Henshaw, Wheeler's Expedition, 1876; Truckee, Nevada County, California, October 10.

104. *MELANOPLUS BLATCHLEYI*, new name.

(Plate XXI, fig. 10.)

Pezotettix occidentalis BRUNER, Can. Ent., VIII (1876), p. 124; *ibid.*, IX (1877), p. 144; Rep. U. S. Ent. Comm., III (1883), p. 59.—MCNEILL, Psyche, VI (1891), p. 76.—OSBORN, Proc. Iowa Acad. Sc., I, Pt. II (1892), p. 117.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 27.—BLATCHLEY!, Can. Ent., XXVI (1894), pp. 243-244.

Pezotettix viola BLATCHLEY!, Can. Ent., XXIII (1891), p. 81.

Of moderately large size, cinereo-fuscous with an olivaceous tinge. Head somewhat prominent, olivaceo-testaceous variably but generally considerably infuscated, above dark fuscous, separated by a testaceous stripe from the broad piceous postocular band; vertex gently tumid, feebly elevated above the pronotum, the interspace between the eyes half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium somewhat steeply declivent, plane, with the lateral margins faintly raised in the male; frontal costa fading before the clypeus, equal or subequal, as wide as the interspace between the eyes, sulcate at and below the ocellus, at least in the male, somewhat densely punctate throughout; eyes moderately large and prominent, very much longer than the infraocular portion of the genae; antennae rufo-testaceous, scarcely shorter than (male), or nearly two-thirds as long as (female) the hind femora. Pronotum subequal, feebly enlarging (at least below) on the metazona, the sides with a broad piceous postocular band confined to the prozona in the male, the same being wholly obsolete, obscure, or confined to the upper limits of the lateral lobes in the female; disk very broadly convex, passing by a distinct but blunt angulation forming feeble lateral carinae into the inferiorly vertical lateral lobes; median carina distinct but not very sharp on the metazona, subobsolete or obsolete, especially between the sulci and, in the male, on the prozona; front margin truncate, hind margin obtusangulate, the angle

rounded in the female and sometimes in the male; prozona distinctly longitudinal (male) or quadrate or feebly longitudinal (female), generally more (male) or generally less (female) than one-third longer than the closely punctate metazona. Prosternal spine long, appressed cylindrical, blunt, retrorse; interspace between mesosternal lobes about half as long again as broad (male), or feebly transverse (female). Tegmina abbreviate, a little longer than the pronotum, overlapping, very broad just beyond the base and rapidly narrowing, short sublanceolate, the costal margin roundly angulate, apically subacuminate, the dorsal and lateral fields angularly separated, brownish fuscous, the dorsal field often cinereous, the lateral often feebly flecked with fuscous. Fore and middle femora very tumid in the male; hind femora testaceous or flavo-testaceous, heavily and broadly but sometimes confusedly bifasciate with blackish fuscous, the geniculation blackish, the inferior face pale flavous, pallid apically; hind tibiae red, blackish at the base, followed by an obscure pallid annulus, below which the red is feebly infuscated, the spines black on their apical half, ten to eleven, rarely nine, in number in the outer series. Extremity of male abdomen strongly clavate, much recurved, the supraanal plate triangular, with an acutangulate or rectangulate apex, slightly angulate sides which are considerably and gradually elevated, and a tolerably broad, percurrent, moderately deep but apically fading median sulcus, broadened at extreme base, lying between sharp walls; furcula consisting of a pair of approximate denticulations of varying length, but generally at least as long as the last dorsal segment, generally slenderer than represented in the figure; cerci coarse and heavy, broad at base, rapidly narrowing, so that the middle is about two-thirds as broad as the extreme base, beyond enlarging slightly, curved rather abruptly inward, and strongly and abruptly compressed or exteriorly sulcate, the apex rounded subtruncate; subgenital plate rather broad and full, the lateral margins arcuate, the apical margin gently elevated but not tuberculate, entire, both margins together as seen from above subsemicircular.

Length of body, male, 23 mm., female, 24 mm.; antennae, male, 14 mm., female, 10 mm.; tegmina, male, 9.5 mm., female, 8.5 mm.; hind femora, male, 15 mm., female, 13.5 mm.

Twenty-one males, 16 females. Nebraska, Dodge; Fort Robinson, Dawes County, Nebraska, August 22, L. Bruner (U.S.N.M.—Riley collection); Omaha, Douglas County, Nebraska (L. Bruner; U.S.N.M.—Riley collection); St. Louis, Missouri, October 10, 27 (U.S.N.M.—Riley collection); Moline, Rock Island County, Illinois, McNeill; Putnam County, Indiana, June 30, October 21 (W. S. Blatchley; A. P. Morse); Vigo County, Indiana, Blatchley (A. P. Morse). It has also been reported from Iowa (Osborn).

According to Blatchley and Bruner it is found in woods. Bruner's specific name for this insect is preoccupied by Thomas.

105. MELANOPLUS TEXANUS.

(Plate XXII, fig. 1.)

Pezotettix texanus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 80-81; Cent. Orth. (1879), pp. 69-70.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Pezotettix scudderi BRUNER!, Bull. Washb. Coll., I (1885), p. 136.

Of moderately large size. Head hardly prominent, the vertex tumid, a little elevated above the pronotum, the interspace between the eyes half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium rather steeply declivent, so shallow as to be hardly perceptible, broad, enlarging, and well rounded apically; frontal costa moderate, rather prominent, equal, plane, nowhere sulcate excepting at and for a short distance below the ocellus and slightly, as broad as the interspace between the eyes, delicately punctate throughout; eyes moderately large, moderately and similarly prominent in the two sexes, a little longer than the infraocular portion of the genae; antennae five-sevenths (male) or two-thirds (female) as long as the hind femora. Pronotum very simple, nearly equal, enlarging a little on the metazona (male) or enlarging posteriorly to a considerable extent and uniformly throughout (female), the front margin scarcely convex (male) or truncate (female), the hind border very broadly angulate; median carina distinct and abrupt but slight and equal, the lateral carinae subobsolete; prozona distinctly longitudinal (male) or longitudinally subquadrate (female), about a third longer than the very faintly rugulose metazona. Prosternal spine long, subconical, mesially enlarged, blunt, a little retrorse; interspace between mesosternal lobes twice or more than twice as long as broad (male) or subquadrate, by exception half as long again as broad (female). Tegmina abbreviate, overlapping, produced ovate, about as long as the head and pronotum together, nearly twice as long as broad, the inner margin rather gently the costal margin considerably convex, the tip roundly pointed. Fore and middle femora somewhat tumid in the male. Extremity of male abdomen clavate, considerably recurved, the supraanal plate triangular, a very little broader than long, pointed, the sides nearly straight; furcula consisting of a pair of slight but broad, depressed, angular teeth, their points as far apart as the width of one of them; cerci rather broad and straight, broadly and roundly constricted in the middle, the extremity truncate and rounded, the whole directed toward the apex of the subgenital plate and curved considerably inward; subgenital plate bluntly subconical, the margin quadrate, the apical margin a little elevated, recurved, and entire.

The general color is a dull somewhat cinereous brown above, a dirty but rather pale greenish brown below, marked conspicuously by a very broad straight piceous belt, scarcely broader behind than in front, extending from the eyes across the prozona, its upper edge at the

lateral carinae; antennae pale red, apically infuscated. The upper surface of the body and the tegmina are more or less profusely dotted with very pale fuscous; an oblique, cuneiform, yellow dash, the apex in front and above, follows the ridge of the metathoracic episterna, margined on either side by an equal piceous belt. The hind femora generally partake of the color of the upper surface of the body, but appear darker from being specked with blackish fuscous dots, which generally cluster more or less into two very oblique bands in the middle and beyond the middle, and also margin interruptedly the upper outer carina; hind tibiae red, the apical half of the spines black, these eleven to thirteen, generally eleven, in number in the outer series.

Length of body, male, 23.5 mm., female, 31 mm.; antennae, male, 10 mm., female, 11 mm.; tegmina, male, 7.6 mm., female, 10 mm.; hind femora, male, 14 mm., female, 17 mm.

Five males, 12 females. Texas, Belfrage (U.S.N.M.—Riley collection); Fort Worth, Tarrant County, Texas, May (same); Dallas, Texas, Boll (same; S. H. Scudder); Labette County, Kansas, W. S. Newlon (L. Bruner).

24. PLEBEJUS SERIES.

In this somewhat homogeneous group, the prozona is distinctly longitudinal in both sexes (the female of one species is not known) and nearly or quite half as long again as the metazona, the posterior margin of which is subtruncate or truncate or sometimes very obtusangulate. The interspace between the mesosternal lobes in the male is more than twice, sometimes thrice, as long as broad. The tegmina are very variable; one species is dimorphic, having either fully developed tegmina and wings considerably surpassing the tips of the hind femora, or ovate lanceolate overlapping tegmina, acuminate at tip and a little longer than the pronotum; another is macropterous with subequal tegmina, reaching the tips of the hind femora; the other species are brachypterous, but the tegmina are variably shaped,—sometimes as in the brachypterous form of the dimorphic species, at others either rounded ovate and attingent, or widely separated and lateral.

The supraanal plate is triangular, with generally a tolerably plane surface; the furcula is obsolete, subobsolete, or reduced to mere brief denticulations; the cerci are long, constricted in the middle, but expanding only a little apically, incurved, and bluntly rounded or inferiorly subacuminate at tip; the subgenital plate is always small, distinctly narrower than long, often narrowing apically, and sometimes ends in a tubercle.

There are five species, most of them widely separated from one another; one occurs in the upper Mississippi valley from the Dakotas to Kentucky, while the others are found respectively in Florida (two species), Texas, and California.

106. MELANOPLUS PLEBEJUS.

(Plate XXII, fig. 2.)

Pezotettix plebejus STÅL, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 12.

Pezotettix pupaeformis SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX, (1879), pp. 83-84; Cent. Orth. (1879), pp. 72-73.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.

Of medium or slightly above medium size. Head not prominent, the vertex feebly tumid, scarcely elevated above the pronotum, the interspace between the eyes half as broad again (male) or twice as broad (female) as the first antennal joint; fastigium rather steeply declivent, broad, shallow, enlarging slightly in front, the bounding walls low and rounded; frontal costa moderate, equal, as broad as (male) or slightly narrower than (female) the interspace between the eyes, flat, sunken a little at the ocellus, and in the female sulcate below it, biserially punctate above; eyes large, rather prominent, very much longer, especially in the male, than the infraocular portion of the genae; antennae fully two-thirds (male) or a little more than one-half (female) as long as the hind femora. Pronotum simple, equal, the front margin a little full, the hind margin gently angulated; median carina distinct though rather slight, equal; lateral carinae rounded off; prozona faintly and distantly, metazona abundantly but not deeply punctate; prozona distinctly longitudinal and similar in the two sexes, fully half as long again as the metazona. Prosternal spine large, long, subcylindrical, blunt, a little retrorse; interspace between mesosternal lobes three times (male) or one and a half, rarely two, times (female) as long as broad. Tegmina abbreviate, overlapping, obovate, about as long as the pronotum, less than twice as long as broad, the curves of the costal and inner margins similar, the tip acutangulate. Male abdomen long and slender, the extremity clavate, somewhat recurved, the supraanal plate triangular, sharply pointed, fully as long as broad, the sides straight; furcula consisting of a pair of minute, rounded, approximate, flattened lobes, as long as broad; cerci with the basal half tapering by the rapid sloping of the upper edge so as to be half as broad in the middle as at base, beyond broadening again somewhat on the same side, so that the apical half is subspatulate, continuous with the basal part but strongly incurved, externally deeply channeled, the tip broadly rounded, the whole about as long as the last joint of the fore tarsi; subgenital plate very small and narrow, tumid, apically subtuberculate, the apical margin slightly elevated, entire.

The general color is a griseous brown, excepting the abdomen which is brownish testaceous; beneath clay yellow; the antennae are yellow at the base, darkening beyond to fuscous ferruginous; from behind the eye a broad black band extends across the prozona, generally enlivened on the genae by an oblique yellow streak, which in the

female narrowly traverses the lateral lobes of the pronotum nearly or quite to the lateral carinae; the tegmina are of the color of the disk of the pronotum and immaculate. Hind femora clay yellow more or less infuscated and with a pair of often obscure blackish bars; hind tibiae glaucous, pallid at base, with a blackish annulus, the spines pallid in basal black in apical half, twelve to thirteen, generally twelve, in number in the outer series.

Length of body, male, 21.5 mm., female, 23 mm.; antennae, male, 8.5 mm., female, 7.5 mm.; tegmina, male, 6 mm., female, 6.5 mm.; hind femora, male, 12.5 mm., female, 14 mm.

Nine males, 13 females. Texas, Belfrage, Lincecum (U.S.N.M.—Riley collection; S. H. Scudder); Dallas, Texas, Boll (same; L. Bruner).

This species resembles *M. flabellatus* in general appearance.

107. MELANOPLUS GRACILIS.

(Plate XXII, fig. 3.)

Pezotettix gracilis BRUNER!, Can. Ent., VIII (July, 1876), p. 124; *ibid.*, IX (1877), p. 144.—SCUDDER, Can. Ent., XII (1880), p. 75.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.—BLATCHLEY!, Can. Ent., XXIII (1891), p. 81.—MCNEILL, Psyche, VI (1891), p. 76.—OSBORN, Proc. Iowa Acad. Sc., I, Pt. II (1892), p. 117.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 27.—GARMAN, Orth. Ky. (1894), p. 7.—BLATCHLEY, Can. Ent., XXVI (1894), p. 233.

Pezotettix minutipennis THOMAS!, Bull. Ill. Mus. Nat. Hist., I (December, 1876), p. 66.—SCUDDER, Can. Ent., XII (1880), p. 75.—THOMAS, Rep. Ent. Ill., IX (1880), pp. 90, 95, 119-120.

A little below the medium size, brownish testaceous above, luteo-flavous beneath, the whole tinged with green, with bright green hind legs. Head hardly prominent, luteo flavous, generally tinged with green and somewhat embrowned, above brownish testaceous with a greenish tinge, sometimes separated by a distinct slender flavous stripe from the broad piceous postocular band; vertex scarcely at all tumid, not at all elevated above the pronotum, the interspace between the eyes scarcely broader than (male) or nearly twice as broad as (female) the first antennal joint; fastigium strongly declivent, distinctly (male) or very feebly and broadly (female) sulcate; frontal costa prominent, percurrent, equal, as broad as the interspace between the eyes, feebly sulcate at and below the ocellus, biserially punctate above; eyes moderate in size, moderately (female) or very (male) prominent, considerably longer than the infraocular portion of the genae; antennae luteous, feebly infuscated apically, more than four-fifths (male) or a little more than two-thirds (female) as long as the hind femora. Pronotum subequal, faintly enlarging posteriorly, above brownish testaceous, the lateral lobes with a very broad and conspicuous piceous percurrent postocular belt above, sometimes enfeebled on the metazona, below varying from bright flavous to flavo-testaceous, the disk very broadly subtectate, passing by an abrupt but rounded shoulder, forming feeble

percurrent lateral carinae, into the vertical lateral lobes; median carina low but distinct, percurrent, equal; front margin faintly convex, hind margin subtruncate, mesially distinctly but weakly emarginate; prozona sparsely and shallowly punctate, distinctly longitudinal in both sexes, nearly twice as long as the finely and densely punctate metazona. Prosternal spine large, conical, blunt, suberect; interspace between mesosternal lobes twice as long as broad (male) or quadrate (female). Tegmina abbreviate, about the length of the prozona, lateral, lanceolate, the costal margin convex, the inner nearly straight, fully three times as long as broad, apically subacuminate, brownish fuscous. Fore and middle femora considerably tumid in the male; hind femora very slender, green, the whole geniculation blackish fuscous, the under surface flavous; hind tibiae green, with a basal, feeble, fuscous annulus, the spines black in the apical half, eleven to twelve in number in the outer series. Abdomen ferrugineo-fuscous, flavescent beneath, compressed, with a distinct median carina, the extremity of the male abdomen considerably clavate, much recurved, the supraanal plate short triangular with subrectangulate apex, nearly plane surface, and a not very deep percurrent median sulcus between low and rounded walls; furcula reduced to a pair of hardly noticeable approximate rounded lobules; cerci long clepsydral, moderately broad at extreme base, tapering regularly in the basal half so that the middle is less than half as broad as the base, beyond enlarging to a subspatulate compressed tip, angulate and faintly produced at the lower posterior extremity, the whole straight except for a faint incurving, and as long as the supraanal plate; subgenital plate small, narrowing apically so as to be hardly more than half as wide apically as at base, the lateral and apical margins in the same plane, well rounded as seen from above, entire.

Length of body, male, 14 mm., female, 19 mm.; antennae, male, 8.5 mm., female, 7.75 mm.; tegmina, male, 3 mm., female, 4 mm.; hind femora, male, 10 mm., female, 11.25 mm.

Twenty-nine males, 39 females. Denison, Crawford County, Iowa, July 20, J. A. Allen; Dallas County, Iowa, August 8-10, September 1-3, J. A. Allen; Nebraska, Dodge; Omaha, Douglas County, Nebraska (U.S.N.M.—Riley collection; L. Bruner); St. Louis, Missouri, July, October 27 (U.S.N.M.—Riley collection); Vigo, Putnam and Fulton counties, Indiana (W. S. Blatchley; A. P. Morse).

It has also been reported from Dakota (Bruner), Illinois—Rock Island, McLean and Champlain counties (Thomas, McNeill), and Kentucky—Webster and Fayette counties (Garman).

This is a sylvan species. Allen found it "abundant in grassy groves" in Iowa, Blatchley finds it in Indiana "on the iron weeds (*Vernonia fasciculata*) which grow abundantly in low open woods," and McNeill speaks of it in Illinois as a wood-loving species. It may be found full grown from the first of July to the middle of November.

108. MELANOPLUS INOPS, new species.

(Plate XXII, fig. 4.)

Of medium size, brownish fuscous. Head not prominent, ferrugineo-testaceous, very heavily punctate with fuscous above the clypeus, the summit dark brownish fuscous; vertex very feebly tumid, elevated a little above the level of the pronotum, but not above the upper level of the eyes, the interspace between the latter of the same width as the first antennal joint; fastigium strongly declivent, feebly and broadly sulcate; frontal costa percurrent, equal, fully as broad as the interspace between the eyes, scarcely sulcate at and below the ocellus, sparsely and feebly punctate; eyes large, very prominent, nearly twice as long as the infraocular portion of the genae; antennae (?). Pronotum feebly enlarging from in front backward, a broad, piceous, percurrent, postocular band occupying more than the upper half of the lateral lobes, below which these are ferrugineo testaceous, the disk broadly convex and passing by a well-rounded shoulder nowhere forming lateral carinae into the vertical lateral lobes; median carina slight, equal, percurrent; front margin faintly convex, feebly margined, hind margin subtruncate, very feebly convex, mesially faintly emarginate; prozona sparsely, coarsely, and shallowly punctate, distinctly longitudinal, fully half as long again as the finely, densely, and rather shallowly punctate metazona. Prosternal spine of moderate length, strongly appressed cylindrical, subtruncate; interspace between mesosternal lobes more than twice as long as broad. Tegmina abbreviate, nearly as long as the pronotum, attingent or subattingent, rotundato-ovate, broadly rounded apically, about half as long again as broad, brownish fuscous. Fore and middle femora a little tumid; hind femora moderately slender, ferrugineo-fuscous above, graduating into dull flavous below, without fasciation, the upper half of the genicular arc fuscous; hind tibiae pale dull green, growing gradually dingy luteous basally, the whole basal half feebly infuscated, the spines black beyond their base, eleven in number in the outer series. Abdomen ferruginous, the extremity in the male strongly clavate, much recurved, the supraanal plate broad triangular, nearly plane, with a short and narrowing shallow median sulcus; furcula obsolete; cerci moderately large, compressed, moderately broad at base, narrowing on basal third, the middle third subequal and about two-thirds as broad as the base, the apical third again expanding slightly, well rounded and slightly tumid at tip, the whole feebly curved upward and more distinctly inward; subgenital plate small, subconical, the apical margin gradually and feebly elevated above the lateral, the apex tumid, forming a sort of blunt, coarse, rounded tubercle, hardly represented in the figure.

Length of body, male, 15 mm.; tegmina, 3.5 mm.; hind femora, 10.25 mm.

One male. Florida, Priddey (L. Bruner).

109. MELANOPLUS MARGINATUS.

(Plates I, fig. i; XXII, fig. 5.)

Pezotettix marginatus SCUDDER!, Ann. Rep. Chief Eng., 1876 (1876), p. 504;
Ann. Rep. U. S. Geogr. Surv. 100th Mer., 1876 (1876), p. 284; BRUNER, Rep.
U. S. Ent. Comm., III, p. 59 (1883).

Euprepcnemis occidentalis Bruner!, MS.

Of medium size, slender. Head not prominent, but slightly projecting, the face retreating more than usual, nearly at right angles with the not very steeply declivent fastigium; vertex very gently tumid, scarcely elevated above the pronotum, the interspace between the eyes a little broader than (male) or twice as broad as (female) the first antennal joint; fastigium rather deeply (male) or slightly (female) sulcate; frontal costa percurrent, equal, about as wide as the interspace between the eyes, shallowly sulcate at and below the ocellus, punctate throughout; eyes not very large, moderately prominent in the male only, a little longer, especially in the male, than the infraocular portion of the genae; antennae at least three-fourths (male) or about four-sevenths (female) as long as the hind femora. Pronotum rather long, the dorsum equal, with slightly sloping sides, distinct but rather slight and equal median carina, and distinct though very obtuse lateral carinae; hind border scarcely angulate. Prosternal spine rather small, bluntly subconical, a little retrorse; interspace between mesosternal lobes more than twice as long as broad (male) or a little longer than broad (female). Tegmina either surpassing considerably the hind femora, moderately broad, subequal beyond the basal expansion of the costa, well rounded apically (*M. m. amplus*, Plate I, fig. i), or slightly longer than the pronotum, ovate lanceolate, apically acuminate, overlapping, the costal margin very strongly arcuate, about twice as long as broad (*M. m. pauper*), brownish testaceous; wings a little shorter than the tegmina, ample, faintly infumate apically and anteriorly, the veins and cross veins black or blackish fuscous. Fore and middle femora considerably tumid in the male; hind femora rather slender, compressed; hind tibiae with eleven to thirteen spines in the outer series. Extremity of male abdomen clavate, somewhat recurved, the supraanal plate triangular, the apex acutangulate but blunt, the surface tectate with a moderately deep and narrow median sulcus in the basal two-thirds; furcula consisting of a pair of slight but coarse approximate denticulations; cerci straight, rather stout, moderately long, noticeably but broadly constricted in the middle, the tip larger than the base, gibbous, the whole scarcely depressed, curving slightly downward beyond the middle; subgenital plate small, subconical, ending in a minute tubercle.

General color dull pale olivaceous brown, slightly darker above, with a broad black stripe, occasionally obsolescent, extending from behind the eye along the upper half of the lateral lobes of the prozona; pleura

sometimes marked with black and the abdomen with a lateral black band, sometimes continuous and equal, sometimes confined to small triangular spots on the anterior segments; hind femora sometimes a little infuscated externally, the genicular lobes sometimes blackish, the hind tibiae rather dark olivaceous, the apical half of the spines black. The summit of the head is sometimes marked with black in broad median and diverging supraorbital stripes.

Length of body (*M. m. amplus*), male, 17.5 mm., female, 22 mm.; antennae, male, 8 mm., female, 7 mm.; tegmina, male, 15 mm., female, 18 mm. (est.); hind femora, male, 10 mm., female, 12.5 mm. Length of body (*M. m. pauper*), male, 14.5 mm., female, 20 mm.; antennae, male, 6 mm., female, 6.25 mm.; tegmina, male, 4.5 mm., female, 5.5 mm.; hind femora, male, 8 mm., female, 11 mm.

Nine males, 8 females. California (U.S.N.M.—Riley collection); Natoma vineyard, Folsom, Sacramento County, California, April, C. H. Dwinell (same); Atwater, Merced County, California, July 27, D. W. Coquillett (same); southern California, H. W. Henshaw; Fort Tejon, California, July 26, H. W. Henshaw.

The National Museum contains a male and female of the different forms taken *in coitu*.

110. MELANOPLUS PAROXYOIDES, new species.

(Plates I, fig. k; XXII, fig. 6.)

Of rather small or medium size, ferrugineo-testaceous, with a marked black postocular band. Head not prominent, more or less olivaceous-luteous, clouded with fuscous on face and genae, with fuscous stripes above, and a black postocular band; vertex very gently tumid, not elevated above the level of the pronotum, the interspace between the eyes narrow, not (male) or scarcely (female) wider than the first antennal joint; fastigium rather rapidly declivent, shallowly (male) or very shallowly (female) sulcate throughout; face retreating more than usual, the frontal costa rather prominent above, percurrent, equal, fully as broad as the interspace between the eyes, sulcate excepting above, strongly punctate; eyes rather large, prominent in the male, very much longer than the infraocular portion of the genae; antennae luteous or rufoluteous, about five-sixths (male) or two-thirds (female) as long as the hind femora. Pronotum long, subequal, hardly enlarging posteriorly even on the metazona, the upper portion of the lateral lobes with a broad solid black band crossing the prozona, and sometimes in a diffused form the metazona, below which the lateral lobes are more or less obscurely luteous; disk pilose, transversely broadly convex, separated from the inferiorly vertical lateral lobes by a rounded shoulder, nowhere forming lateral carinae; median carina uniform, percurrent; front margin subtruncate, hind margin obtusangulate; prozona distinctly longitudinal especially in the male, fully a fourth longer than the finely and

densely punctate metazona. Prosternal spine long, cylindrical, slightly retrorse, in the male bluntly pointed, in the female bluntly rounded and slightly appressed; interspace between mesosternal lobes about three times as long (male) or half as long again (female) as broad, the metasternal lobes attingent (male) or approximate (female). Tegmina not quite reaching the tips of the hind femora, moderately broad, tapering only in the apical third, brownish testaceous and immaculate (male) or feebly maculate along the discoidal area (female); wings moderately broad, hyaline with blackish fuscous veins, lighter colored in the anal area. Mesothoracic epimera black, separating the mostly luteous bordering episterna. Fore and middle femora somewhat tumid in the male; hind femora slender, luteo-testaceous with an olivaceous tinge, more or less ferruginous above, the outer face often more or less minutely clouded irregularly with fuscous, the inner half of the upper face thrice spotted with black, besides the black geniculation, the under surface luteous or flavous; hind tibiae glaucous, the base lutescent with a fusco-glaucous annulation, the spines black with pallid base, eleven to thirteen, usually twelve, in number in the outer series. Extremity of male abdomen a little clavate, somewhat recurved, the supraanal plate subtriangular with sinuous sides, broadly elevated margins, feebly acutangulate apex, and brief, triangular, basal, median sulcus, bounded by elevated ridges which meet in the center of the plate; furcula consisting of a pair of adjacent, parallel, brief, blunt denticulations overlying the median sulcus of the supraanal plate; cerci long and slender, broadly and mesially constricted, apically spatulate, gradually and considerably incurved, the external surface of the apical portion in no way sulcate but rather tumid, the tip attaining the extremity of the supraanal plate; infracereal plates broad, rapidly narrowing, as long or almost as long as the supraanal plate; subgenital plate very narrow, subequal, the apical margin in no way elevated or flaring, well rounded, entire.

Length of body, male, 18.5 mm., female, 27.5 mm.; antennae, male, 10 mm., female, 10.25 mm.; tegmina, male, 13 mm., female, 17.5 mm.; hind femora, male, 11.75 mm., female, 15 mm.

Three males, 4 females. Key West, Florida, Morrison; Tallahassee, Florida, December, F. H. Snow (University of Kansas).

This species is very distinct from any other known to me, and reminds one strongly of *Paroxya*.

25. COLLINUS SERIES.

This is a tolerably homogeneous group, in which the prozona of the male is quadrate or nearly so, varying from a little longitudinal (in one species distinctly longitudinal) to a little transverse, and the interspace between the mesosternal lobes in the same sex ranges from a little longer than broad to twice as long as broad. The tegmina are always fully developed, rarely do not surpass the hind femora, and are more

or less, generally rather vaguely, maculate or blotched. The hind tibiae are either red or green, usually the former, and have ten to fourteen spines in the outer series.

The supraanal plate is pretty regularly triangular, the apex never obtusangulate and generally has a median transverse ridge of greater or less distinctness. The furcula is generally a mere triangular tooth shorter than the last dorsal segment, but in one species is wanting and in others forms a pair of slender spines a little longer than the last dorsal segment. The cerci are of moderate width and invariably forked more or less distinctly, sometimes the upper, sometimes the lower fork the longer, or they have a strongly angulate median process beneath, which stands for an inferior branch. The subgenital plate is variable, but is generally rather broad (but sometimes very narrow) and generally a little, in one species greatly, elevated apically.

The species, nine in number, are of small or medium size, occasionally a little above the medium. Some species or other of the group has been reported from every part of the United States excepting Alaska and California, and is known also from the immediately neighboring parts of the Dominion of Canada west of the Great Lakes, but none have been reported from Ontario or Quebec, where they doubtless exist, nor from the Lower Mississippi Valley, where they also probably occur; nor is a single species known from any part of Mexico.

III. MELANOPLUS ALPINUS, new species.

(Plate XXII, fig. 7.)

Melanoplus alpinus BRUNER!, MS.

Of rather small size, brownish fuscous, more or less ferruginous above, luteo-testaceous below, with a distinct piceous postocular band. Head feebly prominent, luteo-testaceous, sometimes with an olivaceous tinge more or less deeply infuscated above, sometimes confined to two oblique stripes on either side, the outer following the margin of the eye and confluent with the postocular piceous band; vertex gently tumid, elevated a little above the level of the pronotum, the interspace between the eyes nearly twice (male) or fully thrice (female) as broad as the first antennal joint; fastigium rather strongly declivent, shallowly (male) or scarcely and broadly (female) sulcate; frontal costa nearly or quite percurrent, subequal, scarcely narrower than the interspace between the eyes, sulcate at and sometimes below the ocellus, biserially punctate above; eyes moderate, not prominent, about as long as the infraocular portion of the genae; antennae luteous or rufous, more or less feebly infuscated apically, about two-thirds (male) or half (female) as long as the hind femora. Pronotum rather short, feebly expanding posteriorly, the disk more or less ferruginous, the lateral lobes luteous on the prozona, except the broad, piceous, almost unbroken band across the upper half; disk broadly convex, passing into the ver-

tical lateral lobes by a distinct but rounded shoulder, sometimes forming feeble blunt lateral carinae, especially on the metazona; median carina distinct and sharp on the metazona, less distinct and in the female sometimes subobsolete on the prozona; front margin truncate, hind margin bluntly obtusangulate; prozona transverse, rarely quadrate or subquadrate, slightly longer in the male than in the female, at least a fourth (male) or scarcely (female) longer than the finely but obscurely punctate metazona. Prosternal spine short, very blunt conical, erect or suberect, feebly (male) or strongly (female) appressed; interspace between mesosternal lobes fully twice as long as broad (male) or quadrate (female). Tegmina reaching, rarely surpassing, the tips of the hind femora, of normal width and form, brownish fuscous, distinctly but not heavily maculate along the discoidal area, rather more distinctly in the female than in the male; wings moderately broad, hyaline, the veins pale fuscous, deepening apically and anteriorly. Fore and middle femora very little tumid in the male; hind femora of normal length, above and within bimaculate with fuscous, which is ordinarily confined in extent, but when extended takes on the form of very oblique fasciations, developed more on the inner than on the outer face, the latter luteo-testaceous more or less infuscated especially along the upper margin, beneath and on lower half of inner face luteous or flavous, the genicular arc fuscous; hind tibiae variable, red, yellow, or green, but always pale and rather dull in tint, the spines black beyond the base, ten to twelve, usually eleven, in number in the outer series. Extremity of male abdomen clavate, recurved, the supra-anal plate triangular, the apex acutangulate, the surface nearly plane, with a shallow median sulcus on the basal three-fourths, formed by parallel and at last united, not very high, rounded, bounding ridges; furcula consisting of a pair of approximate, feeble, triangular denticulations overlying these ridges; cerci gently arcuate inward, consisting of a stout, tumid, very rapidly narrowing basal portion, a short, subcylindrical, median stem, and an apical furcation which develops two flanges: an upper, inward directed brief finger, hardly longer than broad and blunt tipped; and a long, downcurved, tapering, pointed apophysis, angulate on its upper margin and reaching far beyond the supraanal plate to the base of the apical elevation of the subgenital plate; the latter moderately broad and equal except for the extreme and abrupt apical elevation of the margin, forming, as viewed from behind, a quadrate truncate plate, mesially appressed, rising above the lateral margins of the plate.

Length of body, male, 22 mm., female, 24 mm.; antennae, male, 7.5 mm., female, 6.25 mm.; tegmina, male and female, 16 mm.; hind femora, male, 10.5 mm., female, 13 mm.

Thirteen males, 11 females. British Columbia, Crotch (Museum Comparative Zoology); Fort McLeod, Alberta, August, L. Bruner

(U.S.N.M.—Riley collection; S. H. Scudder); Henry Lake, Idaho, August, Bruner (same). Since this was written, Mr. C. F. Baker has sent me specimens from Fort Collins, Colorado, and from Morris Ranch, Larimer County, Colorado, 8,500 feet.

112. MELANOPLUS INFANTILIS.

(Plate XXII, fig. 8.)

Melanoplus infantilis SCUDDER!, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 65-67; Cent. Orth. (1879), pp. 54-56.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60; Can. Ent., XVII (1885), p. 17.—CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), p. 71.—BRUNER, Rep. U. S. Ent., 1885 (1886), pp. 303, 307; Publ. Nebr. Acad. Sc., III (1893), p. 28.

One of the smallest if not the very smallest macropterous species of *Melanoplus* known. The general color is a dark griseous, the vertex of the head marked in black and dull yellow in a somewhat radiate fashion, the whole face and sides of head brownish olive or sordid yellow, flecked more or less abundantly with black; the antennae are pale dirty yellow, becoming infuscated toward the tip; behind the eye is a broad black band, often edged with yellow above, which also traverses the upper half or less of the lateral lobes, confined to the prozona, and is often enlivened by a small pale quadrate patch in the center of the lobes; the rest of the latter varies from yellow to brown, palest next the margins; the upper surface of the pronotum varies a good deal, but is usually griseous, often with a median belt of dirty yellow or ferruginous, edged on the front of the metazona by a pair of oblique, crescentic, longitudinal or converging patches of black. Tegmina cinereous, with alternate minute blocks of yellow and blackish fuscous in the discoidal area, apically changing to scattered quadrate fuscous dots. Hind femora below straw-yellow, above dark brown, with a pair of conspicuous, very oblique pale bars at the middle and next the base; hind tibiae pale glaucous, occasionally with a faint rufous tinge, becoming paler next the base and straw-yellow at the tip, the spines more or less heavily black-tipped, ten to eleven, rarely twelve, in number in the outer series; hind tarsi yellowish.

Head rather large, but not elevated, and moderately arched; interspace between the eyes scarcely broader than the first antennal joint (male) or broader than the length of the same (female); fastigium steeply declivent, deeply and roundly (male) or shallowly and flatly (female) sulcate, the lateral margins blunt and either slightly (female) or distinctly (male) divergent and then anteriorly convergent; frontal coæta broad, nearly equal, slightly broader below than above, tumid (female) or flat (male) above, with a row of puncta on either side, narrowly and rather slightly sulcate at and just below the ocellus; eyes rather large, moderately prominent, a little longer than (male) or about as long as (female) the infraocular portion of the genae;

antennae about three-fourths (male) or over two-thirds (female) as long as the hind femora. Pronotum rather uniform, subequal, the metazona broadening slightly, especially in the male, subpunctate; median carina distinct throughout, but much slighter on the prozona than on the metazona; lateral carinae tolerably distinct throughout, but blunt; transverse sulci of prozona distinct throughout, unusually sinuous, not severing the median carina; prozona transverse, occasionally in the male subquadrate, distinctly longer than the metazona. Prosternal spine short, stout, erect, conico-cylindrical, appressed, more so in the female than in the male; interspace between mesosternal lobes half as long again as broad (male) or transverse, but narrower than the lobes (female). Tegmina attaining, generally surpassing a little, the tips of the hind femora, slender, feebly tapering. Extremity of male abdomen clavate, a little recurved, the supraanal plate rounded triangular, the extreme apex excised, fully as broad as long; furcula reduced to a pair of minute and blunt triangular teeth; cerci thickened and tumid at base, immediately narrowing to half the width and compressed, almost immediately broadening again, curving inward while they run backward and upward, and forking, the upper branch directed upward and inward, nearly as large as the basal expansion, subtriangular, a little longer than broad, compressed and apically rounded; the other arm much longer, nearly as long as the rest of the appendage, slender, tapering, but bluntly pointed and directed backward and inward, a little arched from beneath; subgenital plate narrow and equal except for the abrupt and considerable elevation of the extreme apical margin, which is mesially notched. Basal tooth of the lower valves of the ovipositor large, triangular, sharp, as long as broad.

Length of body, male 15.5 mm., female 20 mm.; antennae, male 6.25 mm., female 6.5 mm.; tegmina, male 10.5 mm., female 13 mm.; hind femora, male 8.75 mm., female 10.5 mm.

Forty-one males, 52 females. Medicine Hat, Assiniboia, September (U.S.N.M.—Riley collection); Fort McLeod, Alberta, September (same); Yakima River, opposite Ellensburg, Kittitas County, Washington, S. Henshaw (Museum Comparative Zoology); Salmon City, Lemhi County, Idaho, August (U.S.N.M.—Riley collection); Yellowstone, Montana, August (same); Mandan, Morton County, North Dakota (same); Douglas, Converse County, Wyoming, Bruner (same); Evanston, Uintah County, Wyoming, 6,800 feet, August 6; Cheyenne, Laramie County, Wyoming (L. Bruner); Colorado (U.S.N.M.—Riley collection); Colorado, 5,500 feet, Morrison; Florissant, El Paso County, Colorado, 8,000 feet, August 17-22; South Park, Colorado, 8,000 to 10,000 feet, August 11-16; Garland, Costillo County, Colorado, 8,000 feet, August 28-29; Fort Robinson, Dawes County, Nebraska, August 21-22, L. Bruner (U.S.N.M.—Riley collection).

It has also been reported from Regina, Assiniboia, by Caulfield.

113. MELANOPLUS MINOR.

(Plate XXII, fig. 9.)

Caloptenus minor SCUDDER!, Proc. Bost. Soc. Nat. Hist., XVII (1875), p. 478; Ent. Notes, IV (1875), p. 77; Ann. Rep. Chief Eng., 1876 (1876), p. 501; Ann. Rep. Geogr. Surv. 100th Mer. (1876), p. 281.—BRUNER, Can. Ent., IX (1877), p. 145.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 42.—SCUDDER!, Cent. Orth. (1879), p. 22.—DODGE, Rep. U. S. Ent. Comm., II (1881), App., p. 17.—BRUNER, *ibid.*, III (1883), p. 60; Bull. Div. Ent. U. S. Dep. Agric., IV (1884), pp. 57, 58.

Caloptenus occidentalis THOMAS!, Ann. Rep. Chief Eng., 1878 (1878), 1845.

Melanoplus minor SCUDDER, Cent. Orth. (1879), p. 84.—BRUNER, Can. Ent., XVII (1885), p. 17.—BLATCHLEY, *ibid.*, XXIII (1891), p. 81.—MCNEILL, Psyche, VI (1891), p. 74.—MORSE, *ibid.*, VI (1892), p. 250.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 28.—MORSE, Psyche, VII (1894), p. 53.—BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI (1894), pp. 307-308.

Of medium size, dark-brownish fuscous, often with a ferruginous tinge, especially on the disk of the pronotum, luteous beneath. Head very feebly prominent, testaceous, obscurely mottled with fuscous at least above, where there is generally a broad, median blackish stripe and a postocular piceous band; vertex gently tumid, scarcely elevated above the pronotum, the interspace between the eyes nearly twice (male) or nearly thrice (female) as broad as the first antennal joint; fastigium steeply declivent, narrow, equal, deeply (male) or shallowly (female) sulcate, the lateral margins sharp; frontal costa percurrent, faintly narrowed next the antennae, elsewhere subequal, about as broad as the space between the eyes, shallowly sulcate at and below the ocellus; eyes moderately large, a little prominent, almost as long as the infraocular portion of the genae; antennae rufous, apically infuscated, about two-thirds as long as the hind femora, the proportions scarcely differing in the two sexes. Pronotum short, distinctly but not greatly expanding on the metazona, the postocular stripe of the lateral lobes extending over the prozona, broader and more distinct than on the head, the disk very broadly convex, passing into the subvertical lateral lobes by a distinct but always rounded shoulder nowhere forming lateral carinae; median carina slight, scarcely less distinct on the prozona than on the metazona, cut only by the principal sulcus; front margin truncate, hind margin obtusangulate; prozona longitudinally subquadrate, feebly more longitudinal in the male than in the female, distinctly longer than the finely punctate metazona. Prosternal spine not very long, conico-cylindrical, more or less appressed, suberect; interspace between mesosternal lobes half as long again as broad (male) or a little transverse (female). Tegmina reaching about to the tips of the hind femora, sometimes a little short of, sometimes surpassing them, rather slender and subequal, brownish fuscous, more or less distinctly but never heavily maculate with fuscous along the discoidal area; wings moderately broad, hyaline with the faintest possible bluish tinge, the

veins mostly fuscous. Fore and middle femora a little tumid in the male; hind femora luteo-testaceous, outside (excepting below) more or less deeply infuscated, the infuscation sometimes confined to, or more marked in, very oblique dusky fasciations, which also cross the upper face, the lower face generally dull orange; hind tibiae very variable but generally nearly uniform in color, pale red or glaucous being the prevailing color, but they are sometimes plumbeous or yellowish; spines black tipped, ten to twelve, usually eleven, in number in the outer series. Extremity of male abdomen clavate, feebly recurved, the supraanal plate triangular with acutangulate apex, the surface nearly flat with a narrowing, moderately deep, median sulcus between rather prominent ridges, which are confluent apically and terminate a little beyond the middle of the plate; furcula consisting of a pair of rather distant, parallel, slender spines, somewhat longer than the last dorsal segment, overlying the ridges of the supraanal plate; cerci with the basal portion stout, rectangular, not very strongly compressed, nearly twice as long as broad, the apical portion of the same shape but broadly rounded at the tip, nearly as long as the basal part, but narrower, bent from it upward at an angle of 45° , bent also inward, much compressed and shallowly sulcate, with an inferior bounding ridge; subgenital plate very short, subequal but apically rounded, the lateral margin somewhat infolded at base, the apical margin mesially angulate, thickened and feebly tuberculate.

Length of body, male, 19 mm., female, 24 mm.; antennae, male, 8 mm., female, 9 mm.; tegmina, male, 14 mm., female, 16.5 mm.; hind femora, male, 11.25 mm., female, 13 mm.

One hundred and seventy-three males, 119 females. Fryeburg, Oxford County, Maine, August 20 (A. P. Morse); Kearsarge village, North Conway, and Jackson, Carroll County, New Hampshire, July 2-30 (same); Faneuil Station, Boston, Massachusetts, July 14 (same); Sherborn, Belmont, and Natick, Middlesex County, Massachusetts, June 23-August 6 (same); Wellesley, Needham, Dover, and Blue Hill, Norfolk County, Massachusetts, June 13-August 4 (same); Winchendon, Worcester County, Massachusetts, June 30-July 5 (same); Thompson, Windham County, Connecticut, August 4, 6 (same); Montville and Niantic, New London County, Connecticut, August 7, 8 (same); Stamford, Fairfield County, Connecticut, August 13-17 (same); Croton, Delaware County, New York, June 26; Virginia, July (L. Bruner); Indiana, Bollman (U.S.N.M.—Riley collection); Illinois, Dallas County, Iowa, August 6, J. A. Allen; Jefferson, Greene County, Iowa, July 20-24, Allen; Crawford County, Iowa, July 13-24, on prairies, Allen; Brookfield, Linn County, Missouri, E. P. Austin; Nebraska, Dodge; Nebraska?, A. Agassiz (Museum Comparative Zoology); War Bonnet Canyon, Nebraska, L. Bruner (U.S.N.M.—Riley collection); Valentine, Cherry County, Nebraska, Bruner (same); Gordon, Sheridan County, Nebraska, Bruner (same); Boulder, Colorado, June (same); Poudre River, Colorado, July 16, Bruner (same); Colorado, 6,000 feet, Mor-

ri son; Wyoming, Morrison (U.S.N.M.—Riley collection); Fort McKinney, Johnson County, Wyoming, July (same); Douglas, Converse County, Wyoming, Bruner (same); Harney's Peak, 7,000 to 8,000 feet, South Dakota, Bruner (same); Fort Buford, Williams County, North Dakota (same); Dakota (same); Montana, and Yellowstone, Montana (same); Minnesota; Winnipeg, Manitoba, Donald Gunn and R. Kennicott.

It is also reported by Bruner from Washington (State), and from Fort Collins, Larimer County, Colorado.

114. MELANOPLUS CONFUSUS, new species.

(Plate XXII, fig. 10.)

Of medium size, flavo-testaceous. Head not prominent, probably flavo-luteous in life, marked with fuscous above in a median stripe and a pair of divergent, posteriorly enlarging stripes, besides a broad, distinct, piceous, postocular band; vertex somewhat tumid, slightly elevated above the pronotum, the interspace between the eyes hardly so wide as¹ (male) or almost twice as wide as (female) the first antennal joint; fastigium gently declivent, deeply (male) or shallowly (female) sulcate; frontal costa subequal, but slightly broader below, about as broad as the interspace between the eyes, distinctly sulcate at and below the ocellus, biserially punctate above; eyes of moderate size and prominence, only slightly more prominent in the male than in the female, a little longer than the infraocular portion of the genae; antennae luteous, slightly infuscated next the apex, about two-thirds (male) or but little more than a half (female) as long as the hind femora. Pronotum with the prozona subequal except for the tumid sides, the metazona expanding considerably, the sides of the prozona with a broad, piceous, postocular band, which is sometimes a little maculate or strigose with luteous, the disk broadly convex and passing by a well-rounded shoulder, forming blunt lateral carinae on the metazona and extreme front of prozona, into the vertical lateral lobes; median carina distinct, subequal, percurrent; front margin truncate, with feeblest sign of minute emargination, hind margin obtusangulate; prozona distinctly longitudinal (male) or longitudinally subquadrate (female), very sparsely punctate, not a great deal longer than the finely and densely punctate metazona. Prosternal spine moderately long, compressed, blunt conical, feebly retrorse (male), or rather short, appressed conical, very blunt, erect (female); interspace between mesosternal lobes about half as long again as broad (male) or quadrate (female), the metasternal lobes approximate (male) or moderately distant (female). Tegmina long and rather slender, subequal, slightly or considerably surpassing

¹Undoubtedly wider in life, the exceptionally deep sulcation of the fastigium of the single male indicating a contraction of the intraocular space from drying after immersion in alcohol.

the hind femora, brownish fuscous, with a conspicuous, slender, alternating series of dark fuscous and luteous quadrate spots along the middle line; wings not very broad, hyaline, the veins fusco-luteous. Fore and middle femora very slightly enlarged in the male; hind femora slender, compressed, luteo-testaceous, very obscurely and on the sides obliquely bifasciate with fuscous, most distinctly on the upper face, the geniculation more or less infuscated; hind tibiae luteo-testaceous, the spines black beyond the base, ten to twelve in number in the outer series. Extremity of male abdomen clavate, a little recurved, the supraanal plate subtriangular with expanded base and feebly angulate sides, the apex subrectangulate, the apical third a little tumid and distinctly elevated above the median portion, the median sulcus deep, percurrent, narrow in the middle and expanded at both extremities; furcula consisting of a pair of adjacent, subparallel processes, each of which consists of a tumid base bearing an apical, equal, slender, arcuate projection hardly longer than the base; cerci with a subequal, rectangulate basal portion, straight but transversely arcuate, more than half as long again as broad, the upper apical corner of which is produced as a slightly twisted rounded subspatulate lobe, hardly longer than broad, incurved and exteriorly sulcate, about two-thirds as broad as the basal portion, which is thus rectangulate at its lower apical extremity; subgenital plate small, narrow, apically narrowed, the apical margin a little incrassate, entire, not elevated.

Length of body, male, 17 mm., female, 22 mm.; antennae, male, 8 mm., female, 7.5 mm.; tegmina, male and female, 15 mm.; hind femora, male, 11.75 mm., female, 13.5 mm.

One male, 3 females. Munsons Hill [Kentucky?], July 12 (Museum Comparative Zoology); Newport, Campbell County, Kentucky, C. M. Willard (same).

The single female from Newport is placed here with some doubt on account of its divergence from the others; and all the specimens have been dried after long immersion in alcohol, bleaching the colors to some extent, and contracting some of the parts.

115. MELANOPLUS ARIZONAE.

Melanoplus arizonae SCUDDER, Proc. Bost. Soc. Nat. Hist., XX (1879), pp. 64-65; Cent. Orth. (1879), pp. 53-54.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60.

Of medium size. Head rather small, subcompressed, not elevated, moderately arched; eyes moderately prominent; interspace between the eyes as broad as the length of the basal antennal joint; fastigium very shallow, with moderately sharp but not prominent lateral walls, which give it a subspatulate form; frontal costa rather broad, above slightly tumid, with punctulate sides, scarcely broader below, sulcate at the ocellus and to some degree below it. Pronotum rather slender, rather uniform but distinctly broadening on the metazona, which is separated from the prozona by a considerable depression and a pretty deep sulcus; metazona rather distinctly punctate; median carina dis-

tinct throughout though slight; lateral carinae obscure on the prozona, the middle of the prozona tumid on the upper half of the lateral lobes; transverse sulci of prozona distinct throughout, not severing the median carina. Tegmina considerably longer than the body. Supraanal plate of male (so far as can be seen on the single specimen in which the parts are somewhat concealed) semiovate, broadly rounded apically, longer than broad; the forks of the furcula slender, aculeate, parallel, approximate, about half as long as the supraanal plate; cerci of moderate size, compressed, the basal half tapering considerably, straight as seen laterally, directed backward, the apical half a little incurved, nearly equal, enlarging a little apically and notched at the tip; subgenital plate haustate, rounded, entire. Basal tooth of lower valves of ovipositor sharp, triangular, as long as broad.

The specimens on which this description is based were collected in alcohol, and little can be said of their color; there is a more or less broken black postocular band crossing the prozona on the upper half of the lateral lobes; the hind femora may have been faintly banded, the hind tibiae were probably red, with black spines, and there is a distinct row of fuscous rectangular spots down the discoidal area of the tegmina, especially in the female.

Length of body, male, 21 mm., female, 22 mm.; antennae, male, 9 mm., female, 8 mm.; tegmina, male and female, 19 mm.; hind femora, male, 12.5 mm., female, 13.5 mm.

One male, 1 female. Arizona, Thomas.

I have never again seen the specimens on which this species was founded, nor any others that could be referred to it. Accordingly, with slight change in the phraseology, I reproduce the original description, to which I may add the following unpublished notes, taken while the specimens were still in my hands: The species has very much the same general appearance as *M. femur-rubrum*. It has, however, entirely different abdominal appendages, as may be seen above, and also slenderer tegmina, in the venation of which it closely resembles *M. keeleri*. The prosternal spine is not very large, but moderately stout and bluntly rounded at tip, a little appressed, and, on side view, not tapering; the mesosternal lobes are much as in *M. keeleri*. The median carina is more distinct on the metazona than on the prozona; the proportions of the prozona are as in *M. keeleri* and the whole pronotum almost precisely as in that species, with a little more rounded angle to the hind margin.

116. MELANOPLUS KEELERI.

(Plate XXIII, fig. 1.)

Caloptenus keeleri THOMAS!, Bull. U. S. Geol. Surv. Terr., I, No. 2 (1874), p. 69.—GLOVER, Ill., N. A. Ent., Orth. (1874), pl. XVII, fig. 1.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 42.—BRUNER, *ibid.*, III (1883), p. 60.

Melanoplus tenebrosus SCUDDER!, Proc. Bost. Soc. Nat. Hist. (1879), p. 63; Cent. Orth. (1879), p. 52.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60.

Of medium size; above very dark, almost blackish brown, the male darker than the female; beneath dirty olive. Head not elevated, the

face more or less purplish, the genae flecked with yellowish green and with black; vertex moderately arched, feebly elevated above the pronotum, the interspace between the eyes a little broader than (male) or nearly twice as broad as (female) the first antennal joint; fastigium rather shallow, but with distinct blunt bounding walls, which have a subovate outline; frontal costa fully as broad as the interspace between the eyes, slightly compressed above, sulcate at and below the ocellus, laterally punctulate above; eyes rather prominent, a little longer than the infraocular portion of the genae; antennae reddish at the base, becoming more and more fuscous apically, about four-fifths (male) or two-thirds (female) as long as the hind femora. Pronotum pretty uniform, scarcely expanding on the metazona, which is only slightly separated from the prozona and is obscurely punctate; behind the eyes is a black band, which crosses the upper half of the lateral lobes of the prozona, but is not very distinct from the general infuscation of the prothorax; median carina slight, distinct only at the extreme front and on the metazona; lateral carinae tolerably distinct; transverse sulci of prozona slight, the anterior scarcely severing the median carina; front margin truncate, hind margin obtusangulate; prozona feebly longitudinal (male) or quadrate or transverse (female). Prosternal spine of moderate length, stout, conico-cylindrical, somewhat appressed, blunt, erect; interspace between mesosternal lobes nearly or quite twice as long as broad (male) or a little longer than broad (female). Tegmina reaching or somewhat surpassing the tips of the hind femora, moderately broad, distinctly tapering, very dark brown or blackish, especially in the male, rather inconspicuously maculate along the discoidal area; wings rather broad, hyaline, very faintly infumated in the apical half, the veins mostly dark fuscous. Fore and middle femora a little tumid in the male, reddish brown, infuscated above, especially at the apex; hind femora mostly blackish externally, with oblique, more or less broken, median and basal bands of dull testaceous, especially in the male, the geniculation black; hind tibiae red with a narrow basal black or blackish annulus, the spines black, eleven to fourteen in number in the outer series. Extremity of male abdomen a very little clavate, scarcely recurved, the supraanal plate rounded triangular, of about equal length and breadth; furcula reduced to a pair of slight, blunt tubercles; cerci small, compressed, the basal two-thirds straight, slightly tumid, directed backward, tapering slightly, the apical third forked, the forks at right angles, the upper generally twice as broad and half as long again as the lower (but the lower very variable in size), compressed, straight, but a little incurved, rounded at tip, the lower more nearly in the course of the basal portion, straight, bluntly tipped; subgenital plate rather broad, a little longer than broad, haustate, subquadrate, entire. Basal tooth of the lower valves of the ovipositor sharp, triangular, as long as broad.

Length of body, male, 22 mm., female, 26 mm.; antennae, male, 10.5 mm., female, 9.5 mm.; tegmina, male, 16.5 mm., female, 20.5 mm.; hind femora, male, 13 mm., female, 14 mm.

Sixteen males, 16 females. North Carolina, Morrison; Dingo Bluff, North Carolina, November 15, Parker-Maynard; Smithville, North Carolina, November 22, Parker-Maynard; Florida, Priddy (L. Bruner); Florida (U.S.N.M.—Riley collection); Jacksonville, Duval County, Florida, Ashmead (L. Bruner); Cadet, Washington County, Missouri, Riley (U.S.N.M.—Riley collection; S. H. Scudder); Dallas, Texas (same).

117. MELANOPLUS DELETOR.

(Plate XXIII, fig. 2.)

Caloptenus deletor SCUDDER!, Proc. Bost. Soc. Nat. Hist., XVII (1875), pp. 475-476; Ent. Notes, IV (1875), pp. 74-75; Cent. Orth. (1879), pp. 19-20.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 42.—BRUNER, *ibid.*, III (1883), p. 60.
Melanoplus deletor SCUDDER, Cent. Orth. (1879), p. 84.

Of moderately large size, brownish fuscous, darkest above. Head feebly prominent, olivaceo-testaceous, more or less heavily infuscated above in a pair of divergent, longitudinal stripes; vertex rather tumid, distinctly elevated above the pronotum, the interspace between the eyes scarcely broader than (male) or fully twice as broad as (female) the first antennal joint; fastigium steeply declivent, shallow, with slight but rather sharp lateral margins, greatly expanding anteriorly; frontal costa broad, expanding a little at the ocellus and a little sulcate in the same part; eyes rather large, not very prominent, somewhat longer than the infraocular portion of the genae; antennae pale reddish, infuscated apically, about four-fifths (male) or three fourths (female) as long as the hind femora. Pronotum faintly constricted in the middle, a little larger posteriorly than anteriorly, the disk more or less feebly striped with blackish fuscous, plano-convex, passing by an abrupt but rounded shoulder into the subvertical lateral lobes, which are luteo-testaceous with an olivaceous tinge, passing above more or less gradually into the postocular stripe; this crosses the prozona only, is always most distinct and deeper in tint at its upper limit, is sometimes confined to that and often more or less broken with luteous; median carina distinct but slight, nearly equal, cut only by the principal sulcus; front margin subtruncate, hind margin rounded obtusangulate; prozona longitudinal (male) or quadrate (female), distinctly longer than the obscurely punctate metazona. Prosternal spine short, stout, appressed cylindrical, blunt, erect, in the female somewhat conical; interspace between mesosternal lobes fully twice as long as broad (male) or quadrate (female). Tegmina fully reaching, generally somewhat surpassing the hind femora, rather broad, distinctly tapering, brownish fuscous, flecked throughout with fuscous, more conspicuously in the discoidal area from alternating with a line of pallid spots; wings

broad, hyaline, glistening, the veins fuscous only near extreme apex. Fore and middle femora distinctly tumid in the male, dull brownish, the middle femora blackish above, especially apically, all the tarsi marked with blackish; hind femora with the upper outer half blackish, sometimes broken into very oblique dashes by a median and post basal yellowish streak; hind tibiae red, with a narrow black basal annulus, the spines black beyond the base, eleven to thirteen in number in the outer series. Extremity of the male abdomen a little clavate, slightly recurved, the supraanal plate triangular, with roundly angulate, feebly and broadly elevated sides and subrectangulate apex, the median sulcus broad and deep, occupying only the basal half and inclosed between very high and sharp ridges, which apically diverge abruptly at right angles to the sulcus; furcula consisting of a pair of slight and distant denticulations lying just outside the base of the supraanal ridges; cerci long and slender, compressed, a little incurved, broadest at the base, uniformly and very slightly tapering on the basal half, beyond equal, bent a little upward, broadly and roundly truncate at tip, and emitting from the inferior angle a slender, compressed, scarcely tapering shoot, rounded at the tip, running in the direction of the upper margin of the basal half of the cerci and in the same general plane; subgenital plate rather broad, slightly longer than broad, the apical margin feebly elevated, broadly rounded and entire.

Length of body, male, 23.5 mm., female, 30.5 mm.; antennae, male, 11.5 mm., female, 12 mm.; tegmina, male, 21 mm., female, 22 mm.; hind femora, male, 14.5 mm., female, 16 mm.

Sixteen males, 21 females. San Antonio, Bexar County, Texas, May (U.S.N.M.—Riley collection); Bosque County, Texas, November 1, Belfrage (same; S. H. Scudder); Dallas, Texas, Boll (S. H. Scudder; U.S.N.M.—Riley collection; Museum Comparative Zoology); Agricultural College, Mississippi (H. E. Weed); Georgia, Morrison (U.S.N.M.—Riley collection; S. H. Scudder); Jacksonville, Duval County, Florida, Maynard (S. Henshaw).

This species is closely allied to the preceding smaller species, but may be distinguished from it by the points brought out in the table.

118. MELANOPLUS LURIDUS.

(Plate XXIII, fig. 7.)

- Caloptenus luridus* DODGE!, Can. Ent., VIII (1876), p. 11.—BRUNER, *ibid.*, IX (1887), p. 145.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 42.—RILEY, *ibid.*, I (1878), p. 220; Stand. Nat. Hist., II (1884), p. 195.
- Melanoplus luridus* BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60; Bull. Washb. Coll., I (1885), p. 138; Rep. U. S. Ent., 1885 (1886), p. 307.—OSBORN, Proc. Iowa Acad. Sc., I, Pt. II (1892), p. 118.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 28.

Rather small in size, brownish fuscous, more or less ferruginous. Head not at all prominent, dull pallid testaceous, feebly flecked with fuscous, above with widening dull fuscous stripes and a narrow fuscous postocular band: vertex gently tumid, slightly or not elevated

above the pronotum, the interspace between the eyes scarcely wider than (male) or fully half as wide again as (female) the basal antennal joint; fastigium steeply declivent, plane, with well elevated and rounded lateral margins; frontal costa just failing to reach the clypeus, subequal, fully as broad as the interspace between the eyes, sulcate at and below the ocellus, biserially punctate above; eyes of moderate size, not prominent, shorter than the infraocular portion of the genae; antennae ferruginous, feebly infuscated apically, nearly five-sixths (male) or less than three-fourths (female) as long as the hind femora. Pronotum subequal, feebly and gradually enlarging posteriorly, the disk nearly plane, passing by distinct but abruptly rounded shoulders forming subobsolete lateral carinae into the vertical lateral lobes, which have only an obscure, rarely a distinct, dark postocular band, always limited to the prozona; median carina percurrent but blunt and a little obscure on the prozona; front border subtruncate, hind border obtus-angulate, the angle well rounded; prozona slightly longitudinal (male) or quadrate (female), distinctly (male) or not (female) longer than the closely punctate metazona. Prosternal spine short, conical, blunt, erect, in the female a little appressed; interspace between mesosternal lobes a little longer than broad (male) or transverse, but distinctly narrower than the lobes (female). Tegmina reaching or a little surpassing the tips of the hind femora, moderately narrow, very gently tapering, brownish fuscous, scarcely or distinctly though feebly maculate in the proximal part of the discoidal area; wings moderately broad, hyaline, most of the veins fuscous. Fore and middle femora tumescent in the male; hind femora long and slender, luteo-testaceous, above rather broadly bifasciate with blackish fuscous, often confluent along the middle of the outer face and then more or less suffusing the whole face excepting below, which with the under surface is dull luteous, occasionally tinged more or less distinctly with orange, the sides of the geniculation almost wholly fuscous; hind tibiae red, rarely with a very narrow, basal, fuscous annulus, the apical half of the spines black, ten to twelve in number in the outer series. Extremity of male abdomen clavate, somewhat recurved, the supraanal plate triangular with slightly angulate sides, feebly acutangulate tip, and a large, equal, and deep median sulcus extending over the basal three-fourths of the plate, bounded by high and sharp ridges, buttressed in the middle of the plate by slight transverse ridges; furcula consisting of a pair of distant slight denticulations lying on the outer side of the base of the submedian ridges of the supraanal plate; cerci consisting of a straight basal piece, gently and slightly tapering, less than twice as long as the basal breadth, and a bifurcate apical portion, the bifurcation at right angles, each fork bearing a similar angular relation to the basal piece, the lower fork slight and tapering, about as long as the breadth of the basal piece, directed obliquely downward, the upper fork nearly as long as and about half as broad as the basal piece, equal, apically well rounded, directed obliquely upward and bent a very little inward;

subgenital plate broad, fully as broad as long, the apical margin abruptly slightly and equally elevated, entire, the whole margin of the plate as seen from above subquadrate.

Length of body, male, 19 mm., female, 27 mm.; antennae, male, 8.5 mm., female, 9.5 mm.; tegmina, male, 14 mm., female, 17 mm.; hind femora, male, 10.75 mm., female, 13.5 mm.

Sixteen males, 17 females. Dallas County, Iowa, August 8-10, J. A. Allen; Brookfield, Linn County, Missouri, E. P. Austin; Williamsville, Wayne County, Missouri, S. W. Denton (A. P. Morse); Nebraska, Dodge (U.S.N.M.—Riley collection; S. H. Scudder); West Point, Cumming County, Nebraska, August (U.S.N.M.—Riley collection; L. Bruner); Sidney, Cheyenne County, Nebraska, August (L. Bruner); Fort Robinson, Dawes County, Nebraska, August (same); Dakota (U.S.N.M.—Riley collection); Colorado, Morrison (S. Henshaw); Wyoming, Morrison (U.S.N.M.—Riley collection); Mason Valley, Esmeralda County, Nevada, June 30, A. S. Richardson (same); Easton, Kittitas County, Washington (same).

It is also reported from the vicinity of St. Louis, Missouri (Riley), Reno and Barber counties, Kansas (Bruner), and the Yellowstone region, Montana (Bruner).

119. MELANOPLUS COLLINUS.

(Plate XXIII, fig. 6.)

Melanoplus collinus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1878), p. 285; Ent. Notes, VI (1878), p. 44.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60.—FERNALD, Orth. N. Engl. (1888), pp. 31, 32; Ann. Rep. Mass. Agric. Coll., XXV (1888), pp. 115, 116.—SMITH, Cat. Ins. N. J. (1890), p. 413.—DAVIS, Ent. Amer., V (1889), p. 81.—BLATCHLEY!, Can. Ent., XXIII (1891), p. 99.—MCNEILL!, Psyche, VI (1891), p. 74.—SMITH, Bull. N. J. Exp. St., XC (1892), p. 34.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 28.—MORSE!, Psyche, VI (1893), p. 406; *ibid.*, VII (1894), p. 53.—BLATCHLEY!, Can. Ent., XXVI (1894), p. 244.—BEUTENMÜLLER, Bull. Am. Mus. Nat. Hist., VI (1894), pp. 306-307.

Medium or rather small sized, dark brownish fuscous, beneath more or less pale lemon-yellow. Head not prominent but rather large, the face and genae mottled with brownish purple and faint purplish white, the latter sometimes supplanted by an olivaceous tint, the summit with fuscous or purplish longitudinal streaks and a black postocular band edged above by purplish or yellowish; vertex rather tumid, distinctly elevated above the pronotum, the interspace between the eyes slightly broader than (male) or about half as broad again as (female) the first antennal joint: fastigium steeply declivent, shallowly sulcate, broadening considerably in front; frontal costa just failing to reach the clypeus, equal, of the same breadth as the interspace between the eyes, depressed at and generally sulcate below the ocellus, punctate throughout, biserially above; eyes moderately large, moderately prominent, a little longer than the infraocular portion of the genae, mottled with faintly purplish black and faintly purplish white; antennae ferruginous grow-

ing apically infuscated, about three-fourths (male) or two thirds (female) as long as the hind femora; clypeus, labrum and base of mandibles mottled like the face, the labrum edged with black; palpi pallid, streaked exteriorly with purplish brown, the last joint tipped with purplish black. Pronotum subequal, feebly and regularly enlarging posteriorly, the upper portion of the lateral lobes with a broad piceous band, occasionally obsolete, crossing the prozona, below which the lateral lobes have the mottling of the face; disk nearly plane, separated from the vertical lateral lobes by a bluntly angulate shoulder, almost forming a lateral carina; median carina distinct on the metazona, subobsolete on the prozona; front margin subtruncate, hind margin feebly obtusangulate, the angle rounded; prozona longitudinal (male) or quadrate (female), distinctly (male) or scarcely (female) longer than the closely punctate metazona. Prosternal spine short, blunt, conical, a little stouter in the female than in the male and appressed; interspace between mesosternal lobes about half as long again as broad (male) or transverse but much narrower than the lobes (female). Tegmina extending backward about as far as the hind femora, with slight variation, moderately broad, distinctly tapering, brownish fuscous, not infrequently somewhat cinereous, sprinkled with delicate fuscous maculation along the discoidal area; wings not very broad, hyaline, sometimes with a scarcely perceptible yellowish tinge to the anal area, the veins fuscous apically and anteriorly so as almost to give the tip an infumated appearance. Fore and middle legs tumescent in the male, mottled with the colors of the face; hind femora alternately marked externally with faint purplish brown, dark brown and very pale purplish, the inferior carina yellowish bordered with white, the under surface yellowish; hind tibiae coral red with a basal black annulation, the spines tipped with black, eleven to fourteen in number in the outer series; tarsi of all the legs marked with fuscous deepening into black, the hind tarsi also with red. Extremity of male abdomen clavate, a little recurved, the supraanal plate triangular with convex sides and rectangulate tip, the lateral margins feebly elevated, the median sulcus as in the preceding species but with rather less prominent walls; furcula present only as slight swellings of the inner extremities of the mesially parted lateral halves of the last dorsal segment; cerci pale brownish compressed laminae, consisting of a gently tapering basal half, a little tumid, straight and scarcely twice as long as the basal breadth, and a bifurcate apical half, the forks at a little less than a right angle to each other, equally divergent from the basal half, the lower slight and subaculeate, hardly so long as the mesial breadth of the stem, the upper equal or subspatulate, fully half as broad and nearly as long as the stem, incurved, subsulcate and apically rounded; subgenital plate pale yellowish brown, broad, about as broad as long, the apical margin broadly rounded, entire, sometimes subangulate laterally, a little thickened but not raised above the lateral margin

or but in the feeblest degree. Ovipositor pale brownish, tipped with reddish and margined with black.

The colors in the above description are taken mostly from living examples.

Length of body, male, 18 mm., female, 24 mm.; antennae, male and female, 9 mm.; tegmina, male, 13.5 mm., female, 17 mm.; hind femora, male, 11.5 mm., female, 13 mm.

Ninety-two males, 74 females. Moosehead Lake, Maine; Norway, Oxford County, Maine, S. I. Smith (Museum Comparative Zoology); Mount Kearsarge, New Hampshire, 2,000 feet (A. P. Morse); Pinkham Notch, New Hampshire, September (A. P. Morse); Sudbury, Rutland County, Vermont; Adams, Berkshire County, Massachusetts, August 16, 17 (A. P. Morse); Springfield, Hampden County, Massachusetts, Allen (Museum Comparative Zoology); Warwick, Franklin County, Massachusetts, Miss A. M. Edmands (same); Amherst, Hampshire County, Massachusetts (Museum Comparative Zoology); Andover, Essex County, Massachusetts; Malden and Waltham, Middlesex County, Massachusetts, September 9 (S. Henshaw); Blue Hill, Norfolk County, Massachusetts, August 14, 19 (same); vicinity of Boston and Jamaica Plain, Suffolk County, Massachusetts, August 13, 16 (S. Henshaw; S. H. Scudder); Barnstable, Massachusetts; Provincetown, Barnstable County, September (S. H. Scudder; Museum Comparative Zoology); Nantucket, Massachusetts, September (S. Henshaw; S. H. Scudder); North Haven, New Haven County, Connecticut, August 23 (A. P. Morse); Canaan, Litchfield County, Connecticut, August 18 (same); Colona, Henry County, Illinois, August, J. McNeill; Vigo County, Indiana, W. S. Blatchley; Petroleum, Ritchie County, West Virginia (Museum Comparative Zoology).

It has also been reported from Staten Island, New York (Davis), New Jersey (Smith), the borders of Lake Michigan, in Indiana (Blatchley), and Nebraska (Bruner), the last, I think, by mistake.

This species is very closely allied to *M. luridus*, but differs in its lack of any projecting part to the furcula, the less divergent forks of the cerci, less elevated, apical margin of the subgenital plate and greater maculation of the tegmina.

I first observed this species in Sudbury, Vermont, in August, 1868, abundant in the vicinity of groves in dry upland pastures; comparatively few *M. femur-rubrum* occurred with them, the latter being found in open sunny spots, and especially in hollows in the lowlands. McNeill, who was the first to find it in the West, says that in Illinois "it is restricted to the tops of hills and the sides of ravines which are too barren for pasturage." At Provincetown, Massachusetts, I found it at the sandy edges of neglected cranberry beds. According to Blatchley, this species may be found in pairing time "among the leaves and branches of the iron-weed." I found one specimen devouring a perfectly dry and dead hickory leaf. At the middle of August, in Vermont, the eggs are quite undeveloped, the ovaries lying as mere films on the

intestines of those dissected. The first pair taken in coitu was found August 16, though in Indiana many pairs were found by Blatchley by the first of August.

26. ROBUSTUS SERIES.

In this group the male prozona is quadrate or a little longitudinal and the interspace between the mesosternal lobes of the same sex twice or more than twice as long as broad. The eyes are rather widely separated and the frontal costa broad and equal. The prosternal spine is usually long. The tegmina are fully developed or only a little abbreviated and either feebly spotted, longitudinally streaked or wholly free from markings; the hind tibiae are yellow or red, with from ten to twelve spines in the outer series.

The supraanal plate is shield-shaped or triangular with feebly convex or sinuous sides, and with the surface tolerably flat; the furcula is entirely wanting or in one or two instances barely indicated; the cerci are excessively broad and stout, apically greatly expanded and flabellate, with the apical border either convex or more or less emarginate; the subgenital plate is longer than broad, generally moderately narrow, a little elevated apically and sometimes considerably prolonged, always entire.

It comprises insects of the largest size only and of a stout and bulky aspect. Five species are known, occurring in the southern half or more of the United States.

120. MELANOPLUS DIFFERENTIALIS.

(Plate XXIII, figs. 3, 4.)

Caloptenus differentialis UHLER!, MS. (1863).—WALSH, RILEY, Amer. Ent., I (1868), p. 16; *ibid.*, I (1869), p. 187.—THOMAS, Proc. Acad. Nat. Sc. Philad., 1871 (1871), p. 149.—GLOVER, Ill. N. A. Ent., Orth. (1872), pl. VIII, fig. 12, pl. IX, fig. 4, pl. XI, fig. 6.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 166, pl., fig. 5; Key Ill. Orth. (1874-75), p. 3.—RILEY!, Ann. Rep. Ins. Mo., VII (1875), pp. 124, 173, fig. 33; *ibid.*, VIII (1876), pp. 153, 154.—PUTNAM, Proc. Dav. Acad. Sc., I (1876), p. 266.—THOMAS, Bull. Ill. Mus. Nat. Hist., I (1876), p. 68.—WHITMAN, Grasshopper (1876), p. 19, fig.—BRUNER, Can. Ent., IX (1877), p. 144.—BESSEY, Bienn. Rep. Iowa Agric. Coll., VII (1877), p. 209.—THOMAS, Rep. Ent. Ill., VI (1877), pp. 44-45.—RILEY, Loc. Plague (1877), pp. 89, 194, 198-201, fig. 34; Amer. Nat., XII (1878), p. 284; Rep. U. S. Ent. Comm., I (1878), pp. 220, 223, 225-226, 228, 298-299, 301, 327, 447, 459, figs. 32, 110, pl. IV, fig. 1.—THOMAS, *ibid.*, I (1878), p. 42; Bull. U. S. Geol. Surv. Terr., IV (1878), p. 500.—RILEY, Bull. U. S. Ent. Comm., III (1880), p. 39; Amer. Ent., III (1880), p. 220.—THOMAS, Rep. Ent. Ill., IX (1880), pp. 91, 96, 127-128, fig. 24; Rep. U. S. Ent. Comm., II (1881), pp. 106-107.—LINTNER, Ins. Clover (1881), p. 5.—OSBORN, Amer. Nat., XVII (1883), pp. 1286-1287.—BRUNER, Rep. U. S. Ent. Comm., III (1883), pp. 54, 60.—FORBES, Rep. Ins. Ill., XIV (1884), p. 23.—RILEY, Stand. Nat. Hist., II (1884), pp. 194-195, fig. 271.—OSBORN, Bull. Iowa Agric. Coll. Dep. Ent., II (1884), p. 83.—BRUNER, Rep. U. S. Ent., 1884 (1885), p. 399.—RILEY, Amer. Nat., XX (1886), pp. 558-559.—COOK, Beal's Grasses N. A., I (1887), p. 373.—WEED, Bull. Ohio Agric. Exp. St., Techn. Ser., I (1889), pp. 40-41.—LUGGER, Rep. Agric. Exp. St. Minn. (1889), p. 340, fig. 16.—

- OSBORN, *Ins. Life*, IV (1891), pp. 50, 51, 55; *Rep. Ent. Soc. Ont.*, XXII (1891), pp. 70-73.—OSBORN, GOSS, *Bull. Iowa Exp. St.*, XIV (1891), p. 175; *ibid.*, XV (1891), p. 267.—RILEY, *Ins. Life*, IV (1891), p. 145; *Bull. Div. Ent. U. S. Dep. Agric.*, XXV (1891), pp. 30-31, fig. 8.—OSBORN, *ibid.*, XXVII (1892), pp. 59-60.—RILEY, *Ins. Life*, IV (1892), pp. 323, 393, 401.
- Acridium differentiale* THOMAS, *Trans. Ill. St. Agric. Soc.*, V (1865), p. 450.
- Cyrtacanthacris differentialis* WALKER, *Cat. Derm. Brit. Mus.*, IV (1870), p. 610.—THOMAS, *Proc. Acad. Nat. Sc. Philad.*, 1871 (1871), p. 149.
- Pezotettix differentialis* STAL, *Bih. k. Sv. Vet.-Akad. Handl.*, V (1878), No. 9, p. 14.—WEED, *Misc. Ess. Econ. Ent. Ill.* (1886), p. 48.—HUNT, *ibid.* (1886), pp. 122-123, 126.—WEED, *Rep. Ent. Ill.*, XV (1889), p. 40.—GARMAN, *Orth. Ky.* (1894), pp. 4, 8.
- Melanoplus differentialis* BRUNER, *Bull. Washb. Coll.*, I (1885), p. 139; *ibid.*, I (1886), p. 200.—RILEY, *Rep. U. S. Ent.*, 1885 (1886), p. 233.—COQUILLETT, *ibid.*, 1885 (1886), pp. 295, 297.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, XIII (1887), p. 33; *Rep. Ent. Nebr. Bd. Agric.*, 1888 (1888), p. 88, fig. 4.—COMSTOCK, *Intr. Ent.* (1888), pp. 108, 111, fig. 100.—SMITH, *Bull. N. J. Exp. St.*, K (1890), p. 41.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, XXII (1890), p. 104.—BLATCHLEY, *Can. Ent.*, XXIII (1891), p. 99.—BRUNER, *ibid.*, XXIII (1891), p. 193; *Ins. Life*, III (1891), p. 229.—WEBSTER, *ibid.*, III (1891), p. 300.—BRUNER, *ibid.*, IV (1891), p. 22; *Rep. Ent. Soc. Ont.*, XXII (1891), p. 48; *Bull. Div. Ent. U. S. Dep. Agric.*, XXIII (1891), p. 14.—OSBORN, *ibid.*, XXIII (1891), p. 59.—BRUNER, *Rep. St. Bd. Agric. Nebr.*, 1891 (1891), pp. 243, 307, fig. 84.—MCNEILL, *Psyche*, VI (1891), p. 74.—SMITH, *Bull. N. J. Exp. St.*, XC (1892), pp. 4, 31, pl. I.—RILEY, *Ins. Life*, IV (1892), p. 393.—KELLOGG, *ibid.*, V (1892), p. 116.—WEED, *Can. Ent.*, XXIV (1892), p. 278.—OSBORN, *Proc. Iowa Acad. Sc.*, I, Pt. II (1892), p. 118.—KELLOGG, *Inj. Ins. Kans.* (1892), p. 42, figs. 22, 23a.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, XXVII (1892), pp. 32-33; *ibid.*, XXVIII (1893), p. 47.—*ibid.*, fig. 5; *ibid.*, XXX (1893), p. 35.—OSBORN, *ibid.*, XXX (1893), p. 47.—BRUNER, *Publ. Nebr. Acad. Sc.*, III (1893), p. 27; *Rep. Nebr. St. Bd. Agric.*, 1893 (1893), p. 461, fig. 103.—OSBORN, *Ins. Life*, V (1893), pp. 323-324; *Papers Iowa Ins.* (1893), p. 58.—BRUNER, *Ins. Life*, VI (1893), p. 34.—OSBORN, *ibid.*, VI (1893), pp. 80-81.—BRUNER, *Rep. St. Hort. Soc. Nebr.*, 1894 (1894), pp. 163, 204, fig. 67; *Bull. Div. Ent. U. S. Dep. Agric.*, XXXII (1894), p. 12; *Nebr. St. Hort. Rep.*, 1895 (1895), p. 69.

The largest of our species of *Melanopli* and heavy bodied; excepting the hind legs and the lateral lobes of the pronotum, the general color is a nearly uniform brownish testaceous, becoming paler testaceous in specimens from arid regions; in those from Nebraska, Kansas, and Colorado it is sometimes a blackish green, while in those from Illinois and Indiana it is often of a dark brownish green. The head has sometimes a pair of dusky, divergent stripes, passing from the posterior corners of the fastigium backward across the vertex and, when these are present, there are often other but irregular streaks of similar tint on the genae and clouds over parts of the face; the vertex is gently arched, more gently in the female than in the male, with a broad interval between the eyes, the fastigium broadly and not very deeply impressed; frontal costa broad but narrower than the interspace between the eyes, percurrent, equal except for a slight expansion below, broadly and shallowly sulcate below (and including) the ocellus, punctate; eyes moderately prominent, short, not a great deal longer than broad; antennae fulvo-testaceous, nearly twice as long (male) or fully

half as long again (female) as the pronotum. Pronotum subequal, the metazona expanding somewhat, the disk of the prozona sometimes (but not always) very feebly tumid, the front margin feebly convex, the hind margin obtusely and roundly angulate, more obtusely in specimens from the Pacific Coast than in others, the median carina distinct and sharp on the metazona, less prominent but distinct on the anterior half of the prozona, still less distinct (occasionally subobsolete) between the sulci; prozona subquadrate in both sexes, smooth, divided in the middle, and barely before the middle of the posterior half, by sulci, the principal sulcus bent forward in the middle by the posterior emargination of the prozona, the metazona plane, finely subruguloso-punctate; lateral lobes nearly vertical, separated from the disk by a well-rounded angle nowhere forming distinct lateral carinae, marked next the upper limit on the prozona by broken blackish patches, frequently reduced to a pair of short, oblique, black dashes, one in either longitudinal half of the prozona, each in a clearer field, and also by the blackening of the sulci in this region; they are sometimes accompanied by slender, oblique, parallel, black lines lower down, the hinder the lower; the pleural incisures are also heavily marked in black. Prosternal spine rather long, conical as seen from the side, bluntly cylindrical as seen from in front, a very little retrorse. Tegmina at least reaching (female) or distinctly surpassing (male) the hind femora, absolutely free from maculation, the narrowest apical portion about half as broad as the broadest subbasal portion; wings pellucid or (in darkest forms) very feebly infumated, feebly and narrowly opaque along the costal margin, the veins and cross veins mostly brownish fuscous. Fore and middle femora of male heavily bullate, the hind femora stout and rather short, moderately tumid, generally fulvo-testaceous, sometimes flavo-testaceous beneath, the outer face with alternate, fulvo-testaceous and black, narrow, equal fish-bone markings, the black rarely interrupted in the middle,¹ the upper inner face with small basal and large median and postmedian black patches, the genicular arc black on both inner and outer sides; hind tibiae yellow or fulvous (occasionally in California bright coral red), with a postbasal narrow black annulus (in dark specimens more or less infuscated beyond it), the spines black to their very base, ten to eleven, rarely twelve, in number in the outer series. Extremity of male abdomen heavily clavate, the supraanal plate subclypeate, obtusely angulate at apex, the margins feebly and broadly elevated and the median portion correspondingly elevated and bearing on its summit a moderately shallow, longitudinal sulcus, tolerably broad and subequal on the basal half, narrowing and with falling walls apically; furcula completely absent or indicated only by a thickening of the last dorsal segment at their proper position; cerci very large

¹ In the dark forms the black markings sometimes run together and cover the whole face, partially interrupted near the middle and in the middle of the basal half, with fulvous.

and coarse, laminate, boot-shaped, the basal half subequal, punctate and straight, beyond expanding and at the same time feebly bifurcate, the upper fork as long and more than half as broad as the base, feebly incurved, strongly upcurved, apically tapering slightly and well rounded, the lower fork at right angles to it, forming only a rounded, downward and posteriorly projecting lobe, so that the apical margin of the whole is deeply and roundly emarginate below, the whole surpassing a little the supraanal plate; infracercal plates wholly obscured; subgenital plate short and broad, scarcely so broad apically as long, the apical margin thickened, but hardly otherwise either elevated or prolonged, entire; upper valve of ovipositor abruptly upturned apically and sharply acuminate, the upper outer carina feebly serrate.

Length of body, male, 39 mm., female, 41 mm.; antennae, male, 18 mm., female, 16 mm.; tegmina, male, 32 mm., female, 34.5 mm.; hind femora, male, 20 mm., female, 23 mm. Some specimens, especially from the North (Illinois, e. g.), are hardly more than half this size.

Seventy-two males, 90 females. Cheyenne, Laramie County, Wyoming, August 21, Osten Sacken; Lincoln, Lancaster County, Nebraska, August 8 (U.S.N.M.—Riley collection); Brownville, Nemaha County, Nebraska, August, R. N. Furnas (same); Fort McPherson, Nebraska (Museum Comparative Zoology); Denison, Crawford County, Iowa, July 15, J. A. Allen; Jefferson, Greene County, Iowa, July 20–24, Allen; Dallas County, Iowa, August 20–23, September, Allen; Vigo County, Indiana, Blatchley (A. P. Morse); Lafayette, Tippecanoe County, Indiana, November 26, C. R. Barnes (U.S.N.M.—Riley collection); Illinois, Uhler, J. H. Treat (Museum Comparative Zoology); northern Illinois, Strumberg (S. Henshaw); Moline, Rock Island County, Illinois, McNeill; Peoria, Illinois, W. Barnes (Museum Comparative Zoology); southern Illinois, Kennicott, Thomas; Missouri, *in coitu* September 4 (U.S.N.M.—Riley collection); St. Louis, Missouri, Geo. Engelmann; the same, August 18, and central Missouri, July (U.S.N.M.—Riley collection); Garden City, Finney County, Kansas, July 26 (same); Lakin, Kearny County, Kansas, July 27 (same; S. H. Scudder); Fort Ellis, Kansas, Watson (Museum Comparative Zoology); between Smoky Hill, Kansas, and Denver, Colorado, L. Agassiz (same); Colorado (U.S.N.M.—Riley collection); Pueblo, Colorado, 4,700 feet, August 30–31; Sabinal, Socorro County, New Mexico, August 7, Townsend; Socorro, New Mexico, G. May (U.S.N.M.—Riley collection); Agricultural College, Mississippi, Weed; Texas, Belfrage, Lincecum; Dallas, Texas, Boll (U.S.N.M.—Riley collection; S. H. Scudder); Columbus, Colorado County, Texas (U.S.N.M.—Riley collection); Gulf coast of Texas, Aaron; Pecos River, Texas, June 20, Captain Pope; Los Angeles, California, Coquillett (U.S.N.M.—Riley collection; L. Bruner); Agua Caliente, Sonoma County, California, Palmer; Mexico (Museum Comparative Zoology; U.S.N.M.—Riley collection); Queretaro, Mexico, November (L. Bruner).

It has also been reported from New Jersey in cranberry bogs

(Smith); Posey and Gibson counties, Indiana (Webster); western Kentucky (Garman); Mercer County, Illinois (Thomas); Iroquois County, Illinois (Riley); Jackson County, Illinois (Thomas); western Iowa (Bruner); Buchanan and Nodaway counties, Missouri (Osborn); Shawnee, Labette, and Barber counties, Kansas (Bruner); Hamilton County, Kansas (Bruner, Kellogg); Indian Territory (Bruner); Brown and Washington counties, Texas (Riley); Grand Junction, Mesa County, Colorado (Bruner); Lincoln County, Nevada (Riley); Arizona (Bruner); and San Joaquin Valley, California (Coquillett).

It appears from this that it inhabits the Mississippi Valley from as far north as latitude 43° to the Gulf, and the region to the west as far as the Pacific, from a somewhat lower latitude to central Mexico. I do not think it occurs above 6,000 feet. One can not but question the accuracy of the statement that it occurs in New Jersey,¹ as it has never been reported elsewhere east of the Alleghanies, and if found there would also occur farther south; so large an insect and so distinct from others found there would hardly have escaped notice by entomologists of the eastern seaboard in Maryland and Virginia.

The oviposition and arrangement of eggs in the egg-capsule of this insect, as well as its parasites, are described by Riley in the first Report of the United States Entomological Commission, and with its life-history are later summarized by him, as follows:—

In the vicinity of St. Louis, Missouri, the first specimens of this locust were observed to become winged July 19. Eggs were laid September 9. As a deviation from the usual egg-laying habits of the genus . . . the eggs are sometimes very numerous placed under bark of logs that have been felled on low lands. The eggs of this species, unlike those of *spretus*, *atlantis* and *femur-rubrum*, are not quadrilinearly but irregularly arranged. . . . The head ends of the eggs in the pod point mostly outward. One hundred and seventy-five eggs have been counted in a single mass.

Mr. Coquillett has made some interesting observations [in California]. . . . They acquired wings from the last week in June to the last week in July and began laying eggs July 23. A single female occupied 75 minutes in depositing an egg-mass. The situation chosen for egg laying was invariably the edge of one of the basin-like hollows [for irrigation?] at the foot of a tree. This locust is not easily startled, and its ordinary flight is rather heavy, and sustained only for a distance of 12 to 20 feet.

According to Thomas and Riley, this insect is occasionally seen flying at considerable heights and apparently migrating, though these are rare occurrences. It certainly is occasionally one of the most destructive pests in the West, particularly in Kansas, Missouri and Illinois, and it has been noted as injuring grass, alfalfa, Indian corn, beets, orchard trees, mulberry, poplar and catalpa trees, and even grape vines; also dahlias, hollyhocks and other garden flowers have been specified as its food, not to mention the rag weed, *Ambrosia trifida*.

¹Since this was sent to the printer I have seen specimens from Camden County, New Jersey, in the collection of the American Entomological Society.

Professor Lawrence Bruner gives the following excellent summary of its destructiveness and habits:

This insect has very frequently multiplied in such numbers in limited areas over its range as to do considerable injury to cultivated crops growing upon low, moist ground; and has even been known very frequently to spread over higher and dryer lands adjoining these, its customary haunts. It is one of the few species of locusts that has thus far shown a tendency toward civilization. This it has done readily, since its habits are in unison with the cultivation of the soil. It is only since the settlement of the country where it originally occurred that it has multiplied so as to become sufficiently numerous to become a serious pest. . . .

The eggs . . . are laid in cultivated grounds that are more or less compact, preferably old roads, deserted fields, the edges of weed patches, and well-grazed pastures adjoining weedy ravines. Egg laying begins about the middle of August and continues into October, varying of course, according to latitude and climatic conditions. Usually but not always, only a single cluster of eggs is deposited by each female. Frequently there are two, and in extreme cases perhaps even three, of these clusters deposited by a single female.

121. MELANOPLUS ROBUSTUS.

(Plate XXIII, fig. 5.)

Caloptenus robustus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XVII (1875), p. 473; Ent. Notes, IV (1875), p. 72.—THOMAS, Rep. U. S. Ent. Comm., I (1873), p. 42.—SCUDDER!, Cent. Orth. (1879), p. 17.—RILEY, Am. Ent., III (1880), p. 220.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60.

Caloptenus ponderosus SCUDDER, Proc. Bost. Soc. Nat. Hist., XVII (1875), p. 473; Ent. Notes, IV (1875), p. 72.—THOMAS, Rep. U. S. Ent. Comm., I (1873), p. 42.—SCUDDER, Cent. Orth. (1879), p. 17.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60.

Pezotettix robustus STÅL, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 14.

Melanoplus robustus SCUDDER, Cent. Orth. (1879), p. 84.—BRUNER, Bull. Div. Ent. U. S. Dep. Agric., XXVII (1892), p. 33; *ibid.*, XXVIII (1893), pp. 17-19, figs. 6, 7; Rep. Nebr. St. Bd. Agric., 1893 (1893), p. 460.

Melanoplus ponderosus SCUDDER, Cent. Orth. (1879), p. 84.—BRUNER, Can. Ent., XXIII (1891), p. 193; Ins. Life, IV (1891), p. 22; Rep. Ent. Soc. Ont., XXII (1891), p. 48.

Varying from brownish testaceous to brownish fuscous, with more or less of a cinereous tint; front of head and sides of pronotum a little paler, tinged with yellow, the head obscurely and more or less heavily flecked with brown: antennae yellow, infuscated toward the tip. Interspace between the eyes much broader than (male) or twice as broad as (female) the basal antennal joint, the fastigium broad, broadening in front, scarcely depressed except sometimes slightly in the narrowest part, the lateral margins sharp: frontal costa broad, broadening below, broadly and shallowly sulcate excepting above. Pronotum broadening a little on the metazona, the median carina slight, broken by all the sulci, distinct only in front of and behind them: lateral carinae rather distinct but slight and rounded. Slight black markings follow the anterior portion of the lateral carinae and the transverse sulci of the lateral lobes: occasionally these markings are more pronounced, and then a slender blackish stripe passes from behind the eyes to the metazona, sometimes interrupted, sometimes accompanied by an infuscation

beneath, broadening the band; disk of prozona more or less flecked with dark brown, sometimes collected into a V-shaped patch opening forward, the apex at the middle of the metazona; hind margin dotted with blackish; metazona profusely, prozona sparsely, both shallowly, punctate; sides of metathorax with a pale oblique stripe narrowing upward to a point. Prosternal spine moderately long, stout, subcylindrical, feebly appressed, erect, blunt-tipped. Tegmina reaching (female) or slightly surpassing (male) the tips of the hind femora, darker or lighter brownish fuscous, flecked rather distantly with brownish spots, relieved by similar pale spots along the middle, occasionally more or less confluent. Legs of the color of the under surface, the fore and middle femora a little deeper or duskier; hind femora broadly bifasciate with blackish, broken by the pale incisures, the genicular arc black on both sides; hind tibiae yellow, occasionally tinged with red, paler next the base with a black annulus, the spines black to their very base, ten to twelve, usually eleven, in number in the outer series. Extremity of male abdomen subclavate, upturned slightly, well rounded; supraanal plate broad, clypeate, with slightly produced rectangulate apex, slightly sinuate sides, the lateral margins gently elevated, the middle longitudinal half very broadly tectate with a moderately broad and deep median sulcus extending over a little more than the basal half; furcula wanting or sometimes indicated by the merest angle; cerci very stout, subspatulate, compressed, largest at tip, the basal two-fifths equal and straight, the remainder expanding into an obliquely transverse, obovate, rounded lobe, its outer border convex, directed upward and more produced above than below, making the tip fully half as broad again as the base; infracereal plates visible only by their feeble, narrow, blunt-tipped projection beyond the supraanal plate; subgenital plate not very broad, the apex both produced and elevated a little.

Length of body, male, 29.5 mm., female, 34.5 mm.; antennae, male, 13.5 mm., female, 15 mm.; tegmina, male, 21 mm., female, 24 mm.; hind femora, male, 17.5 mm., female, 21 mm.

Twenty-two males, 18 females. Texas, Belfrage; Dallas, Texas, Boll (U.S.N.M.—Riley collection; S. H. Scudder); Gulf coast of Texas, Aaron.

Although the single male type of *Cal. ponderosus* has been lost, I have no doubt from the study of the larger material now at hand that it is the same as *Cal. robustus*, described at the same time and place.

122. MELANOPLUS VIOLA.

(Plate XXIV, fig. 1.)

Pezotettix viola THOMAS!, Bull. Ill. Mus. Nat. Hist., I (1876), p. 68.—RILEY, Rep. U. S. Ent. Comm., I (1878), pp. 220, 226.—SCUDDER!, Can. Ent., XII (1880), p. 75.—THOMAS!, Rep. Ent. Ill., IX (1880), pp. 90, 95, 121.—MCNEILL, Psyche, VI (1891), p. 76.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 27.—GARMAN, Orth. Ky. (1894), p. 8.

Caloptenus affiliatus UHLER!, MS.

Pezotettix affiliatus SCUDDER!, Can. Ent., XII (1880), p. 75.

Dark brownish fuscous, the upper half of the lateral lobes of the pronotum and especially of the prozona generally distinctly darker than the lower, often forming a broad dark band. Head brownish fuscous, lighter below, irregularly flecked and mottled with fuscous, gently tumid above; interspace between the eyes broad, but narrower than the frontal costa, the fastigium plane but with the margins feebly and roundly elevated at its narrowest, broadening in front and passing insensibly into the frontal costa; the latter very broad, subequal, not at all constricted above, shallowly sulcate at and below the ocellus, feebly punctate; eyes elongate oval, narrower above than below, but little prominent; antennae about as long (male) or hardly three-fourths as long (female) as the hind femora, rather slender, fulvo-testaceous. Pronotum scarcely enlarging posteriorly, the disk nearly plane, with rounded lateral carinae separating it from the vertical lateral lobes, the prozona barely longitudinal (male) or barely transverse (female), about a fourth (male) or less than that (female) longer than the metazona, the median carina subobsolete between the sulci and more distinct on the metazona than on the prozona, the front border barely convex, the hind border broadly convex or more frequently obtusely angulato-convex, its prominence slightly variable, the principal sulcus not quite transverse by the slight emargination of the posterior border of the prozona, ferrugineo-testaceous, profusely and finely flecked with fuscous, rather feebly punctate even on the metazona, the lateral lobes with a sometimes obsolete, generally somewhat obscure, dark fuscous band, in extreme cases extending from the eyes across the whole pronotum and occupying nearly the whole upper half of the lateral lobes; thoracic epimera black. Prosternal spine stout, rather long, cylindrical, tapering only at the rounded apex, somewhat retrorse. Tegmina always abbreviated, distinctly shorter than the abdomen or the hind femora, generally a little longer than the head and pronotum together, dark fuscous, the anal area sometimes much lighter, the discoidal area flecked somewhat confusedly with mingled blackish and light testaceous, the apex bluntly acuminate. Hind femora moderately stout and rather long, testaceous, varying from cinereous to dull flavous, broadly bifasciate with black, the genicular are black on both sides; beneath they are normally flavous or fulvous; hind tibiae dull red, with a narrow, subbasal, black annulus, next which they are more or less obscured with fuscous, sometimes forming a dusky belt half way to the tip, the spines black almost to the very base, ten to eleven in number in the outer series. Posterior extremity of male abdomen feebly clavate, well rounded, the supraanal plate rounded triangular with a feebly produced tip, nearly flat, the median sulcus percurrent, slender, moderately deep, bounded by low rounded walls which extend over about three-fourths of the plate; furcula wanting, the last dorsal segment narrow and narrowly parted in the middle; cerci heavy, broad, punctate except apically, externally broadly convex, the basal two-fifths nearly equal, beyond expanding rapidly and con-

siderably to an obliquely transverse, broad, oval lobe with regularly rounded contour, above expanding twice as much as below, the whole feebly incurved and surpassing the supraanal plate; infracercal plates hardly visible, briefer than the supraanal plate; subgenital plate rather narrow, subequal, abruptly, roundly, and considerably elevated apically, but not produced, entire.

Length of body, male and female, 25 mm.; antennae, male, 15 mm., female, 12 mm.; tegmina, male, 13.5 mm., female, 9 mm.; hind femora, male and female, 16 mm. The female measured has exceptionally short tegmina.

Nine males, 12 females. St. Louis, Missouri (U.S.N.M.—Riley collection); central Missouri (same); Illinois, Uhler; southern Illinois, Kennicott, Thomas.

It has also been reported from central Illinois (Thomas): Running Lake, Illinois, July 15, September (McNeill); Anderson, Fulton, Hopkins and Christian counties and Elk Lick Falls, Kentucky (Garman); southeast Nebraska (Bruner). It would therefore appear to have a rather narrow range, in the central Mississippi Valley, between latitude 37°–40°, and longitude 86°–96°.

123. MELANOPLUS CLYPEATUS.

(Plate XXIV, fig. 2.)

Caloptenus clypeatus SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1877), p. 40; Ent. Notes, VI (1878), p. 18.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60.
Melanoplus clypeatus SCUDDER!, Can. Ent., XII (1880), p. 75.

Brownish testaceous. Front of head varying from dull luteous to dull reddish brown, faintly dotted with fuscous; tips of mandibles and lower edge of labrum marked with black; interspace between the eyes a little (male) or much (female) broader than the basal antennal joint, very slightly depressed centrally, at least in the male; frontal costa broad, subequal, slightly depressed at the ocellus; antennae luteous, infuscated on the apical half, nearly (male) or about two-thirds (female) as long as the hind femora. Pronotum scarcely enlarging posteriorly, with but slight transverse sulci and a slight median carina, equal and percurrent in the female, interrupted slightly between the sulci in the male; lateral carinae indistinct, rounded; top of head and pronotum dotted faintly with fuscous, the lateral lobes of the latter paler, marked next the lateral carinae with a black streak, which narrows and disappears posteriorly, broadens anteriorly and extends slightly upon the head. Prosternal spine rather long, cylindrical or conico-cylindrical, blunt-tipped, feebly retrorse. Tegmina not reaching the tip of the abdomen, about as long as the femora, the costal field dark testaceous, the discoidal field blackish, and the anal field, which is separated angularly from the rest, light testaceous or wood-brown. Fore and middle legs of the color of the body; hind femora long and moderately stout, blackish on their outer face, but the inferior outer carina

yellow, black interrupted with luteo-testaceous on the inner face, beneath vinous red; hind tibiae varying from vinous to bright red, more or less infuscated on basal half, with a blackish fuscous subbasal annulus, the spines black to the base, eleven to twelve in number in the outer series. Extremity of male abdomen considerably thickened, forming a subglobose mass; supraanal plate shield-shaped, triangularly produced at the apex, narrowly and deeply sulcate down the middle; no furcula; cerci stout, compressed, constricted in the middle as seen from the side, beyond incurved, expanded especially above, the apical border much compressed, convex in the middle half, straight above and below, or feebly emarginate at the union of the convex and straight portions; infracercal plates completely concealed; subgenital plate moderately broad, slightly, broadly, and uniformly elevated apically, hardly prolonged.

Length of body, male, 28.5 mm., female, 36 mm.; antennae, male, 15 mm., female, 14.5 mm.; tegmina, male, 17 mm., female, 18.5 mm.; hind femora, male, 17 mm., female, 21 mm.

Two males, 1 female. Georgia, Morrison.

124. *MELANOPLUS FURCATUS*, new species.

(Plate XXIV, fig. 3.)

Brownish-ferruginous, the top of head and prozona very faintly dotted with fuscous. Head gently tumid above, the interspace between the eyes broad, but distinctly narrower than the frontal costa, the fastigium most feebly depressed, running without break into the frontal costa, which is broad, equal, shallowly sulcate at and below the ocellus, punctate on either side; eyes pretty large, rather elongate, not very prominent; antennae fulvous, becoming a little infuscated apically, almost as long as the hind femora in both sexes, being relatively almost as long in the female as in the male. Pronotum enlarging slightly posteriorly, at least in the female, the disk very flatly tectate, the median carina very slight and subequal throughout, the lateral carinae merely forming blunt angles separating the disk from the lateral lobes, the front margin scarcely convex, the hind margin broadly and roundly angulate; disk of prozona feebly longitudinal, sparsely feebly and shallowly punctate laterally, about a fourth longer than the finely and closely punctate metazona, minutely emarginate in the middle posteriorly; lateral lobes marked precisely as in *M. clypeatus*. Prosternal spine rather long, slightly retrorse, cylindrical, but a little enlarged on the apical half. Tegmina not much shorter than the abdomen, but not nearly reaching the tip of the hind femora, testaceo-cinereus in the anal field, the rest fuscous, with dark fuscous flecks (male) or blotches (female) in the discoidal area; wings impure hyaline, with very pale brown veins and cross veins, becoming more and more fuscous in the upper half, especially toward the apex. Fore and middle femora only a little tumid in the male, uniform in color: hind femora long and rather stout and tumid,

the inner face twice barred with black, which sometimes shows feebly above, and appears again on the outer face, but diffused, subconfluent, and crossed by the pallid angulate incisures; inferior face red; genicular arc black on both sides; hind tibiae red, with a subbasal, narrow, fuscous annulus, the spines black to their base, twelve in number in the outer series. Extremity of the male abdomen roundly clavate and upturned, the supraanal plate triangular and tolerably flat, but with a deep basal median sulcus reaching more than half way to the tip with pretty high and sharp bounding ridges, fading apically; furcula wholly wanting; cerci stout, heavy, and incurved, narrowing considerably toward the middle, then very rapidly expanding and furcate, the upper lobe longer than the lower and more equal, well rounded apically, directed sharply upward, the lower triangular, bluntly pointed, and turned but little downward, the apical margin of the whole deeply and angularly excised, scarcely surpassing the supraanal plate; infracercal plates just longer than the supraanal plate; subgenital plate moderately narrow, the apex a little and angularly elevated, scarcely prolonged, entire.

Length of body, male, 31.5 mm., female, 39 mm.; antennae, male, 16 mm., female, 17.5 mm.; tegmina, male, 19.5 mm., female, 23 mm.; hind femora, male, 18.5 mm., female, 22.5 mm.

One male, 1 female. Jacksonville, Duval County, Florida, Pridday, (L. Bruner).

27. BIVITTATUS SERIES.

This group is nearly related to the robustus series; the male prozona is more or less distinctly longitudinal, and the interspace between the mesosternal lobes of the same sex nearly or more than twice as long as broad; the eyes are rather widely separated, and the frontal costa broad and equal. The prosternal spine is rather long and generally slightly retrorse. The tegmina are fully developed, at least as long as the hind femora, without spots or, rarely, very feebly marmorate, but sometimes with a light stripe dividing the dorsal and lateral faces and extending across the pronotum. The hind femora are longitudinally striped on the outer face or unmarked, the hind tibiae usually red, rarely purplish, with ten to thirteen spines in the outer series.

The supraanal plate is much as in the robustus series; the furcula is present as small but coarse lobes, and the cerci are much as in the robustus series, but less extravagantly developed; the subgenital plate is longer than broad, generally moderately narrow, somewhat elevated and sometimes thickened apically, hardly prolonged, and always entire.

It comprises insects of a large or a very large size, with heavy bodies and poor in flight. Five species are known, and among them they cover our entire territory, from Atlantic to Pacific and from Central Mexico to the Saskatchewan and Hudson Bay. It comprises two of our commonest species.

125. MELANOPLUS FEMORATUS.

(Plate XXIV, fig. 4.)

- Caloptenus femoratus* BURMEISTER, Handb. Ent., II (1838), p. 638.—BRUNNER, Verhandl. Zool.-Bot. Gesellsch. Wien, 1861 (1861), p. 224; Orth. Stud. (1861), p. 4.—WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 678.—PROVANCHER, Faune Ent. Can., II (1877), p. 35.
- Acridium milberti* SERVILLE!, Orth. (1839), p. 649.
- Acridium flavovittatum* HARRIS, Treat. Ins. Inj. Veg. (1841-42), p. 140; *ibid.*, 2d ed. (1852), p. 151; *ibid.*, 3d ed. (1862), p. 173.—FITCH, Amer. Journ. Agric. Sc., VI (1847), p. 146.—EMMONS, Agric. N. Y., V (1854), p. 147.—RATHVON, Rep. U. S. Dep. Agric., 1862 (1862), p. 384.
- Locusta flavovittata* PACKARD, Rep. Nat. Hist. Me. (1861), p. 375.
- Acridium (Caloptenus) femoratum* DE HAAN, Bijdr. Kenn. Orth. (1842), p. 144.
- Acridium hudsonium* BARNSTON!, MS. (Brit. Mus.).
- Caloptenus bivittatus* UHLER (pars) SAY, Ent. N. A., ed. LeC., II (1859), p. 238.—SCUDDER! (pars), Can. Nat., VII (1862), p. 287; (pars), Bost. Journ. Nat. Hist., VII (1862), p. 465.—SMITH, Proc. Portl. Soc. Nat. Hist., I (1868), p. 150.—WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 678; Can. Ent., IV (1872), p. 30.—SMITH, Rep. Conn. Bd. Agric., 1872 (1872), pp. 362, 381, fig. 7.—GLOVER, Ill. N. A. Ent., Orth. (1872), pl. v, fig. 16.—THOMAS (pars), Rep. U. S. Geol. Surv. Terr., V (1873), p. 166.—PROVANCHER, Nat. Can., VIII (1876), p. 109.—HOWARD, Ins. Life, VII (1895), p. 274.
- Pezotettix edax* SAUSSURE!, Rev. Mag. Zool., 1861 (1861), p. 161; Orth. Nov. Am., II (1861), p. 11.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 152.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59.—SMITH, Cat. Ins. N. J. (1890), p. 412.
- Acridium (Caloptenus) bivittatum* UHLER (pars), Harr. Treat. Ins. Inj. Veg. (1862), p. 174.
- Podisma edax* WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 718.
- Melanoplus bivittatus* SCUDDER! (pars), Hitchc. Rep. Geol. N. H., I (1874), p. 376.—SMITH, Bull. N. J. Exp. St., K (1890), p. 41; Cat. Ins. N. J. (1890), p. 413.—BLATCHLEY (pars), Can. Ent., XXIII (1891), pp. 99-100.—BRUNER (pars), Can. Ent., XXIII (1891), p. 193; (pars), Ins. Life, IV (1891), pp. 21-22, 146; (pars), Rep. Ent. Soc. Ont., XXII (1891), p. 48; (pars), Bull. Div. Ent. U. S. Dep. Agric., XXVIII (1893), pp. 19-21, fig. 8.—MORSE (pars), Psyche, VII (1894), p. 106.—BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI (1894), p. 308, pl. VIII, fig. 8.
- Melanoplus femoratus* SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1878), pp. 285, 288; Ent. Notes, VI (1878), pp. 44, 47; Rep. U. S. Ent. Comm., II (1881), App., p. 24.—BRUNER, *ibid.*, III (1883), p. 60; Can. Ent., XVII (1885), p. 18.—CAULFIELD, Rep. Ent. Soc. Ont., XVIII (1886), p. 71; Can. Ent., XVIII (1886), p. 212.—COMSTOCK, Intr. Ent. (1888), pp. 108, 110, fig. 99.—FERNALD, Orth. N. E. (1888), pp. 31, 32, fig. 13; Ann. Rep. Mass. Agric. Coll., XXV (1888), pp. 115, 116, fig. 13.—DAVIS, Ent. Amer., V (1889), p. 81.—BRUNER, Publ. Nèbr. Acad. Sc., III (1893), p. 27.
- Caloptenus (Melanoplus) femoratus* CAULFIELD, Can. Rec. Sc., II (1887), p. 401; Can. Orth. (1887), p. 14.
- Melanoplus bivittatus femoratus* MORSE, Psyche, VII (1894), p. 106.

Very variable in brightness of color, but generally dark brownish fuscous, marked, generally heavily, with flavous stripes, flavo-fulvous beneath, the female at least often tinged throughout with olivaceous. Head flavous, more or less blotched or suffused with fuscous, blackish

fuscous above except in widening flavous stripes which follow the outer margins of the fastigium and cross the head to the lateral carinae of the pronotum; vertex gently tumid, the interspace between the eyes broad, almost or quite as broad as the frontal costa, the fastigium plane or rarely, in the male, very feebly briefly and broadly sulcate, passing insensibly into the frontal costa; the latter broad, subequal but feebly and broadly narrowed above, plane or feebly sulcate below, percurrent; eyes moderately prominent in the male, moderately large, not very elongate even in the female, scarcely longer than the infraocular portion of the genae; antennae fulvous, becoming fuscous apically, as long (male) or hardly more than two-thirds as long (female) as the hind femora. Pronotum subequal, but barely expanding on the metazona (male) or distinctly though not greatly expanding from the posterior sulcus of the prozona (female), the disk nearly plane but slightly convex, separated from the subvertical lateral lobes by a tolerably pronounced but rounded angle, the median carina feeble, between the sulci feebler, rarely subobsolete; prozona very feebly and very sparsely punctate, slightly (male) or feebly (female) longitudinal, fully a half (male) or from a fourth to a third (female) longer than the closely and delicately punctate metazona; front margin truncate or barely convex, hind margin broadly rotundato-angulate; disk dark brownish fuscous, more or less dark olivaceous in life, the lateral carinae more or less heavily marked with a flavous stripe upon the disk, next to which the lateral lobes are darkest, gradually fading below, but often forming a blackish lateral stripe, which extends from the hinder edge of the eyes across the prozona and dies out upon the metazona; at their lowest margin the lateral lobes are of nearly the same color as the under surface, and occasionally the whole of the lateral lobes are uniformly dull flavous or flavo-testaceous, the flavous stripe of the lateral carinae marked only by its brightness and a feeble blackish external edging. Prosternal spine rather long and a little retrorse, conical as seen laterally, cylindrical or conico-cylindrical from in front. Tegmina reaching or a little surpassing the hind femora, rarely a little less in the female, tapering very regularly and gradually from the subbasal expansion, strongly and uniformly rounded at tip, with a flavous stripe along the anal vein, elsewhere fuscous, deepest in color in the discoidal area, free from mottling; wings hyaline with the feeblest flavous tinge, the veins and cross veins pallid green but becoming more and more fuscous toward the apex. Fore and middle femora fulvo-olivaceous, a little infuscated above and apically; hind femora rather long and only moderately stout, very variable in ground color but usually lighter than the general color of the body, sometimes much lighter, sometimes without stripes or bands except an infuscation along the upper carina of the outer face, at others infuscated over most of the upper half of that face, rarely with three distinct, broad, black patches along the inner half of the upper face, basal, median, and postmedian, the genicular are always black or

blackish fuscous on both sides; hind tibiae paler or brighter coral red, sometimes with a subbasal, narrow, black, imperfect annulus, occasionally followed but not immediately by a slight and brief infuscation, the spines black, at extreme base pale or reddish, ten to thirteen in number in the outer series. Extremity of male abdomen feebly clavate, well rounded, upturned, the supraanal plate subelypate, nearly flat, with a narrow and very deep median sulcus, fading just before the tip, bounded by high sharp walls, between which and the lateral margins is a broad and shallow trough; furcula consisting of a pair of slight triangular lobes broader than long, separated by their own breadth; cerci very stout, large and broad, laminate, externally convex, the basal half narrowing gently, beyond the middle at once expanding into two lobes: an upper, nearly as long as the basal half of the cerci, directed upward and backward, forming an ovate pad; and a lower, brief, triangular denticle, broader than long, the apical margin more or less distinctly emarginate below between them; infracercal plates shorter than the supraanal plate, but expanding a little laterally beyond its margins; subgenital plate moderately narrow and subequal, at apex a little elevated and prolonged, with a subdued tubercle.

Length of body, male, 26.5 mm., female, 41 mm.; antennae, male, 18 mm., female, 14 mm.; tegmina, male, 21 mm., female, 23.5 mm.; hind femora, male, 17.25 mm., female, 21 mm.

Ninety males, 124 females. Halifax, Nova Scotia, H. Piers; Maine (U.S.N.M.—Riley collection): Moosehead Lake, Maine; Norway, Oxford County, Maine, S. I. Smith (Museum Comparative Zoology); Brunswick, Cumberland County, Maine, Packard (same); Montreal, Canada; New Hampshire (U.S.N.M.—Riley collection); White Mountains, New Hampshire, Shurtleff, Packard (Museum Comparative Zoology; S. Henshaw); Mount Washington, subalpine, and valleys of White Mountains, New Hampshire; Mount Washington, alpine (A. P. Morse); summit Mount Kearsarge, New Hampshire, 3,251 feet (A. P. Morse); Bethlehem, Grafton County, New Hampshire, L. Agassiz (Museum Comparative Zoology); Sudbury, Rutland County, Vermont; Burlington and Hinesburg, Chittenden County, Vermont, J. B. Perry (Museum Comparative Zoology); Warwick, Franklin County, Massachusetts, Miss Edmonds (same); Salem, Essex County, Massachusetts, Putnam, Kingsley (same); vicinity of Boston, Massachusetts; Nantucket Island, Massachusetts; Williamstown, Berkshire County, Massachusetts; Connecticut; New York, Akhurst; Sullivan County, New York, Shaler (Museum Comparative Zoology); Chateaugay Lake, Adirondacks, New York, F. C. Bowditch; Long Island, New York; Pottsville, Schuylkill County, Pennsylvania, Shaler (Museum Comparative Zoology); Maryland, Uhler (same); Patterson Creek, West Virginia, Shaler (same); Upper Tract, Pendleton County, West Virginia, Shaler (same); Williamsport, Virginia, Shaler (same); Shenandoah Valley, Virginia, Packard (same); North Carolina, Morrison; Indiana (U.S.N.M.;

W. S. Blatchley); Michigan, M. Miles; Bear Lake, Michigan (U.S. N.M.—Riley collection); Lake Winnipeg, Manitoba; Illinois, Uhler, Stromberg (S. Henshaw; S. H. Scudder); Moline, Rock Island County, Illinois, McNeill; Denison, Crawford County, Iowa, J. A. Allen; Missouri, (U.S.N.M.—Riley collection); Fort Robinson, Dawes County, Nebraska, Bruner (same); Colorado, 5,500 feet, Morrison; Cheyenne, Laramie County, Wyoming, Osten Sacken; Evanston, Uinta County, Wyoming, 6,800 feet, August 6; Steele, Wyoming (U.S.N.M.—Riley collection); Calgary, Alberta, June 15 (S. Henshaw); British Columbia (same); Vancouver Island, British Columbia, H. Edwards; Vancouver Island, British Columbia, Crotch (Museum Comparative Zoology); Washington, Morrison (S. Henshaw); Mount Shasta district, California, H. Edwards; Sissons, Siskiyou County, California (Museum Comparative Zoology); Los Angeles, California, Coquillett (U.S.N.M.—Riley collection).

It has also been reported from Hudson Bay (Walker); Quebec, Canada (Provancher), and Carolina (Burmeister, Saussure). Its range in the eastern part of the country is therefore from Hudson Bay to North Carolina, on the Pacific Coast from Vancouver to southern California, while in the interior, south of Canada, it occurs in less abundance as far south as latitude 40° or thereabouts.

An examination of three females in Vermont in the middle of August showed thirty-nine eggs in the ovaries on one side and thirty on the other of the first; forty-five on one side and forty-two on the other of the second; and thirty-eight on each side of the third, the total number of eggs varying from sixty-nine to eighty-seven. A fourth female had no eggs in the ovaries, but the abdomen was filled with a filarian worm at least two feet long; the eggs are pale yellow.

This insect is very fond of perching by the roadside on the broad leaves of *Inula helenium*, sunning itself.

126. MELANOPLUS BIVITTATUS.

(Plate XXIV, fig. 5.)

Gryllus bivittatus SAY, Journ. Acad. Nat. Sc. Philad., IV (1825), p. 308; Ent. N. A., ed. LeC., II (1859), p. 237.

Acridium (Opsomata) bivittatum DE HAAN, Bijdr. Kenn. Orth. (1842), p. 144.

Caloptenus bivittatus UHLER (pars) Say, Ent. N. A., ed. LeC., II (1859), p. 238.—SCUDDER! (pars), Can. Nat., VII (1862), p. 287; (pars), Bost. Journ. Nat. Hist., VII (1862), p. 465.—WALSH, RILEY, Amer. Ent., I (1868), p. 16.—PACKARD, Guide Ins. (1869), p. 570.—THOMAS, Proc. Acad. Nat. Sc. Philad., 1870 (1870), p. 78; Ann. Rep. U. S. Geol. Surv. Terr., II (1871), p. 265.—DODGE, Can. Ent., IV (1872), p. 15.—SCUDDER, Rep. U. S. Geol. Surv. Nebr. (1872), pp. 250, 259.—GLOVER, Ill. N. A. Ent., Orth. (1872), pl. 1, fig. 16.—THOMAS (pars), Rep. U. S. Geol. Surv. Terr., V (1873), p. 166; Key Ill. Orth. (1874-75), p. 3.—SCUDDER!, Daws. Rep. Geol. Rec. 49th Par. (1875), p. 343.—RILEY, Ann. Rep. Ins. Mo., VII (1875), pp. 124, 173, fig. 34.—THOMAS, Proc. Dav. Acad. Nat. Sc., I (1876), p. 261.—SCUDDER!, Bull. U. S. Geol. Surv. Terr., II (1876), p. 261.—WHITMAN, Grasshopper (1876), p. 19, fig.—UHLER, Bull. U. S. Geol.

- Surv. Terr., III (1877), p. 796.—BESSEY, Bienn. Rep. Iowa Agric. Coll., VII (1877), p. 209.—THOMAS, Rep. Geol. Expl. Surv. W. 100th Mer., V (1875 [1877]), p. 894.—BRUNER, Can. Ent., IX (1877), p. 144.—RILEY, Loc. Plague (1877), pp. 89, 194-195, fig. 38.—THOMAS, Bull. U. S. Geol. Surv. Terr., IV (1878), p. 484; Ann. Rep. Chief Eng., 1878 (1878), 1845; Rep. U. S. Ent. Comm., I (1878), p. 42.—RILEY, *ibid.*, I (1878), pp. 220, 221, 226, 327, 459, fig. 111.—PACKARD, *ibid.*, I (1878) pp. [140, 142].—GIRARD, *Traité élem. d'ent.*, II (1879), p. 248.—RILEY, *Amer. Ent.*, I (1880), p. 220.—THOMAS, Rep. Ent. Ill., IX (1880), pp. 91, 96, 126-127.—LINTNER, *Ins. Clover* (1881), p. 5.—BRUNER, Bull. Div. Ent. U. S. Dep. Agric., II (1883), p. 9; Rep. U. S. Ent. Comm., III (1883), pp. 9, 10, 14.—RILEY, *Stand. Nat. Hist.*, II (1884), pp. 194-195, fig. 272.—COOK, *Beal's Grasses N. A.*, I (1887), pp. 373, 396.—RILEY, *Ins. Life*, I (1888), p. 87.—WEED, *Bull. Ohio Agric. Exp. St., Techn. Ser.*, I (1889), p. 40.—LUGGER, *Rep. Agric. Exp. St. Minn.* (1889), p. 340, fig. 17.—OSBORN, *Ins. Life*, IV (1891), pp. 50, 55.—RILEY, *ibid.*, IV (1891), p. 145.—OSBORN, Rep. Ent. Soc. Ont., XXII (1891), p. 70, 73.—RILEY, *Bull. Div. Ent. U. S. Dep. Agric.*, XXV (1891), pp. 31, 32, fig. 9.—OSBORN, *ibid.*, XXVII (1892), pp. 59-64.—MILLIKEN, *Ins. Life*, VI (1893), pp. 19, 21.
- ? *Pezotettix sumichrasti* SAUSSURE, *Rev. Mag. Zool.*, 1861 (1861), pp. 160-161; *Orth. Nova Amer.*, II (1861), p. 11.
- Acridium* (*Caloptenus*) *birittatum* UHLER (pars), *Harr. Treat. Ins. Inj. Veg.* (1862), p. 174.
- Acridium birittatum* THOMAS, *Trans. Ill. St. Agric. Soc.*, V (1865), p. 449.
- Melanoplus birittatus* SCUDDER! (pars), *Hitchc. Rep. Geol. N. H.*, I (1874), p. 376; Rep. U. S. Ent. Comm., II (1881), app., p. 24.—BRUNER, *ibid.*, III (1883), p. 60; *Bull. Washb. Coll.*, I (1885), p. 139.—RILEY, Rep. U. S. Ent., 1885 (1886), p. 233.—BRUNER, *ibid.*, 1885 (1886), p. 307.—RILEY, *Ins. Life*, II (1889), p. 27.—FLETCHER, Rep. Exp. Farms Can., 1888 (1889), p. 63.—TOWNSEND, Proc. Ent. Soc. Wash., II (1891), p. 43.—BLATCHLEY! (pars), Can. Ent., XXIII (1891), pp. 99-100.—BRUNER (pars), *ibid.*, XXIII (1891), p. 193; *Ins. Life*, III (1891), p. 229; (pars), *ibid.*, IV (1891), pp. 21-22, 146; (pars), Rep. Ent. Soc. Ont., XXII (1891), p. 48; *Bull. Div. Ent. U. S. Dep. Agric.*, XXIII (1891), p. 14; *ibid.*, XXVII (1891), pp. 12-29, 33.—MCNEILL, *Psyche*, VI (1891), p. 74.—BRUNER, Rep. St. Bd. Agric. Nebr., 1891 (1891), pp. 243, 307-308, figs. 85-86.—KELLOGG, *Ins. Life*, V (1892), p. 116.—OSBORN, Proc. Iowa Acad. Sc., I, Pt. II (1892), p. 118.—KELLOGG, *Inj. Ins. Kans.* (1892), pp. 42-43, figs. 22, 23 b.—NUTTING, *Bull. Lab. Nat. Hist. Univ. Iowa*, II (1893), p. 291.—BRUNER (pars), *Bull. Div. Ent. U. S. Dep. Agric.*, XXVIII (1893), pp. 19-21, fig. 8; *ibid.*, XXX (1893), p. 35; *Publ. Nebr. Acad. Sc.*, III (1893), p. 27; Rep. Nebr. St. Bd. Agric., 1893 (1893), pp. 461-462, figs. 104-105; *Ins. Life*, VI (1893), p. 34.—COOK, *Trans. Amer. Ent. Soc.*, XX (1894), p. 337.—BRUNER, Rep. St. Hort. Soc. Nebr., 1894 (1894), pp. 163, 205, fig. 71.—MORSE (pars), *Psyche*, VII (1894), p. 106.—BLATCHLEY, *Can. Ent.*, XXVI (1894), pp. 244-245.—BRUNER, *Bull. Div. Ent. U. S. Dep. Agric.*, XXXII (1894), p. 12; *Nebr. St. Hort. Rep.*, 1895 (1895), p. 69.
- Pezotettix birittatus* Stål, *Bih. K. Sv. Vet.-Akad. Handl.*, V, No. 9 (1878), p. 14.—GARMAN, *Orth. Ky.* (1894), p. 8.

[Some of the above references belong with little doubt to *M. femoratus*, with which this species has often been confounded, but whenever it was not clear that they belonged to *M. femoratus* I have retained them here.]

Varying in general ground color from fusco-testaceous to very dark brownish fuscous, striped with fulvo- or pallid testaceous. Head flavo-testaceous, more or less infuscated, the summit with a broad, median, widening, blackish fuscous stripe, which extends backward from the

front of the fastigium but avoids the eyes; vertex gently tumid, the interspace between the eyes broad, equaling the frontal costa, the fastigium broadly, equally, and very shallowly sulcate; frontal costa broad, subequal, with rounded margins, feebly sulcate at and below the ocellus, feebly punctate laterally; eyes as in *M. femoratus*; antennae ferruginous, more or less considerably and broadly infuscated apically, about as long (male) or about two-thirds as long (female) as the hind femora. Pronotum enlarging a little from in front backward, more feebly in the male than in the female, the disk as in *M. femoratus*, the median carina slight but distinct throughout, generally slighter (but only a little) between the sulci, the lateral carinae obscure, consisting of a rounded angle, the front margin very feebly convex, the hind margin broadly rounded or obtusely rotundato-angulate; prozona distinctly longitudinal (male) or quadrate (female), generally a third (male) or a fourth (female) longer than the metazona, with very faint and exceedingly sparse punctation, the metazona finely and closely punctate; disk very dark brownish fuscous, rather broadly bordered laterally, including the lateral carinae, with an equal, generally percurrent, fulvo-testaceous or pallid testaceous stripe, usually half as broad as the frontal costa, and which is bordered more or less narrowly and irregularly on the lateral lobes of the prozona with blackish fuscous, fading below into fuscous, except in the sulci. Prosternal spine as in *M. femoratus*. Tegmina attaining or a little surpassing the hind femora, generally longer in the male than in the female (in a single instance seen, a female, no longer than the femora themselves) brownish or blackish fuscous, the anal vein marked by a slender flavous stripe, the discoidal area not darker than the rest, generally almost clear but frequently with faint and delicate mottling; wings hyaline, the cross-veins, except in the inner half of the expanded anal area, fuscous. Fore and middle femora ferruginous, more or less heavily infuscated above; hind femora rather long and moderately stout, ferrugineo-testaceous, the outer and generally the inner faces black above, flavo-testaceous below, the inner half of the upper face thrice very broadly banded with black, the genicular arc and a basal transverse stripe across the lower genicular lobe black on both sides; hind tibiae passing more or less gradually, at varying points but generally near the middle, from purplish at the base to greenish yellow (very rarely red or reddish) at the tip, the patella of the lighter color, followed in lighter examples by a narrow black annulus, the spines black almost or quite to their base, ten to thirteen in number in the outer series. Extremity of male abdomen clavate, rounded, well upturned, the supraanal plate clypeate, with strongly sinuous sides, rectangulate tip, a slender percurrent very deep median sulcus, bounded in the basal half or more by sharp walls, between which and the lateral margins the whole plate is longitudinally hollowed; cerci very broad, laminate, externally convex, gently incurved, surpassing the supraanal plate, shaped almost precisely as in *M. femoratus* but more elongate, and with the

upper lobe of the expanded extremity bent at a lesser angle with the basal portion; infracercal plate shorter than the supraanal, scarcely surpassing its lateral margins; subgenital plate moderately narrow, at apex considerably and abruptly elevated and thickened, hardly prolonged posteriorly.

Length of body, male, 27 mm., female, 37 mm.; antennae, male, 14.75 mm., female, 13 mm.; tegmina, male, 20.5 mm., female, 26.5 mm.; hind femora, male, 15 mm., female, 20 mm. Specimens in Texas grow to a much larger size, and it is very variable in this respect.

One hundred and twenty-nine males, 141 females. Franklin County, Ohio, Lesquereux (Museum Comparative Zoology); Vigo and Fulton counties, Indiana, W. S. Blatchley; Chicago, Illinois; Rock Island Illinois, Walsh; Moline, Rock Island County, Illinois, McNeill; southern Illinois, Kennicott; St. Louis, Missouri, Engelmann; Iowa (U.S.N.M.—Riley collection); Dallas County, Iowa, August 8–10, September 1–3, J. A. Allen; Jefferson, Greene County, Iowa, July 20–24, Allen; Crawford County, Iowa, July 15–24, Allen; Minnesota, Uhler; Lake Winnipeg, Manitoba, Scudder (Museum Comparative Zoology); Winnipeg, Manitoba, Kennicott, Gunn (Uhler); Custer, South Dakota, Bruner (U.S.N.M.—Riley collection); Dakota, Rothhammer; Nebraska, Dodge; Nebraska, A. Agassiz (Museum Comparative Zoology); Fort Robinson, Dawes County, Nebraska, Bruner (U.S.N.M.—Riley collection); North Fork of Platte River, Hayden; West Point, Cuming County, Nebraska (L. Bruner); Nebraska City, Otoe County, Nebraska, Hayden; Ellis, Kansas (Museum Comparative Zoology); Fort Hayes, Kansas, Allen (same); Lakin, Kearny County, Kansas, 3,000 feet; between Smoky Hill, Kansas, and Denver, Colorado, L. Agassiz (Museum Comparative Zoology); Texas, October 1, November 10, Belfrage (U.S.N.M.—Riley collection; S. H. Scudder); northern Texas, Ubler: Dallas, Texas, Boll (Museum Comparative Zoology; S. H. Scudder); Pecos River, Texas, Captain Pope; Taos, New Mexico (U.S.N.M.—Riley collection); Colorado (Museum Comparative Zoology); Colorado, 5,500 feet, Morrison (U.S.N.M.—Riley collection; S. H. Scudder); Garland, Costilla County, Colorado, 8,000 feet, August 28–29; Veta Pass, Costilla County, Colorado (U.S.N.M.—Riley collection); Pueblo, Colorado, 4,700 feet, August 30–31; Grenada and Las Animas, Bent County, Colorado; Colorado Springs, El Paso County, Colorado, E. S. Tucker (University of Kansas); Clear Creek Canyon, Jefferson County, Colorado, Packard (Museum Comparative Zoology); Pacific R. R. expl., latitude 38°, Lieutenant Beckwith; Grand Junction, Mesa County, Colorado (L. Bruner); White River, Rio Blanco County, Colorado, (U.S.N.M.—Riley collection; S. H. Scudder); Fort Collins, Larimer County, Colorado, Buffum (U.S.N.M.—Riley collection); Utah, Garman (Museum Comparative Zoology); American Fork Canyon, Utah, 9,500 feet, August 23; Salt Lake Valley, Utah, 4,300 feet, August 1–4; Spring Lake Villa, Utah County, Utah, August 1–4, Palmer; Wyoming,

Morrison (U.S.N.M.—Riley collection); North Pacific Railroad survey, George Suckley; upper Missouri River, Hayden; head waters of Missouri and Yellowstone, Hayden; Medicine Hat, Assiniboia, Canada, (U.S.N.M.—Riley collection); Fort McLeod, Alberta, Canada (same); various localities on the Yakima River, Washington (Museum Comparative Zoology); Loon Lake, Colville Valley, Washington, July 25 (same); Spokane, Washington, July 21-22 (same); Puget Sound, C. B. Kennerly.

It has also been reported from Tennessee and Mississippi (Thomas), Nevada (Riley), Idaho (Thomas, Milliken), Souris River, Alberta, Canada (Scudder), Grand Rapids, NW. T. (Nutting), and Victoria (Fletcher); also, possibly, from Mexico (Saussure). It therefore probably ranges from southern Canada to the Gulf, but is unknown along the Atlantic Seaboard, and wholly unreported from the Pacific Slope south of Washington, (unless, as above, in Mexico) and it hardly ranges as far north as *M. femoratus*.

Bruner in one of his accounts of this species says it is "a lover of rank and succulent vegetation, such as is found upon bottom lands, along the edges of cultivated fields, at the margins of woodlands and on the shaded mountain slopes." When "it develops in large numbers, then these haunts are forsaken, to a greater or less extent, and it spreads over cultivated fields, eating the choicest of everything." In Iowa, Mr. J. A. Allen found it common on dry prairies, as well as in moist sloughs on tall grass.

It seldom develops any marked migratory propensity and its egg-laying habits "differ considerably from those of the smaller migratory species, inasmuch as but one or two clusters or pods are deposited by a single female. Nevertheless, just as many eggs are laid by each female insect. These eggs are deposited in prairie sod or any compact soil in the vicinity of the regular haunts or feeding places. Old roads and closely cropped pastures, when located handily, are favorite resorts for the heavily laden females when attending to this mission of theirs." (Bruner.)

Its destructiveness appears to be mainly confined to grass, grain, and garden vegetables. It appears in the winged state the last of June or early in July, but eggs are not laid until late in August; sixty-two to seventy-two eggs have been counted in the egg pods by Donald Gunn in Manitoba.

Blatchley has taken the male of this species *in coitu* with *M. femoratus*, and considers them the same species, as do many others. The range of the two species, which are certainly very closely allied, differs to a considerable extent, though both are found over a large extent of territory side by side; one is a seaboard and northern form, the other an interior species. Besides the differences in the hind tibiae, which rarely cause hesitation in attempting to separate them, there are slight differences which I have attempted to state, in the abdominal append-

ages and in the tegmina, besides some distinction in the general coloration.

The specimens from Grand Junction, Colorado, mentioned above as in Bruner's collection, are short winged and indicate occasional dimorphism in this species.

127. *MELANOPLUS THOMASI*, new species.

(Plate XXV, fig. 1.)

Melanoplus thomasi BRUNER!, MS.

Dark plumbeo-olivaceous, the abdomen dark ferruginous. Head marked with flavo-testaceous below and on the inner side of the eyes above, above the antennal scrobes, along the lateral edges of the frontal costa, and in a broad stripe behind the upper part of the eyes, which passes backward; vertex gently tumid; interspace between the eyes scarcely narrower than the frontal costa, the fastigium broadly and rather shallowly sulcate in front, the frontal costa broad, equal, delicately punctate, shallowly sulcate at and below the ocellus; eyes moderately large, not very prominent, about as long as the infraocular portion of the genae; antennae reddish becoming infuscated apically, a little shorter (male) than the hind femora. Pronotum subequal, enlarging a very little posteriorly, the front margin nearly truncate, the hind margin very broadly angulate, the disk nearly plane, separated by subdistinct but rounded lateral carinae from the subvertical, slightly tumid, lateral lobes, the median carina distinct on the metazona, very feeble on the prozona, the smooth prozona considerably and roundly emarginate in the middle half behind, distinctly longitudinal, nearly a half longer than the closely but shallowly punctate metazona, with a moderately broad, equal, flavo-testaceous stripe on either side of the disk of the whole pronotum, limited by the lateral carinae, the lateral lobes nearly uniform dark plumbeo-olivaceous, but deeper in color above than below. Prosternal spine stout, rather long, cylindrical, blunt, enlarging slightly on apical half as seen from the front. Tegmina not reaching the tip of the femora, testaceous with dark veins, a flavo-testaceous stripe following the anal vein; wings pellucid, the veins testaceous or fusco-testaceous, colorless in the lower half of the anal area. Femora dark plumbeo-olivaceous, the hind pair tinged above with ferruginous, the lower half of the outer side flavous, the inner and lower face coralline, with a faint pregenicular flavous annulus more or less complete, preceded on the inner side above by a fuscous patch, the genicular arc plumbeo-fuscous; hind tibiae wholly coral red, the spines black at the base, eleven in number in the outer series. Extremity of male abdomen somewhat clavate, rounded, a little upturned, the supra-anal plate broad and triangular with sinuate lateral margins, rectangular apex, nearly plane, but with a rather broad and shallow median longitudinal sulcus in the basal half, bordered by rather low walls, and a pair of apical, distant and subparallel, short, gently arcuate, slight

ridges; furcula consisting of a pair of subsemicircular distant lobes, projecting from the middle of the thickened plates occupying the inner portion of the last dorsal segment, the projecting portion lying outside the bases of the ridges bordering the basal sulcus of the supraanal plate; cerci large, broad, and rather stout, apically a little incurved, broadly constricted mesially as seen from the side, the apical portion triangularly expanded above, truncate after a slight expansion below, the apical margin broadly convex, subtruncate; infracercal plates about as long as the supraanal plate, in the apical half a little expanded beyond the lateral margins of the same; subgenital plate moderately narrow, considerably prolonged and elevated apically, as well as thickened.

Length of body, male, 33 mm.; antennae, circ. 16 mm.; tegmina, 25 mm.; hind femora, 18.5 mm.

One male. Lerdo, Durango, Mexico, November (L. Bruner).

This species is rather nearer to *M. femoratus* than to *M. bivittatus*, though geographically separated more widely from the former.

128. MELANOPLUS YARROWII.

(Plate XXV, fig. 2.)

Caloptenus yarrowii THOMAS, Rep. Geol. Geogr. Expl. 100th Mer., V (1875), p. 894, pl. XLV, fig. 5; Rep. U. S. Ent. Comm., I (1878), p. 43.—BRUNER, *ibid.*, III (1883), p. 60.

Light brownish yellow, somewhat cinereous, nearly uniform. Head nearly uniform, hardly darker above, the vertex gently tumid, the interspace between the eyes not very broad, distinctly narrower than the frontal costa, the fastigium feebly sulcate throughout; frontal costa moderately broad, slightly broader below than above, failing to reach the clypeus, very feebly and broadly sulcate below the ocellus, punctate on either side; eyes moderate, only feebly prominent, hardly longer than the infraocular portion of the genae; antennae red. Pronotum feebly enlarging apically, the front margin truncate, the hind margin bluntly and very obtusely angulate, the disk nearly plane, the lateral lobes subvertical; median carina feeble, subobsolete between the sulci; lateral carinae very rounded; prozona nearly smooth, scarcely longitudinal (male) or quadrate (female), but little longer than the metazona, its middle sulcus transverse, the posterior sinuate; metazona closely and rather finely punctate; pronotum without markings except a faint slender flavous streak along the discal side of the lateral carinae and, in the male at least, some irregular blackish fuscous blotches on the lateral lobes. Prosternal spine moderately long, conico-cylindrical, blunt, erect. Tegmina reaching the tip of the hind femora, brownish testaceous without markings, tapering very gently and regularly to a well-rounded tip; wings pellucid with a feeble greenish tinge, the veins and cross veins fuscous only above the anal area, except to a slight degree. Hind femora olivaceo-testaceous, more or less infumated above and on the outer face, the lower carina of the outer face flavous, and

dull flavous beneath, with a median and postmedian fuscous patch on the upper half of the inner face, the genicular arc plumbeous or fusco-plumbeous; hind tibiae red, the spines black except at extreme base, ten to thirteen in number in the outer series. Extremity of male abdomen feebly clavate, rounded, upturned, the supraanal plate broad, rounded triangular, the lateral borders slightly bent in the middle, with a narrow, moderately deep, percurrent, median sulcus with moderately high, not very sharp walls, on either side of the posterior extremity of which is a similar, parallel, short ridge; furcula present only as the sharply rectangulate inner corners of the slightly parted lateral halves of the last dorsal segment; cerci broad, stout, laminate, faintly convex, considerably and regularly incurved, the basal half tapering gently, beyond the middle expanding considerably, more above than below, into a flabellate pad considerably broader than long, bluntly rounded above and below, with nearly straight and truncate, but not broadly truncate, posterior margin, the whole fully as long as the supraanal plate; infracercal plates broader than the apical half of the supraanal plate, no longer than it, narrowing rapidly and roundly; subgenital plate rather broad and short, considerably elevated and prolonged apically, entire, extending far beyond the supraanal plate.

Length of body, male, 25.5 mm., female, 33 mm.; tegmina, male, 19 mm., female, 21 mm.; hind femora, male, 13.5 mm., female, 16.5 mm.

One male, 1 female. Grand Junction, Mesa County, Colorado, August 28, C. P. Gillette, through L. Bruner.

Although Thomas's description of *C. yarrowii* was based upon a female only, I am tolerably confident that this species is to be referred to it; it certainly fits it better than any known to me, and its reference here was suggested to me by Professor Bruner. Thomas gave no locality beyond "found in the collection," which was made in "portions of Nevada, Utah, California, Colorado, New Mexico and Arizona." He afterwards mentions it as "probably from Arizona, but possibly from Nevada," without giving reasons. From all that appears it might have come as well from Colorado or Utah.

129. MELANOPLUS OLIVACEUS, new species.

(Plate XXV, fig. 3.)

Melanoplus olivaceus BRUNER!, MS.

Dark brownish testaceous with an olivaceous tint, nearly uniform in coloring. Head varying in front from dark olivaceous to fuscous or ferruginous, the vertex like the rest of the body and gently tumid; interspace between the eyes only moderately broad, distinctly narrower than the frontal costa; fastigium very slightly and broadly sulcate; frontal costa moderately broad and equal, hardly reaching the clypeus, seriatly punctate at the sides, more or less shallowly sulcate excepting above; eyes moderately large, rather prominent especially in the male, considerably longer, at least in the male, than the infraocular

portion of the genae; antennae red, infuscated apically. Pronotum subequal, scarcely expanding posteriorly even in the female, the front margin subtruncate, the hind margin broadly angulate, the angle rounded; disk very feebly convex and separated by subdistinct lateral carinae formed of a rounded angle from the subvertical lateral lobes, the median carina distinct but slight on the metazona, feeble on the prozona, sometimes subobsolete between the sulci; prozona smooth, distinctly longitudinal (male) or subtransverse (female), a third (male) or scarcely (female) longer than the finely and closely punctate metazona, the principal sulcus between them straight; without lighter markings at the lateral carinae, the lateral lobes more or less but feebly discolored, the posterior lobe of the prozona usually the darker. Prosternal spine rather long, moderately stout, subcylindrical, blunt, a little retrorse. Tegmina surpassing the hind femora, rather slender, tapering very feebly, brownish testaceous without longitudinal stripes. Fore and middle femora plumbeo-olivaceous, somewhat tumid in the male; hind femora brown or ferruginous above, dark olivaceous on the outer face, dull flavous beneath and on the inner side, but on the latter more or less interrupted with fuscous above, the genicular arc brownish testaceous; hind tibiae wholly coral red, the spines black almost to the base, ten to twelve in number in the outer series. Extremity of male abdomen feebly clavate, upturned, the supraanal plate triangular with gently sinuate margins, subrectangulate apex, nearly flat, with a very broad and obscure, feebly percurrent, longitudinal sulcus, bounded by low broad walls, a little constricted in the apical half; furcula consisting of a pair of slight acuminate denticulations, arising from the thickened inner extremities of the divided halves of the last dorsal segment, and overlying the ridges bounding the median sulcus of the supraanal plate; cerci large and broad, gently incurved, slightly tapering on the basal half, and then expanding into a transversely suboval apical flabellation, nearly half as broad again as the extreme base, expanding more above than below, the apical margin broadly convex, the whole considerably surpassing the supraanal plate; infracercal plates surpassing but slightly the sides of the supraanal plate, about as long as it; subgenital plate moderately broad, the lateral margins hardly elevated apically, but considerably prolonged, subtuberculate.

Length of body, male, 23 mm., female, 29 mm.; tegmina, male, 20 mm., female, 24.5 mm.; hind femora, male, 13.75 mm., female 15.75 mm.

Three males, 2 females. Los Angeles, California, Coquillett, July (L. Bruner; U.S.N.M.—Riley collection).

This is the smallest and at the same time the slightest species in this series.

28. PUNCTULATUS SERIES.

This group is composed of species with prominent head and rapidly declivent fastigium, and, in the male, very prominent eyes. The joints of the antennae are unusually long. The pronotum is rather short and

in front rather flaring to receive the head, the prozona quadrate (male) or distinctly transverse (female), the prosternal spine short, conical, and erect, and the interval between the mesosternal lobes relatively broad. The tegmina are fully developed, longer than the hind femora, maculate over their whole breadth. The hind femora are twice rather narrowly belted with black, and the hind tibiae red, more or less obscured.

The supraanal plate of the male is triangular, the furcula very slight or wanting, the cerci very large and broad, immensely expanded apically and flabellate, with convex apical margin, the subgenital plate very much prolonged and greatly elevated apically.

The insects are of medium or large size and dark color, much mottled, and live as far as known only on coniferous trees. Two species are known, one from the Southwest, the other over a large part of the country east of the Rocky Mountains.

130. MELANOPLUS ARBOREUS, new species.

(Plate XXV, fig. 5.)

Dull grimy olivaceous, heavily spotted and clouded with brownish and blackish fuscous, giving it a more or less conspicuously mottled appearance. Head very large and exceptionally prominent; in brightest specimens livid or dull pale flavous, heavily and irregularly flecked with very dark olivaceous inclining to blackish fuscous, forming more or less well-marked stripes, bordering the upper part of the eyes and following the median line of the vertex; vertex tumid; interspace between the eyes rather narrow, narrower than the frontal costa; fastigium rapidly declivent, sulcate, the sulcation broadening a little anteriorly; frontal costa moderately broad, equal, laterally punctate, at and below the ocellus sulcate; eyes large, very prominent, particularly in the male; antennae pale flavous, becoming ferruginous apically, infuscated broadly and obscurely at intervals throughout, a little longer (male) or a little shorter (female) than the hind femora. Pronotum very feebly subelate, the metazona flaring slightly and the prozona distinctly, though over but little space, to receive the head, the front margin faintly convex, the hind margin broadly angulate, the angle broadly rounded, the whole brownish fuscous or yellowish brown, more or less mottled (except on the metazona) with olivaceous or dull flavous and with fuscous, the latter (sometimes tinged with olivaceous) forming on the upper half of the lateral lobes a broad more or less broken band; prozona gently convex transversely, passing insensibly into the inferiorly vertical lateral lobes, quadrate (male) or distinctly transverse (female), a half (male) or a fourth (female) as long again as the metazona, smooth, the median carina very feeble, subobsolete between the sulci, but distinct though slight on the metazona; the latter punctate, with feebly indicated lateral carinae. Prosternal spine short, conical, bluntly pointed, erect; interval between mesosternal lobes slightly longer than

broad (male) or slightly broader than long (female). Tegmina surpassing considerably the hind femora, gently and feebly tapering from the subbasal expansion to the well-rounded tip, fusco-testaceous with an olivaceous tinge, distantly and uniformly flecked with usually roundish or subquadrate dark fuscous spots, less abundant in the apical third, but not confined at all to the discoidal area; wings smoky pellucid, becoming feebly infuscated apically, the veins and cross-veins mostly blackish fuscous. Fore and middle femora luteo-ferruginous, flecked with dark olivaceous or fuscous; hind femora varying from sordid luteo-fuscous to dull pale olivaceous, rather narrowly and completely bifasciate with black, forming unusually regular transverse bands, the whole apex blackish fuscous or black; hind tibiae plumbeo-fuscous at extreme base, followed by a very narrow black annulus and this by a broader pale annulus, beyond which the tibiae are dull red, obscured above, excepting at apex, and sometimes on the sides for a similar and beneath for a brief distance, with fuscous, often broken into flecks, the whole pilose above; spines black nearly or quite to their base, ten to twelve in number in the outer series. Extremity of male abdomen feebly clavate, much upturned, the supraanal plate broad, triangular, with nearly straight lateral margins, acutangulate tip (too nearly rectangulate in our figure), with a broad and rather shallow median sulcus, interrupted beyond the middle, and in the basal half bounded by moderately high walls; furcula composed of a pair of slight triangular projections at the inner angles of the divided last dorsal segment, overlying the ridges of the supraanal plate; cerci large, subequal on the basal two-fifths or more, then abruptly expanding into a transverse apical flap, twice as broad as the base, the expansion almost wholly on the upper side and at right angles to the basal portion, the apical margin broadly convex, but below emarginate to form a denticulation of the lower posterior angle of the flap, the whole gently incurved and surpassing the supraanal plate; infracercal plates wholly concealed beneath the supraanal plate; subgenital plate moderately broad, very greatly extended and abruptly elevated at the extreme apex.

Length of body, male, 30 mm., female, 44 mm.; antennae, male, 18 mm., female, 16.5 mm.; tegmina, male, 26 mm., female, 31 mm.; hind femora, male, 16 mm., female, 21 mm.

Six males, 2 females. Dallas, Texas, Boll (U.S.N.M.—Riley collection; S. H. Scudder); Gulf coast of Texas, Aaron; Arizona, Schaupp (L. Bruner).

This species is certainly very closely allied to *M. punctulatus*, which not only occurs with it, but over a much wider extent of country; it is a much larger insect and differs in several points in the abdominal appendages of the male, though it is possible that the two should be looked upon as races of a single species.

131. MELANOPLUS PUNCTULATUS.

(Plate XXV, fig. 4.)

- Caloptenus punctulatus* UHLER!, MS. (1862).—SCUDDER!, Bost. Journ. Nat. Hist., VII (1862), p. 465.—SMITH, Proc. Portl. Soc. Nat. Hist., I (1868), p. 150.—WALKER, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 678.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 163.—BRUNER, Can. Ent., IX (1877), p. 145.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 43.—BRUNER, *ibid.*, III (1883), p. 60.
- Caloptenus griseus* THOMAS, Ann. Rep. U. S. Geol. Surv. Terr., V (1872), p. 454.—GLOVER, Ill. N. A. Ent., Orth. (1872), pl. XII, fig. 14.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 165.—BRUNER, Can. Ent., IX (1877), p. 144.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 42.—BRUNER, *ibid.*, III (1883), p. 60.
- Melanoplus punctulatus* SCUDDER!, Hitchc. Rep. Geol. N. H., I (1874), p. 376; Proc. Bost. Soc. Nat. Hist., XIX (1878), p. 285; Ent. Notes, VI (1878), p. 44.—FERNALD, Orth. N. E. (1888), pp. 31, 32; Ann. Rep. Mass. Agric. Coll., XXV (1888), pp. 115, 116.—DAVIS, Ent. Amer., V (1889), p. 81.—SMITH, Cat. Ins. N. J. (1890), p. 413.—MCNEILL, Psyche, VI (1891), p. 74.—SMITH, Bull. N. J. Exp. St., XC (1892), p. 34.—SCUDDER, Psyche, VII (1894), p. 55.—MORSE, *ibid.*, VII (1894), pp. 55, 106.—BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI (1894), pp. 252, 307.
- Caloptenus helluo* SCUDDER!, Proc. Bost. Soc. Nat. Hist., XVII (1875), p. 476; Ent. Notes, IV (1875), p. 75.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 43.—SCUDDER!, Cent. Orth. (1879), p. 20.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60.
- Pezotettix helluo* STÅL, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 14.
- Melanoplus helluo* SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1878), p. 285; Ent. Notes, VI (1878), p. 44; Psyche, VII (1894), p. 55.—MORSE, *ibid.*, VII (1894), p. 55.
- Melanoplus griseus* BLATCHLEY!, Can. Ent., XXIV (1892), pp. 30-31.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 28.—SCUDDER, Psyche, VII (1894), p. 55.—MORSE, *ibid.*, VII (1894), p. 55.—BLATCHLEY!, Can. Ent., XXVI (1894), p. 245.

Dark brownish fuscous much mottled with blackish and often tinged with dull olivaceous, beneath ferrugineo-testaceous. Head varying from pale dull olivaceous to ferrugineo-testaceous, irregularly mottled with blackish fuscous and with a blackish band behind the eyes and a widening median stripe of the same upon the summit; vertex tumid; fastigium rapidly declivent, sulcate throughout, the margins much raised between the eyes, which are separated by a space less than the width of the frontal costa; the latter prominent above, moderate in breadth, subequal, sulcate below the ocellus, sparsely punctate throughout, each point marked by a dark olivaceous dot; eyes large and in the male very prominent, in both sexes much longer than the infraocular portion of the genae; antennae varying from fusco-luteous to fusco-ferruginous, much longer (male) or a little or no shorter (female) than the hind femora. Pronotum subequal, widening a little at the metazona in the female, slightly flaring in front to receive the head, especially in the male, varying from luteo-testaceous to brownish fuscous, often much flecked and punctate with black or blackish fuscous, the lateral lobes more heavily marked above with black on the prozona, forming generally a broken or maculate band; front and hind margin as in

M. arboreus; prozona quadrate (male) or distinctly transverse (female), not more than a third (male) or scarcely (female) longer than the metazona, the feebly tumid disk passing insensibly without lateral carinae into the lateral lobes, though these are sometimes visible in the posterior section as on the metazona; median carina occasionally distinct throughout, but always feebler and sometimes very feeble on the prozona; metazona closely ruguloso-punctate. Prosternal spine short, conical, erect; interval between mesosternal lobes subquadrate (male) or distinctly transverse, but narrower than the lobes themselves (female). Tegmina somewhat surpassing the hind femora, very gradually tapering to a well-rounded apex, fusco-testaceous, sprinkled with moderately large roundish or quadrate fuscous spots; wings pellucid, with a feeble greenish-yellow tinge, feebly infumated apically where the veins and cross veins are blackish fuscous. Fore and middle femora luteo- or olivaceo-testaceous heavily flecked with black, showing a tendency to form a triple belting; hind femora similar, the black forming moderately narrow basal, premedian, postmedian, and apical belts, which do not touch the coralline under and inner surfaces, except the latter in a partial way; hind tibiae dull red, with a postbasal obscure flavous annulus, before which they are sometimes blackened, and beyond which, above and on the sides, often flecked or suffused with plumbeo-fuscous, the serial space between the spines often dull luteous, the whole pilose; spines black nearly or quite to their base, except on the inner side, ten to twelve in number in the outer series, none arising very near the base of the tibiae. Extremity of the male abdomen scarcely clavate, somewhat upturned, the supraanal plate triangular, with convex lateral margins and subrectangulate apex, its median sulcus terminating abruptly in the middle, rather broad, somewhat shallow, bounded by rather sharp walls; furcula entirely wanting; cerci large, broad, the basal half or less subequal, exteriorly convex and punctate, beyond abruptly expanding to nearly double the width in exactly opposite directions, considerably more above than below, but otherwise symmetrical, the apical margin angulato-convex, the whole gently incurved; infracercal plates surpassing the sides of the supraanal plate only at the extreme base and slightly; subgenital plate moderately broad, apically abruptly elevated to a considerable degree and thickened, but only a little prolonged.

Length of body, male, 21 mm., female, 28 mm.; antennae, male, 14.5 mm., female, 12 mm.; tegmina, male, 17 mm., female, 18.5 mm.; hind femora, male, 10.5 mm., female, 12 mm.

Nineteen males, 34 females. Maine, Packard, P. R. Uhler; North Conway, Carroll County, New Hampshire; Andover, Essex County, Massachusetts, November; vicinity of Boston, Massachusetts, Uhler; Cambridge, Middlesex County, Massachusetts, September (Museum Comparative Zoology; S. H. Scudder); Waltham, Middlesex County, Massachusetts, September 5, C. J. Maynard (A. P. Morse); Sherborn, Middlesex County, Massachusetts, September, Mrs. A. L. Babcock

(same); Amherst, Hampshire County, Massachusetts, August 22 (same); Canaan, Litchfield County, Connecticut, August 18 (same); Ellenville, Ulster County, New York, September, Beutenmüller (A. P. Morse; S. H. Scudder); Ithaca, Tompkins County, New York, August 2, 28 (A. P. Morse); Point of Rocks, Frederick County, Maryland, August 19, Pergande (L. Bruner); Middle States, Osten Sacken; Virginia (L. Bruner); Shenandoah Valley, Virginia, October, Packard (Museum Comparative Zoology); Indiana, October 7, Blatchley (A. P. Morse); Fulton County, Indiana, Blatchley; Vigo County, Indiana, Blatchley (A. P. Morse); Putnam County, Indiana, August 20, Blatchley (same); Bloomington, Monroe County, Indiana, Bollman (U.S.N.M.); Illinois, September (L. Bruner); Rock Island, Illinois, Walsh; Dallas, Texas, Boll (U.S.N.M.—Riley collection; S. H. Scudder).

It has also been reported from Vermont (Scudder); Staten Island, New York (Davis); Ocean County, New Jersey (Smith); Ohio (Thomas); Galesburg, Knox County, and Urbana, Champaign County, Illinois (McNeill), and eastern Nebraska (Bruner).

Bruner reports it from oak groves and Smith on cranberry bogs, but Beutenmüller has found that it lives on pine trees. Blatchley found it in the depths of a tamarack swamp, and says it is not an active insect, "usually, after one or two short leaps, squatting close to the earth, and seemingly depending upon the close similarity of its hues to the grayish lichens about it to avoid detection." Others have since found it on coniferous trees, and these are, apparently, its proper station.

24. PHOETALIOTES, new genus.

(Φοιταλιώτης, a roamer.)

Body elongate, rather slender, a little compressed, very feebly pilose, including faintly the tegmina and legs. Head large, full, prominent, relatively elongate, nearly half as long again as the long prozona, the space behind the eyes fully half as long as the breadth of the eyes, the genae a little tumescent, the head apart from the eyes slightly broader than the pronotum; vertex prominent and well arched both longitudinally and transversely; face a little oblique; eyes rounded broad oval, moderately prominent, subtruncate anteriorly, moderately distant, somewhat farther apart than the greatest width of the frontal costa; fastigium very faintly sulcate, almost plane; frontal costa prominent, markedly narrower above than below the ocellus; antennae slender, moderately long, but shorter than the hind femora, though fully twice as long as the pronotum. Pronotum of moderate length, faintly subsellate but otherwise equal, feebly flaring in front to receive the head; disk rounded subtectate, with broadly rounded very indistinct lateral carinae, and a sharp, equal, and percurrent median carina; prozona longitudinal, nearly half as long again as the metazona, with indistinct transverse sulci; front margin subtruncate, hind margin extremely obtusangulate. Prosternal spine rather large, erect, conical, blunt; meso- and metastethia together much more than twice as long as broad;

interspace between mesosternal lobes much (male) or a little (female) longer than broad, the metasternal lobes attingent (male) or approximate (female); portion of metasternum behind the lobes about twice as broad as long and about half as broad as the greatest breadth of the metasternum. Tegmina either abbreviate, broad lanceolate, acuminate, attingent, slightly longer than the pronotum, or fully developed, surpassing the hind femora, rather broad and equal, well rounded at tip, hardly tapering in the distal half, at a distance from the apex equal to the breadth of the tegmina as broad as the metazona, the intercalaries and cross veins of the discoidal area everywhere few, the venation in general loose, irregular, and ill-defined, the humeral vein broadly sinuous, terminating on the costal margin at least as far before the apex as the breadth of the tegmina, nowhere running closely parallel to the costal margin nor gradually merging into it, the area intercalata not reaching the middle of the tegmina. Hind femora long and slender, the genicular lobes pallid with a transverse basal fuscous stripe, the hind tibiae glaucous, sometimes yellowish, with eleven to thirteen spines in the outer series. Abdomen compressed, mesially carinate, apically clavate and recurved in the male, the subgenital plate narrow and long, with lateral margins ampliate at base, the apical margin mesially pinched but not elevated, the apical face with no subapical tubercle; furcula delicately developed; cerci compressed styliform, rather small; ovipositor of female normally exerted.

This genus is very closely related to *Melanoplus*, from which it is to be distinguished by its large tumid head and subsellate equal pronotum, as well as by its substyliform cerci, though the last characteristic is found in some degree in a couple of species of *Melanoplus*. The neuration of the tegmina, when the latter are developed, also differs to a certain degree, pointed out in the descriptions. Bruner¹ has already expressed the opinion that this type should be generically dissociated from other *Melanopli*.

A single species is known, found in the western Mississippi basin and beyond its latitudinal limits from Alberta to Mexico.

PHOETALIOTES NEBRASCENSIS.

(Plates I, fig. e; XXV, figs. 6, 7.)

Pezotettix megagephala THOMAS, MS., fide Dodge, Can. Ent., IV (1872), p. 15—undescribed.

PHOETALIOTES NEBRASCENSIS NEBRASCENSIS.

(Plate XXV, fig. 6.)

Pezotettix nebrascensis THOMAS, Ann. Rep. U. S. Geol. Surv. Terr., V (1872), p. 455.—GLOVER., Ill. N. A. Ent., Orth. (1872), pl. XIII, fig. 2.—THOMAS, Rep. U. S. Geol. Surv. Terr., V (1873), p. 151.—BRUNER, Can. Ent., IX (1877), p. 144.—STÄL, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 14.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 59; Bull. Washb. Coll., I (1885), pp. 136-137; Rep. U. S. Ent. (1885-86), p. 307.—OSBORN, Proc. Iowa Acad. Sc., I, Pt. II (1892), p. 117.

¹ Bull. Washb. Coll., I, p. 37.

Pezotettix autumnalis DODGE!, Can. Ent., VIII (1876), p. 10.—BRUNER, *ibid.*, IX (1877), p. 144; Rep. U. S. Ent. Comm., III (1883), p. 59.—MCNEILL, *Psyche*, VI (1891), p. 76.

Caloptenus sanguinocephalus LA MUNYON, Proc. Nebr. Ass. Adv. Sc. (1877), March 8, 1877.

Euprepocnemis nebrascensis BRUNER, Pub. Nebr. Acad. Sc., III (1893), p. 28.

PHOETALIOTES NEBRASCENSIS VOLUCRIS.

(Plates I, fig. *e*; XXV, fig. 7.)

Caloptenus volucris DODGE, Can. Ent., IX (1877), p. 112.—BRUNER, *ibid.*, IX (1877), p. 145.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 43.—BRUNER, *ibid.*, III (1883), p. 60.

Fusco-testaceous, flavous beneath. Head flavo-testaceous, in fresh specimens more or less fusco-olivaceous, much infuscated above, with a broad piceous postocular band, and often with a pair of divergent fuscous or ferruginous stripes on the summit; vertex very tumid, distinctly elevated above the level of the pronotum, the interspace between the eyes twice (male) or thrice (female) as broad as the first antennal joint; fastigium rather rapidly declivent, with scarcely perceptible sulcation; frontal costa not nearly reaching the clypeus, much broader below than above the ocellus, the change rather abruptly effected and more striking in the female than in the male, at its broadest considerably narrower than the interspace between the eyes, distinctly impressed at the ocellus, and in the male sulcate below it, punctate throughout, above biseriately; eyes moderately large, rather prominent, with no great difference between the sexes, fully as long as (female) or distinctly longer than (male) the infraocular portion of the genae; antennae testaceous, feebly infuscated apically, about four-fifths (male) or three-fifths (female) as long as the hind femora (but in southern examples of *P. n. nebrascensis* relatively longer). Pronotum equal, except for being faintly subsellate, especially in the male, the disk ferrugineo-fuscous, rounded subtectate, passing by a very broadly and uniformly rounded shoulder, forming a semblance of blunt lateral carinae, into the anteriorly feebly tumid vertical lateral lobes, which are more or less flavous below, and above are marked on the prozona with a very broad piceous postocular band, generally broader on the posterior section and occasionally broken there; median carina sharp but not high, equal, percurrent; front margin subtruncate, hind margin very obtusangulate, in the female often rotundato-obtusangulate; prozona distinctly longitudinal in both sexes, sparsely and shallowly and sometimes very obscurely punctate, nearly half as long again as the densely and finely punctate metazona. Prosternal spine rather long, erect, conical, blunt; interspace between mesosternal lobes about two and a half times longer than broad (male) or about half as long again as broad (female). Tegmina slightly longer than the pronotum, broad lanceolate, attingent, the costal margin angulato-convex, the tip bluntly acuminate, ferrugineo-testaceous (*P. n. nebrascensis*), or surpassing a little the hind femora, overlapping, rather broad, remarkably equal, the apex well

rounded, ferrugineo-testaceous in the basal half, beyond subhyaline with fusco-testaceous veins and cross veins (*P. n. volucris*, Plate I, fig. *e*); wings in the latter form about as long as the tegmina, moderately broad, hyaline with fusco-olivaceous or fusco-ferruginous veins becoming increasingly infuscated apically. Fore and middle femora a little tumid in the male; hind femora flavo-testaceous, generally more or less infuscated or fusco-olivaceous in the upper half of the outer face, the inner side and outer carina of the upper face and upper limit of the inner face more or less distinctly and rather narrowly bifasciate or bimaculate with fuscous; lower face flavous sometimes deepening into roseate; upper genicular lobe and base of lower genicular lobe blackish fuscous; hind tibiae usually glaucous, sometimes lighter, sometimes darker, occasionally yellowish, with a subbasal blackish annulus and the apex fuscous or flavescent, the spines black almost or quite to the base, twelve to thirteen, rarely eleven, in number in the outer series. Extremity of male abdomen feebly clavate, a little recurved, the supraanal plate triangular with slightly convex sides and feebly acutangulate apex, the median sulcus rather broad and equal, reaching only the middle of the plate and there fading abruptly, the moderately high walls terminating against a feebly transverse plica; furcula consisting of a pair of very slender and brief needles overlying the submedian ridges of the supraanal plate, not nearly so long as the last dorsal segment; cerci compressed substyliiform, moderately broad at base, tapering more rapidly in the basal than in the apical half, bluntly acuminate at tip and about as long as the supraanal plate; subgenital plate narrow and apically narrowing slightly, the lateral and apical margins in about the same plane, the apical margin laterally compressed mesially, so as to simulate an apical tubercle, entire.

Measurements: P. n. nebrascensis (Colorado).—Length of body, male, 22 mm., female, 23 mm.; antennae, male, 9.5 mm., female, 7 mm.; tegmina, male, 6 mm., female, 6.5 mm.; hind femora, male, female, 11.75 mm. (Texas), body, male, 22.5 mm., female, 30 mm.; antennae, male, female, 11 mm.; tegmina, male, 6 mm., female, 7.5 mm.; hind femora, male, 13 mm., female, 15.25 mm. *P. n. volucris* (male, Nebraska; female, Montana), body, male, 23 mm., female, 24 mm.; antennae, male, 9 mm., female, 7.25 mm., tegmina, male, 18.5 mm., female, 18 mm.; hind femora, male, 11.2 mm., female, 12.5 mm. (Texas), body, male, 24 mm., female, 28.5 mm.; antennae, male, 10.5 mm., female, 9 mm.; tegmina, male, 18.25 mm., female, 20 mm.; hind femora, male, 13.5 mm., female, 15 mm.

Twenty-seven males, 28 females. Medicine Hat, Assiniboia, September (U.S.N.M.—Riley collection); Fort McLeod, Alberta, September (same); Glendive, Dawson County, Montana (L. Bruner); Wyoming, Morrison (U.S.N.M.—Riley collection); Nebraska, Dodge, October (same; S. Henshaw; S. H. Scudder); Gordon, Sheridan County, Nebraska, September (U.S.N.M.—Riley collection); Fort Robinson,

Dawes County, Nebraska, August 21, Bruner (same); Ogalalla, Keith County, Nebraska, August 31 (L. Bruner); West Point, Cuming County, Nebraska, September (U.S.N.M.—Riley collection; L. Bruner); Omaha, Douglas County, Nebraska, September (U.S.N.M.—Riley collection); Cordova, Rock Island County, Illinois, September 28, J. McNeill; Lakin, Kearny County, Kansas, 3,000 feet, September 1; between Smoky Hill, Kansas, and Denver, Colorado, September, L. Agassiz (Museum Comparative Zoology); Pueblo, Colorado, 4,700 feet, August 30-31; Dallas, Texas, Boll (U.S.N.M.—Riley collection; S. H. Scudder); Fort Worth, Tarrant County, Texas, May (U.S.N.M.—Riley collection); Tucson, Pima County, Arizona (same); Montelovez, Coahuila, Mexico, September 20, E. Palmer; Sierra de San Miguelito, San Luis Potosi, Mexico, E. Palmer; Guanajuato, Mexico, A. Dugès (U.S.N.M.); Queretaro, Mexico, November (L. Bruner); Tlalpan, Mexico, November (same).

The species has also been reported from Colona, Henry County, Illinois (McNeill), Topeka, Shawnee County, Kansas (Bruner), Iowa (Osborn), and Dakota (Bruner). McNeill states that the species was to be found at Cordova, Illinois, only "in a large orchard on the east side of a high hill."

P. n. volucris has been seen by me from Montana, Wyoming, Nebraska, Texas, Arizona, and Mexico; *P. n. nebrascensis* from all the general regions mentioned excepting Montana, Wyoming, and Arizona. Bruner long ago pointed out the dimorphism. The antennae of southern examples are relatively longer than in those from northern stations, at least in the form *P. n. nebrascensis*.

25. PAROXYA.

(Παρά, beside; Oxya, a genus of Acridiinae.)

Paroxya SCUDDER, Proc. Bost. Soc. Nat. Hist., XIX (1877), pp. 28-29.

Body straight, subcylindrical, briefly pilose. Head moderately large, not prominent, the face subdeclivent, the eyes large, prominent, half as long again (female) or twice as long (male) as the anterior infraocular portion of the genae, separated from each other above by fully (male) or very much more than (female) the width of the basal joint of the antennae; fastigium rather broad, slightly sulcate; frontal costa rather prominent above and punctate, subequal, percurrent, feebly sulcate, about as broad as the interspace between the eyes; antennae long, half or much more than half the length of the body in the male, equal, the joints subdepressed, beyond the middle punctate. Dorsum of pronotum twice as long as the average width, at least in the male, subequal throughout, there being no median constriction, transversely very broadly tectate, nearly plane, the median carina slight, equal, percurrent, the lateral carinae distinct but blunt, the prozona only about a third (or less) longer than the metazona, the hind border of latter

obtusely and bluntly angulate; lateral lobes vertical, their lower border very obtusely angulate in the middle. Prosternal spine prominent, subcylindrical, bluntly pointed, laterally compressed at the base, at least in the male; mesosternal lobes narrowly separated in both sexes; metasternal lobes subattigent (male) or as distant as the mesosternal lobes (female). Tegmina and wings variable, but at least as long as the pronotum. Hind femora reaching or generally surpassing the tip of the abdomen, moderately stout but tapering very regularly, unarmed above, the inferior genicular lobes produced but apically rounded, marked at base with a transverse dark bar; spined margins of hind tibiae smooth, scarcely dilated toward the tip, provided on outer margin with nine to thirteen, generally eleven, spines, the larger number being more common in the female. Subgenital plate of male short, transverse, of subequal width throughout, more or less tumid, the lateral margins ampliate at the base; anal cerci of male long, laminate, subclepsydral in shape, incurved; edges of inferior valve of ovipositor smooth.

This genus bears a close general resemblance to the gerontogeiic genus *Oxya*, but differs strikingly from it in the separated metasternal lobes of the female, the blunt tips of the inferior genicular lobes of the hind femora, the smooth edges of the hind tibiae and the absence of the terminal spine of the outer series of the same. It is very narrowly separable from *Melanoplus*, and I do not see how it could be distinguished from it if we include in it, as Stål did, his *Pezotettix plebejus* and *rusticus*. The combination of such peculiarities as the long antennae and strongly transverse subgenital plate of the male with the long and parallel-sided pronotum of both sexes serves to distinguish it from *Melanoplus*, as here limited; while the strongly banded sides of the body and the long and clepsydral cerci of the male in all the species mark it as a peculiar type even if these markings and form of genitalia do occur in certain species of the diversified genus *Melanoplus*.

Three species are known and appear to be confined almost entirely to our Atlantic and Gulf borders, though some of the species occur as far inland as Indiana, Ohio, and Michigan. It is unknown west of the Mississippi, except in Louisiana and Texas (though Professor Bruner suspects its presence in Nebraska). They inhabit moist places.

The type is *P. floridana*.

ANALYTICAL KEY TO THE SPECIES OF PAROXYA.

A¹. Antennae and cerci of male relatively short; furcula of male consisting of a pair of triangular plates; tegmina at least as long as body. . . . 1. *atlantica* (p. 382).

A². Antennae and cerci of male relatively long; furcula of male consisting of a pair of subequal fingers; tegmina variable.

b¹. Furcula coarse, heavy, and depressed, generally straight; supraanal plate short triangular; tegmina much shorter than body 2. *hoosieri* (p. 382).

b². Furcula relatively slender, cylindrical, often divergent; supraanal plate long triangular; tegmina normally as long as body but very variable. 3. *floridana* (p. 383).

1. PAROXYA ATLANTICA.

(Plate XXV, fig. 8.)

Paroxya atlantica SCUDDER! (pars), Proc. Bost. Soc. Nat. Hist., XIX (1877), pp. 29, 88; (pars), Ent. Notes, VI (1878), pp. 7, 29; (pars), Cent. Orth. (1879), pp. 46-47.

Dark wood-brown above, luteo-testaceous below, with a broad black stripe on the sides of the head behind the eye and the upper half of the lateral lobes of the pronotum, sometimes not affecting the metazona; antennae ferruginous, uniform or sometimes slightly infuscated apically, in the male slightly less than half as long as the body. Tegmina uniform brownish fuscous, just about as long as the body in both sexes. Hind femora luteo-testaceous, the upper inner surface with fuscous median and postmedian bars, the geniculations black, the hind tibiae pale glaucous, with ten to thirteen (usually as many as twelve) spines in the outer row. Supraanal plate of male very short triangular, with a short basal median sulcus with low walls; furcula consisting of a pair of flattened short triangular plates, whose adjacent inner walls are slightly elevated, but which diverge apically; cerci much shorter than in the other species, not extending beyond the tip of the supraanal plate, compressed laminate, strongly incurved, tapering rapidly at base, then subequal for a short space, ending in a spatulate tip nearly as broad as the base, well rounded apically.

Length of body, male, 23 mm., female, 29 mm.; antennae, male and female, 11 mm.; tegmina, male, 17 mm., female, 18 mm.; hind femora, male, 13 mm., female, 15.5 mm.

Nine males, 4 females. Georgia, H. K. Morrison (U.S.N.M.—Riley collection; S. H. Scudder); Fort Reed, Orange County, Florida, April 7, 21, 23, J. H. Comstock; Sandford, Orange County, Florida, G. B. Frazer.

2. PAROXYA HOOSIERI.

(Plate XXV, fig. 9.)

Pezotettix hoosieri BLATCHLEY!, Can. Ent., XXIV (1892), pp. 31-33.

Paroxya atlantica BLATCHLEY!, Can. Ent., XXV (1893), p. 90; Proc. Ind. Acad. Sc., 1892 (1894), p. 118; Can. Ent., XXVI (1894), p. 244.

Dark wood brown with an olivaceous tinge above, varying from flavous to clay yellow beneath, with a broad piceous stripe on the sides, occupying the upper half of the lateral lobes of the pronotum, in the female often fading out on the posterior part of the metazona. Face of the color of the under surface, but generally more or less obscured with fuscous or fuliginous; antennae uniform ferrugineo-testaceous, in the male much more than half as long as the body. Tegmina uniform olivaceous brown, less than twice as long as the pronotum. Legs bright olive green, the hind femora more or less embrowned, especially above, the geniculation black; hind tibiae pale glaucous, more or less luteous

basally with a narrow post-basal black annulus in the luteous portion, the spines black excepting at extreme base, ten to eleven in number in the outer series. Supraanal plate of male short triangular, mesially tectate, with a very slender, deep, percurrent sulcus broadening considerably at the apex; furcula consisting of a pair of adjacent, parallel, pretty long and coarse, strongly depressed, somewhat tapering, blunt apophyses; cerci compressed laminate, strongly incurved throughout, tapering to as much as half the basal width in the proximal half and then immediately and as regularly widening to nearly the basal width in the distal half, subtruncate apically.

Length of body, male, 20 mm., female, 29 mm.; antennae, male, 12 mm., female, 12.5 mm.; tegmina, male, 9.25 mm., female, 10.5 mm.; hind femora, male, 12 mm., female, 16 mm.

Ten males, 8 females. Vigo County, Indiana (W. S. Blatchley; A. P. Morse); Oberlin, Lorain County, Ohio, September 21, coll. L. Jones, W. S. Blatchley. Mr. Blatchley has also taken it in a tamarack swamp in Fulton County, Indiana, and says it is found abundantly from August to October. It was found around the margins of a pond in Vigo County and in Ohio in a swamp in woods.

Mr. Lynds Jones writes me that it is "found in abundance in the rank vegetation which sprang up in a dry swamp surrounded by woods" in the vicinity of Oberlin, Ohio.

Mr. Blatchley¹ describes the colors of the living insect.

3. PAROXYA FLORIDANA.

(Plate XXV, fig. 10.)

Caloptenus floridianus THOMAS¹, Bull. U. S. Geol. Surv. Terr., I, No. 2 (1874), p. 68.

Caloptenus floridanus GLOVER, Ill. N. A. Ent., Orth. (1874), pl. XVII, fig. 3.—THOMAS, Rep. U. S. Ent. Comm., I (1878), p. 42.—BRUNER, *ibid.*, III (1883), p. 60.

Paroxya atlantica SCUDDER¹ (pars), Proc. Bost. Soc. Nat. Hist., XIX (1877), pp. 29, 88; (pars), Ent. Notes, VI (1878), pp. 7, 29; (pars), Cent. Orth. (1879), p. 46.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 61.—FERNALD, Orth. N. E. (1888), p. 34; Ann. Rep. Mass. Agric. Coll., XXV (1888), p. 118.—DAVIS, Ent. Amer., V (1889), p. 81.—SMITH, Cat. Ins. N. J. (1890), p. 412; Bull. N. J. Exp. St., K (1890), p. 41; *ibid.*, XC (1892), pp. 4, 31, fig. 4g, pl. I, 2 figs.—BRUNER, Publ. Nebr. Acad. Sc., III (1893), p. 27.—MORSE, Psyche, VI (1893), pp. 401-402; *ibid.*, VII (1894), p. 105.—GARMAN, Orth. Ky. (1894), pp. 3, 8.—BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI (1894), p. 305, pl. VIII, fig. 5.

Paroxya recta SCUDDER¹, Proc. Bost. Soc. Nat. Hist., XIX (1877), p. 30, 88; Ent. Notes, VI (1878), pp. 8, 29; Cent. Orth. (1879), p. 47.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 61.—SMITH, Cat. Ins. N. J. (1890), p. 412; Bull. N. J. Exp. St., K (1890), p. 41; *ibid.*, XC (1892), pp. 4, 31, fig. 4h.

Pezotettix atlanticus STÅL, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 12.

Pezotettix rectus STÅL, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 12.

Paroxya floridana SMITH, Cat. Ins. N. J. (1890), p. 412.—BEUTENMÜLLER, Bull. Amer. Mus. Nat. Hist., VI (1894), p. 305.

Olivaceous, excepting top of head, thorax, and tegmina, which vary from light to dark brown. Head olivaceous yellow on face and sides,

¹ Can. Ent., XXIV, p. 32.

in the female more or less infuscated; above the antennæ brownish fuscous, more or less tinged with castaneous; behind the eyes a broad, straight, horizontal, black band, edged more or less distinctly, both above and below, with yellowish; antennæ varying in length, being relatively longer in southern than in northern examples, but generally about two-thirds as long as the body in the male, yellow at base, beyond testaceous, deepening into fuscous toward the tip, the apices of the joints normally pallid. Upper surface of the pronotum of the color of the top of the head, the upper half of the deflected lobes with a very broad black band in continuation of that on the head, anteriorly edged more or less distinctly, both above and below, with yellowish and generally fading out before, or abruptly terminating at, the metazona (in the earlier stages it continues uninterruptedly across the pronotum, and this persistence is occasionally shown in the adult, or is indicated on the metazona by a brown band sometimes percurrent and usually reduced in width); pleura with a horizontal stigmatal stripe running backward from the hinder edge of the mesothoracic episterna (sometimes confined to the mesothoracic epimera), and an oblique stripe nearly following the division line between the metathoracic episterna and epimera; when the lower stripe is complete it renders the metathoracic episterna conspicuous, especially in the male, on account of the cuneiform oblique yellow dash which lies between these two black stripes. Hind margin of pronotum less distinctly angulate—that is, more uniformly rounded—than in the other species, though the difference is but slight and sometimes disappears. Tegmina nearly uniform brownish fuscous, often with a faint line of small fleckings down the middle in the female. Legs of the color of the body, the middle and hind femora generally more or less infuscated on their outer face, the upper half of the genicular lobes of the latter black; hind tibiae glaucous with black or blackish spines. Supraanal plate of male long triangular with a broad mesial rounded ridge extending two-thirds its length, on the summit of which, in the basal half of the plate, is a very narrow deep sulcus which, after interruption, is repeated again in the apical fourth; furcula consisting of a pair of moderately long, moderately slender, cylindrical, slightly tapering, blunt, adjacent fingers (shorter than usual in the specimen figured and drawn too stout), often divergent: cerci lamellate, very long, strongly incurved, gradually narrowing and then as gradually enlarging, so as to make the spatulate tip nearly as broad as the base, the apical margin rounded and submarginate.

The tegmina are ordinarily of about the length of the body, but, in the South particularly, it often occurs with tegmina only reaching a little beyond the middle of the abdomen. I have seen one such from Massachusetts; and in a pair from Fort Worth, Texas, in the National Museum the tegmina are scarcely longer than the pronotum and subacuminate at tip. This form may receive the racial name *texana*.

Length of body (in larger specimens), male, 29 mm., female, 41 mm.; antennae, male, 19 mm., female, 15.5 mm.; tegmina, male, 18 mm., female, 25.25 mm.; hind femora, male, 15.5 mm., female, 21 mm. The average length of New England specimens is: Male, 21 mm.; female, 31.

One hundred and thirteen males, 87 females. Michigan, M. Miles; Cambridge, Massachusetts, Boll (Museum Comparative Zoology); Fanueil Station, Boston, Massachusetts, July 22, 26, August 11 (A. P. Morse); Newtonville, Middlesex County, Massachusetts, August 11 (A. P. Morse); Niantic, New London County, Connecticut, August 8 (A. P. Morse); New Haven, Connecticut, S. I. Smith; North Haven, New Haven County, Connecticut, August 23 (A. P. Morse); Deep River, Middlesex County, Connecticut, August 24 (A. P. Morse); Stamford, Fairfield County, Connecticut, August 13-17, 24 (A. P. Morse); Staten Island, New York, July 25; Newark, Essex County, New Jersey, September 13, C. G. Rockwood (U.S.N.M.—Riley collection); Middle States, Baron Osten Sacken; Washington, D. C., July 27, August 23, 28, September 6 (U.S.N.M.—Riley collection); Virginia, September 10, October 19 (same); Diego Bluff, North Carolina, November 5, C. J. Maynard; Charleston, South Carolina, August; Georgia, A. Oemler, H. K. Morrison; Florida (U.S.N.M.—Riley collection); Enterprise, Volusia County, Florida, May 15, E. A. Schwarz; Fort Reed, Orange County, Florida, May 1, J. H. Comstock; Baton Rouge, Louisiana, September 7 (A. P. Morse); New Orleans, Louisiana, June 20, Shufeldt (U.S.N.M.—Riley collection); Dallas, Texas (same); Fort Worth, Tarrant County, Texas, May (same). Bruner reports it doubtfully from Nebraska.

Professor J. B. Smith found this insect injurious to cranberries in New Jersey.

Mr. A. P. Morse describes¹ a melanistic form. He found most of his New England specimens on *Spartina* and other grasses and sedges. It is found most abundant in wet localities.

26. POECILOTETTIX, new genus.

(*Ποικίλος*, mottled; *τέττιξ*, grasshopper.)

Head and body with the general aspect of *Melanoplus*. Head nearly vertical, especially in the female, the eyes moderately large, moderately prominent in the male, broad oval, not more than half as long again as broad; antennae very little longer in both sexes than head and pronotum together. Pronotum enlarging very slightly posteriorly, the suture between prozona and metazona deeply impressed, with rounded walls; the prozona scarcely or but little longer than the metazona, coarsely and distantly punctate, the transverse sutures distinct and rather heavy, transversely broadly convex with no lateral carinae; the

¹ Psyche, VI, pp. 401-402.

metazona finely and closely punctate, slightly tumid in the female, the angle of the lateral carinae well rounded, the posterior border broadly angulato-convex, margined; median carina obsolete or sub-obsolete throughout. Prosternal spine slender, straight, acuminate; meso- and metastethia together longer than broad; interval between mesothoracic lobes distinctly, generally very much, longer than broad, generally broader in the female than in the male, the metasternal lobes subattinent or approximate, the portion of the metasternum behind the lobes small, hardly more than twice as broad as long. Tegmina fully developed in all known species, remarkably uniform in width, with the costa very slightly expanded near the base, and a strongly and uniformly rounded apex. Hind femora moderately slender, with immaculate inferior genicular lobes, the tibiae with eight to nine external spines. Cerci of male extremely slender beyond the tapering laminate base, the furcula subobsolete; the lateral margins of the subgenital plate ampliate at base and the apex provided with a distinct tubercle; the pallium often has a pyramidal erection.

P. picticornis (Thomas) may be regarded as the type.

As far as known, this genus occurs only on the Pacific coast, near our southern borders. It is remarkable for the tuberculate abdomen, resembling *Hesperotettix*, but apical instead of subapical, and for the sometimes vivid and always exceptionally variegated colorings of its different species.

ANALYTICAL KEY TO THE SPECIES OF POECILOTETTIX.

- A¹. Antennae annulate and pronotum and femora distinctly and distantly punctate with blackish fuscous; antennae hardly attenuate apically; eyes of female anteriorly truncate; apical tubercle of male abdomen raised above the level of the sides of the subgenital plate 1. *picticornis* (p. 386).
 A². Antennae concolorous, distinctly attenuate apically; eyes of female anteriorly subtruncate; pronotum and femora variegated with red and brown; apical tubercle of male abdomen not elevated above the sides of the subgenital plate.
 b¹. Relatively stout-bodied, with stout femora; apex of male abdomen with a bifid tubercle 2. *sanguineus* (p. 387).
 b². Relatively slender-bodied, with slender femora; apex of male abdomen with a simple conical tubercle 3. *coccinatus* (p. 389).

I. POECILOTETTIX PICTICORNIS.

(Plate XXVI, fig. 1.)

Caloptenus (*Hesperotettix*) *picticornis* THOMAS!, Proc. Dav. Acad. Sc., II (1877), p. 125, pl. IV, figs. 1, 2.

Ground color very uniform luteo-testaceous, the pronotum and femora slightly darker than the tegmina and feebly lustrous. Head distantly and coarsely punctate with blackish brown along the carinae of the face, the front and inferior margins of the genae and across the labrum; pronotum similarly punctate, except upon the dorsum of the metazona (though the puncta follow the posterior margin), the puncta transversely disposed and in the center of the lateral lobes more or less

suffused and confluent, forming infumate spots; and similar puncta upon the thoracic pleura, all the femora, and the fore and middle tibiae; antennae coarse, bluntly terminated, annulate with blackish brown, which oddly occurs at the apex of one and the base of the succeeding joint, the incisures excepted; frontal costa slightly narrower than the interspace between the eyes, uniform in width, deeply sulcate; eyes of female anteriorly truncate, not more than half as long again as the anterior infraocular portion of the genae. Pronotum most sparsely pilose, the metazona with exceedingly delicate punctuation and with a very feeble median carina, continued on the prozona as an impressed line only; hind margin obtusangulate, the angle rather broadly rounded. Tegmina subhyaline on the apical half or more, both veins and cross-veins very pale testaceous; wings hyaline, nearly as long as the tegmina, of ample breadth, with pallid veins and cross veins. Hind tibiae and tarsi luteous, the spines black tipped, varying from eight to nine on the outer margin in both sexes. Supraanal plate of male triangular, rather elongate, with rounded acute apex, the surface with two high and sharp, subparallel, convergent and then divergent, longitudinal ridges, fading apically, including between them a rather narrow and very deep median sulcus extending the whole length of the plate, but shallow apically; furcula consisting of two distinct, not large, adjacent, rounded lobes, projecting by half their length; cerci moderately broad and slightly inflated at the base, at once narrowing, wholly on the upper side, beyond straight, compressed, equal, scarcely incurved, about one-third the width of the base, the tip roundly pointed, reaching as far as the tip of the supraanal plate; infracercal plates concealed when the cerci are recumbent; lateral margins of the subgenital plate sinuous, the apical tubercle a little elevated, broad, subtruncate, and subbidid as viewed posteriorly, pilose.

Length of body, male, 19 mm., female, 28 mm.; antennae, male, 10 mm., female, 11.5 mm.; tegmina, male, 19.75 mm., female, 23.5 mm.; hind femora, male, 12.75 mm., female, 15 mm.

Two males, 2 females. Arizona, Dunn (L. Bruner; U.S.N.M.—Riley collection). It was originally described by Thomas from Arizona. Professor L. Bruner writes me that he has received the same species from Tepic, Jalisco, Mexico.

This insect may be instantly distinguished from every other in the entire group of Melanopli by its peculiar blackish punctuation and the annulate antennae. I had an opportunity of studying the type many years ago, and part of the above description is taken from notes made at the time.

2. POECILOTETRIX SANGUINEUS, new species.

(Plate XXVI, fig. 2.)

Dactylotum longipennis BRUNER, MS., fide TOWNSEND, Ins. Life, VI (1893), p. 30—undescribed.

Head bright yellow luteous, broadly clouded above and below and especially below with plumbeo-fuscous and somewhat irregularly enliv-

ened with crimson at various points, especially along the carinae, upon either side of the labrum, along the clypeal suture and the margins of the genae, besides a mediodorsal stripe on the vertex, and sometimes an oblique genal streak, and touches behind the eyes; eyes of female subtruncate anteriorly, the lower portion of their front with a distinct posterior curve; antennae rather slender, apically acuminate, dark fusco-plumbeous. Pronotum most sparsely pilose, light olivaceo-fuscous, the sulci marked with blackish fuscous, a mediodorsal crimson stripe, and crimson margining the lateral lobes of the metazona, broadly behind, narrowly beneath, besides touches in the center of an olivaceous patch in the upper part of the lateral lobes of the prozona and along the front margin of the same; metazona with crowded fine punctuation and a slight median carina, the hind margin obtusangulate, the angle rounded. Tegmina far surpassing the abdomen, rather slender, hyaline on much more than the distal half, the veins pea-green; wings nearly as long as the tegmina, with ample breadth, hyaline, the veins pale glaucous. Fore and middle femora yellow luteous, longitudinally and narrowly striped with fuscous; hind femora yellow luteous, the outer face and especially its lower half, excepting a pregenicular band, plumbeo-fuscous, the upper face crossed by four plumbeo-fuscous bands—a basal more or less obsolete, an apical covering the geniculation, and two between; hind tibiae and tarsi glaucous, the spines pallid glaucous with black tips, eight in number in both sexes. Abdomen olivaceo-fuscous above, bright yellow beneath, the lower margins of the dorsal plates and the dorsal carina marked with carmine; supraanal plate of male triangular with bluntly pointed apex, the surface with two rather distant, parallel, longitudinal, somewhat elevated but not very sharp ridges, extending over the basal two-thirds of the plate, inclosing between them a rather broad, subequal, moderately deep sulcus which does not continue to the apex; furcula consisting of two closely approximated, rounded, little projecting lobes lying over the sulcus; cerci moderately broad and laminate at base, rapidly tapering on basal half, largely by the excision of the upper margin, the apical half or more subcylindrical, very slender, equal, terminating bluntly, gently incurved; infracereal plates concealed by the recumbent cerci; lateral margins of the subgenital plate straight beyond the ampliate bases, the apical tubercle not elevated above its level, rather slight, bifid.

Length of body, male, 21 mm., female, 26 mm.; antennae, male, 8.75 mm., female, 9 mm.; tegmina, male, 18.25 mm., female, 24.5 mm.; hind femora, male, 10.5 mm., female, 13.5 mm.

One male, 1 female. Bradshaw Mountain, Arizona, June 21, A. B. Cordley (L. Bruner).

The bright coloring of this species recalls that of *Dactylosum*. Professor Bruner informs me that this was the species referred to by Townsend in *Insect Life* (VI, p. 30) as found at Hance's in the Grand Cañon of the Colorado, 3,000 to 5,000 feet below the rim. As all the

species of the present genus have similarly long wings, I have not retained the manuscript name of Bruner, given by him to distinguish it from the species of *Dactyloptum* which have short wings.

3. *POECILOTETTIX COCCINATUS*, new species.

(Plate XXVI, fig. 3.)

Head brighter or duller yellow, more or less infumated, especially on the lower half, but enlivened with crimson more or less distinctly (but not so conspicuously) as in *P. sanguineus* and at somewhat similar points, but especially on the fastigium, the sides of the labrum, the clypeal suture, and the lateral carinae of the face, besides the medio-dorsal stripe of the vertex; eyes of female as in *P. sanguineus*; antennae apically acuminate, greenish plumbeous, the basal joints pale. Pronotum most sparingly pilose, olivaceo-fuscous with shades varying from olivaceous to fuscous, the latter more pronounced on the front part of the metazona and the dorsum of the prozona, except an olivaceous, continuous, mediodorsal stripe, more or less conspicuously marked with a crimson thread; crimson also margins the lateral lobes of the metazona and appears more or less distinctly on the upper half of the lateral lobes of the prozona; the transverse sulci of the disk are only slightly darker than the ground; metazona with crowded fine punctuation and a slight median carina, the hind margin strongly convex, hardly angulate. Tegmina slender, far surpassing the abdomen, hyaline on more than the apical half, the veins yellow; wings nearly as long as the tegmina, greenish hyaline, the veins of the upper half fuscous or greenish fuscous, of the lower half and most of the cross veins glaucous. Fore and middle femora luteous, clouded with fuscous; hind femora luteous, the outer face infuscated and the upper area alternately pale fuscous and luteous or carmine; hind tibiae and tarsi glaucous, the spines glaucous or pallid with black tips, seven to eight on the outer row in the female, eight in the male. Abdomen light fuscous with dull luteous areas, but no enlivenment with brighter colors; supraanal plate of male triangular, elongate, the apex acute; surface with two parallel, not distant, sharply elevated ridges which extend, diminishing posteriorly, nearly or quite the length of the plate, including between them a rather narrow and deep narrowing sulcus; furcula consisting of only a slight thickening of the posterior edge of the last dorsal segment above the two ridges of the supraanal plate; cerci not very broad at extreme base, rapidly and regularly tapering in the basal third, the remainder very slender, equal or barely expanded at the blunt extremity; lateral margins of the subgenital plate straight on the apical half, the apical tubercle not rising above their level but having the same direction, conical, simple.

Length of body, male, 20 mm., female, 30 mm.; antennae, male, 7.5 mm., female, 8 mm.; tegmina, male, 19 mm., female, 24.5 mm.; hind femora, male, 10 mm., female, 14 mm.

One male, 3 females. Los Angeles, California, Coquillett (U.S.N.M.—Riley collection).

This species closely resembles the preceding, but is rather slenderer, especially the male, with less pronounced crimson markings, besides the differences noted in the table.

27. OEDALEONOTUS, new genus.

(*Οἰδαλέως*, swollen; *ῥῶτος*, back.)

Body stout, heavy and clumsy. Head large and full, the vertex well arched, raised considerably above the level of the prothorax, the fastigium broad, broadly and shallowly sulcate and considerably declivent, the eyes separated rather widely; face nearly vertical; frontal costa very broad, subequal, nearly plane, percurrent but sometimes obscure basally; eyes rather large, not very prominent, broadly ovate, with a slight production above anteriorly; antennae not slender, uniform, slightly longer (male) or slightly shorter (female) than head and pronotum together. Pronotum short and stout, enlarging posteriorly only by the slight flare of the metazona, with vertical though slightly tumid lateral lobes, more or less flaring on the metazona below, separated from the dorsum by more or less pronounced, coarse, rounded rugae, generally interrupted on the posterior portion of the prozona, the median carina interrupted between the sulci; disk of prozona distinctly tumid, but little longer than the metazona, from which it is separated by a very deep sulcus, its own posterior transverse sulci deeply impressed, approximate, and subparallel, the anterior submarginal sulcus also very distinct, the margin being elevated to receive the head; metazona plane, punctato-rugulose, very obtusely angulate behind, the border marginate. Prosternal spine short, conical, blunt; meso- and metastethia together distinctly longer than broad in both sexes, the mesosternal lobes a little longer than broad in both sexes, the metasternal lobes subattingent in the male, slightly distant in the female, the space behind the latter laterally elongate, extending forward to the coxae. Tegmina fully developed or abbreviate, rarely shorter than the pronotum and then but slightly. Hind femora stout, heavy, and tumid, the inferior genicular lobe pallid, immaculate. Abdomen of female with abbreviated terminal segments (recalling *Bradynotes*) and partially exerted ovipositor; of male not enlarged at the extremity and scarcely elevated, terminating roundly and bluntly, the last ventral segment (in advance of the subgenital plate) scarcely longer than the penultimate; subgenital plate of male very brief and subequal, its lateral margins distinctly ampliate at the base and entire apically, with no tubercle; cerci tumid and enlarged at base, suddenly contracted, and terminating in a slender posterior process.

This genus is quickly separated from those in its immediate vicinity by the tumidity of the prozona, and the clumsy form, which give it a very distinct appearance.

I know of but a single species, which inhabits the Pacific coast from Canada to Mexico, and which assumes three forms according to the length of the organs of flight, that with the organs fully developed being thus far known only from southern California, from the head of the San Joaquin Valley to San Diego. It is distinguished from the others not only by the development of these organs, but by a slightly slenderer body, the grossness of the others seeming to be correlated with their incapacity of flight.

OEDALEONOTUS ENIGMA.

(Plate XXVI, figs. 4-6.)

Melanoplus collaris SCUDDER!, Can. Ent., XII (1880), p. 75.

Melanoplus flavoannulatus BRUNER, Ins. Life, III (1890), p. 140.

Pezotettix enigma BRUNER, Bull. Div. Ent. U. S. Dep. Agric., XXVIII (1893), pp. 33-34, fig. 17.

OEDALEONOTUS ENIGMA COLLARIS.

(Plate XXVI, fig. 6.)

Melanoplus collaris SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1878), p. 286;

Ent. Notes, VI (1878), p. 45.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 60.

Caloptenus flavolineatus BRUNER (*nec* THOMAS), Bull. Div. Ent. U. S. Dep. Agric., XXVIII (1893), p. 33.

OEDALEONOTUS ENIGMA ENIGMA.

(Plate XXVI, fig. 5.)

Pezotettix enigma SCUDDER!, Ann. Rep. Chief Eng., 1876 (1876), p. 505; Ann. Rep.

Geol. Surv. 100th Mer., 1876 (1876), p. 285; Proc. Bost. Soc. Nat. Hist., XIX

(1878), p. 287; Ent. Notes, VI (1878), p. 46.—BRUNER, Rep. U. S. Ent. Comm.,

III (1883), p. 59; Can. Ent., XVII (1885), p. 15; Bull. Div. Ent. U. S. Dep.

Agric., XXVII (1892), p. 29.

OEDALEONOTUS ENIGMA JUCUNDUS.

(Plate XXVI, fig. 4.)

Pezotettix jucundus SCUDDER!, Ann. Rep. Chief Eng., 1876 (1876), p. 505; Ann.

Rep. Geol. Surv. 100th Mer., 1876 (1876), p. 285.—BRUNER, Rep. U. S. Ent.

Comm., III (1883), p. 59.

Body yellowish testaceous marked with brownish fuscous. Head above, behind the narrowest part of the vertex, marked with an elongated, expanding, blackish fuscous stripe, through the middle of which runs a yellow line, and by a supraorbital arcuate band of a similar color, usually broken, often obsolete, and terminating just below a narrow short yellow stripe behind the upper part of the eye; space between the eyes rather narrower than the frontal costa, the fastigium broadening considerably in front of the eyes and broadly sulcate throughout; frontal costa broad and nearly equal, broadest just above the ocellus, rather sparsely punctate, and at the ocellus very shallowly sulcate, often nearly imperceptible. Pronotum short and rather stout,

the anterior and posterior halves of the lateral lobes nearly symmetrical; disk obscured with fuscous or dark brown, with equal sides; the median carina, which is marked with dark brown and is distinct though slight on the metazona, is obsolete on the prozona, represented only by the dark line, sometimes faintly impressed; lateral carinae very obscure, converging anteriorly, and distinguished by a narrow, dull yellow stripe, the rest of the disk and the upper part of the lateral lobes being obscurely marked with dusky brown, which on the lateral lobes is darkest in the sulci; a distinct longitudinal sulcus, more distinct for its deeper color, unites the two pereurrent sulci of the lateral lobes in the middle; anterior margin of the prozona marked by a submarginal continuous sulcus, distinct only on the lateral lobes; posterior border of the metazona very broadly rounded or subangulate. Prosternal spine straight, rather slender, subconical, bluntly pointed. Tegmina subovate, slightly longer than the pronotum in the form *juvendus*, fully half as long as the abdomen in the form *enigma*, fully as long as and generally much longer than the abdomen in the form *collaris*, brownish fuscous, the longitudinal veins mostly yellowish, and flecked, principally along the median area but also without it, with longitudinal series of subquadrate, blackish fuscous spots, the apex subacuminate when abbreviate, well rounded when fully developed; wings pellucid with fuscous veins. Pleura with an oblique, bright yellow stripe, edged with black above the hind coxae. Hind femora luteous, the outer and in part the upper face marked by a large, apical, yellowish-brown spot, a very broad, angulate, transverse median band of the same color, and a similar basal band, sometimes obsolete or obsolescent, on the lower half; outer arc of upper genicular lobes black; tibiae glaucous, yellow on the sides and at extreme base, the apical half of the spines black; arolium either quadrate, rather narrow, longer than the claws (male) or obpyriform, small, but little more than half as long as the claws (female). Abdomen yellow, the sides chafed by the femora dark fuscous; supraanal plate of male rather short triangular, the sides feebly sinuate, the apex acute, the surface marked by a pair of deep and broad converging sulci, lying between the lateral margins and the thereto parallel, elevated and rather sharp ridges, which inclose a deep, triangular, basal sulcus: a slender delicate median sulcus on apical half; cerci very broadly expanded and bullate at the base, tapering rapidly and regularly just beyond the middle, beyond less rapidly, forming a delicate, slender, but bluntly pointed tip, slightly hooked downward and feebly incurved.

Length of body, male, 25 mm., female, 24 mm.; antennae, male and female, 8.5 mm.; tegmina, male, 21.5 mm., female, 23 mm.; hind femora, male, 14 mm., female, 16 mm. These measurements are taken from the form *collaris*.

Seventy-one males, 78 females. Boise City, Ada County, Idaho (U.S. N.M.); Washington, Morrison (U.S.N.M.: S. Henshaw) La Chapples, Yakima County, Washington, July 16 (Museum Comparative Zoology);

Lone Tree, Yakima River, Washington, July 18 (same); Spokane, Washington, July 21–22 (same); Loon Lake, Colville Valley, Washington, July 25 (same); Umatilla, Oregon, June 24, 27 (same); The Dalles, Wasco County, Oregon, H. Edwards; The Dalles, Oregon, June 23, Henshaw (Museum Comparative Zoology); California, Burrison (S. Henshaw): Fort Reading, Shasta Valley, California, Lieutenant Williamson; Walker Basin, Siskiyou County, California, July 15, A. K. Fisher (U.S.N.M.); Tehama County, California, Coquillett (same); Agua Caliente, Sonoma County, California, E. Palmer; Sacramento County, California, Coquillett (U.S.N.M.); Atwater, Merced County, California, July 29, Coquillett (same); Tipton, Tulare County, California Crotch (Museum Comparative Zoology; S. H. Scudder); Santa Barbara, California, July 1, H. W. Henshaw, C. J. Shoemaker; San Buenaventura, Santa Barbara County, California, August 18 (U.S.N.M.); Mohave River, California, O. Loew; Los Angeles, California, July, C. J. Shoemaker; Los Angeles County, California, May, June, and *in coitu* September, Coquillett (U.S.N.M.); Los Angeles, California (L. Bruner); San Bernardino County, California, May, *in coitu* (U.S.N.M.); San Diego County, California (E. Palmer; U.S.N.M.); Tighes Station, San Diego County, California, E. Palmer.

Bruner reports the species also from Nevada and Arizona.

Palmer found this species on grassy slopes, beside brooks.

The form *enigma* appears to be the only one found in the northern part of the range of the species north of central California, and the form *collaris* is rarely met with anywhere.

The different forms have not been taken *in coitu* with each other, so far as I know. The form *juvundus* besides having very short tegmina, is noticeably smaller than the others.

I can scarcely think the form *collaris* to be the insect described by Thomas as *Caleoptenus* [sic] *flavolineatus*,¹ as Bruner has supposed. Thomas's description very poorly fits it; he makes no mention of the tumid prozona, and he states, both here and subsequently,² that it closely resembles *Melanoplus spretus*, and that the posterior margin of the subgenital plate of the male is notched, whereas its general appearance is very different indeed from *M. spretus*; so much so that it can hardly be believed that anyone would select it for comparison; nor has the apical margin of the subgenital plate the faintest sign of any emargination. Thomas's specimen was derived from Crotch's collection in the Museum of Comparative Zoology; Crotch collected *Oedaleonotus enigma collaris* in central, not southern, California, whereas Thomas gave his *C. flavolineatus* from southern California. Thomas's description does not at all fit any species from southern California which has come under my notice, and until such a form occurs his name should go for nothing—at least until the Acridian fauna of that region is fairly well known.

¹ Bull. U. S. Geol. Surv. Terr., I, No. 2, p. 68.

² Rep. U. S. Ent. Comm., I, p. 43.

28. ASEMOPLUS, new genus.

(*Ἀσήμεος*, without device; *ὄπλα*, armor.)

Body resembling *Conalcaea* in general appearance, rather slender, compressed cylindrical, feebly and sparsely pilose. Head moderately large, not prominent, with feebly tumescent genae, the vertex well arched, raised but little above the general level of the pronotum, the fastigium rapidly descending, the face rounded and a little retreating; eyes separated widely, the fastigium depressed only between them and very feebly, passing insensibly into the broad and equal frontal costa, which is yet narrower than the interspace between the eyes, rounded, fading below the ocellus; eyes large, moderately prominent, very broad oval, the front border subtruncate, half as long again as the anterior infraocular portion of the genae; antennae very slender, longer than the head and pronotum together. Pronotum short, subequal, the metazona flaring somewhat, transversely convex, the disk passing insensibly into the subvertical lateral lobes, with no sign of lateral carinae, the median carina slight and occurring only on the metazona; fore and hind margins both truncate, the latter feebly and broadly emarginate; prozona coarsely and sparsely punctate, transverse, almost twice as long as the finely and densely punctate metazona, the transverse sulci of the former distinct, the postmedian more or less sinuate. Prosternal spine erect, stout, subconical; meso- and metastethia together distinctly (male) or slightly (female) longer than broad, the interval between the mesosternal lobes quadrate (male) or transverse and as broad as the lobes (female); metasternal lobes rather (male) or distinctly (female) distant, but in neither case more distant than the width of the frontal costa, the portion of the thorax behind the metasternal lobes only a little more than half as broad as the metasternum, but more than twice as broad as long. Tegmina linear, lateral, shorter than the pronotum. Hind femora not very long, but slender, the inferior genicular lobe pallid and immaculate, the hind tibiae with ten to twelve spines in the outer series. Abdomen of male feebly clavate apically and somewhat upturned, the lateral margins of the subgenital plate strongly ampliate at base, apically produced and acutangulate, but with no tubercle; cerci substyliform; abdomen of female tapering regularly to a pointed tip, the ovipositor normally exerted.

This genus is represented by a single species, found only in the extreme northwestern United States.

ASEMOPLUS MONTANUS.

(Plate XXVI, fig. 7.)

Braconynotes montanus BRUNER!, Can. Ent., XVII (1885), pp. 16-17.

Body very dark reddish brown, marked with black and testaceous, beneath luteous. Head olivaceo-luteous, infumated, above and on the

posterior parts of the genae above the lower level of the eyes dark reddish brown, with a mediodorsal thread of testaceous, and another behind the middle of the upper half of the eyes; whole face and especially frontal costa punctate; antennae ferruginous, apically infuscated. Pronotum with the metazona ferrugineo-testaceous, the prozona very dark reddish brown, the upper two-thirds of the lateral lobes piceous or plumbeo-piceous, sometimes merely dull piceous, with black sulci, the lower portion of the lobes including the metazona luteous, fading upward gradually on the metazona. Mesonotum, metanotum, and abdomen dark reddish brown, with a sometimes obsolete, slender, flavo-testaceous or ferrugineo-testaceous dorsal stripe edged with black, which in some cases reappears on the prozona of the pronotum. Tegmina about as long as the prozona,¹ subequal, three or four times as long as broad and well rounded at tip, fusco-testaceous, lighter along the inner (upper) margin. Legs luteous, more or less heavily tinged with ferruginous along the upper surface, the hind femora more than the anterior pairs, the carinae being often more or less heavily marked with black, the genicular arc black; hind tibiae very feebly incurved, yellow luteous, the spines black-tipped. Supraanal plate of male triangular with slightly rounded sides, the tip well rounded, with a deep basal median sulcus, half as long as the plate and bounded by rather high ridges, which after uniting in the middle again part slightly and run parallel to the apex, leaving a slight sulcus between them; furcula consisting of a pair of slightly separated minute triangular lobes; cerci slender, slightly compressed, tapering gently on basal half, beyond very slender, subcylindrical, scarcely tapering, acuminate, and curved downward (the latter feature not shown in the figure); infracereal plates rather short, rounded, concealed by the recumbent cerci.

Length of body, male, 17 mm., female 19.5 mm.; antennae, male, 6.75 mm., female, 6 mm.; tegmina, male and female, 3 mm.; hind femora, male, 8.75 mm., female, 10 mm.

Seven males, 7 females. Montana, L. Bruner (L. Bruner; S. H. Scudder; U.S.N.M.—Riley collection); Loon Lake, Colville Valley, northeastern Washington, July 23–25, S. Henshaw (Museum Comparative Zoology).

Bruner states that the Montana specimens were taken near Helena "among the trailing junipers on north mountain slopes, at moderate elevations." He also states that the colors of the living insect are much more vivid than in cabinet specimens. "The yellowish hair-lines and dorsal line of the abdomen are glossy white, while the front and lower surface are of a bright lemon yellow; the brown is a bright hazel."

In some specimens, especially of the female, the pronotum is crossed by a narrow testaceous stripe which cuts the darker markings, running

¹Bruner states that the tegmina are sometimes absent, but I think only from individuals that have lost them by accident. I have seen only one in which they were lost from both sides; several in which they have been lost from one side.

obliquely upward from the lower level of the eye toward the upper posterior limit of the lateral lobes of the prozona, usually narrowing as it goes.

29. PHILOCLEON, new genus.

(Φιλοκλεων), a character in Aristophanes "Wasps," who ends the play in a leaping dance.¹)

Body closely resembling that of *Podisma*, compressed cylindrical, not very slender, rather thinly pilose throughout with rather long delicate hairs. Head moderately large, feebly prominent, the genae not tumescent, the vertex well arched but only slightly elevated above the pronotum: fastigium sulcate and declivent, passing insensibly into the straight and little prominent frontal costa, the face retreating but little; eyes rather widely separated, moderate in size, rather prominent, broad oval, the front margin subtruncate (female) or feebly convex (male), not more than half as long again as broad, produced neither above nor below; antennae slender, much longer than (male) or as long as (female) the head and pronotum together. Pronotum short, compressed cylindrical, with no trace of lateral carinae and very feeble median carina, both front and hind margins truncate; prozona sparsely and feebly, metazona more closely but not densely punctate, the transverse sulci moderate. Prosternal spine short, corical; meso- and metastethia together much longer than broad in both sexes, the latter narrowing rapidly behind, so that the portion behind the lobes is only (male) or scarcely more than (female) half as broad as the metastethium; interspace between the mesosternal lobes longer than broad (male) or subquadrate (female), the metasternal lobes attingent or subattingent (male) or approximate, the interspace narrower than the frontal costa (female). Tegmina wanting. Hind femora moderately stout, the inferior genicular lobe pallid except at extreme base, the hind tibiae with nine to eleven spines in the outer series. Sides of the first abdominal segment with no tympanum, the extremity in the male clavate, the subgenital plate with no apical tubercle, its lateral margins abruptly and considerably ampliate at the base; cerei lamellate, narrow beyond the rather broad base and incurved. Abdomen of female regularly tapering, the ovipositor normally exerted.

The genus is represented by a single Mexican species, originally described as *Pezotettix nigrovittatus* Stål.

PHILOCLEON NIGROVITTATUS.

(Plate XXVI, figs. 8, 9.)

Pezotettix nigrovittatus STÅL, Bih. K. Sv. Vet.-Akad. Handl., III, No. 14 (1875), p. 32; *ibid.*, V, No. 9 (1878), p. 15.

Pezotettix apterus BRUNER!, MS.

Flavo-testaceous, heavily variegated with black and red, pilose. Head fusco-olivaceous, darker in the male than in the female, above

¹ "For now in these sinewy joints of ours
The cup-like socket is twirled about."

with a median black stripe and a broad postocular piceous band broadly margined with flavo-testaceous; vertex well arched, slightly or not elevated above the pronotum, the interspace between the eyes a little broader than (male) or fully twice as broad as (female) the first antennal joint; fastigium considerably declivent, rather deeply sulcate; frontal costa almost percurrent, equal, about as broad as (male) or distinctly narrower than (female) the interspace between the eyes, strongly sulcate throughout, sparsely punctate; eyes moderate in size, prominent particularly in the male, much longer than the infraocular portion of the genae; antennae pale red, feebly infuscated apically, fully four-fifths (male) or about two-thirds (female) as long as the hind femora. Pronotum short, subcylindrical, a little compressed, in the female feebly and regularly enlarging posteriorly, in the male equal on the prozona and faintly flaring on the metazona, the disk in both sexes transversely convex and passing quite insensibly into the vertical lateral lobes; the ground color of the pronotum is flavo-testaceous, but it is heavily overlaid with black somewhat irregularly, which however forms a broad dorsal band (divided in the female by a mediodorsal flavous stripe) crossing the prozona only, and very broad piceous (male) or brownish fuscous (female) postocular bands crossing the whole pronotum, broken to some extent, and especially posteriorly divided by a flavo-testaceous, posteriorly flavous, longitudinal stripe running through its upper portion; the transverse sulci are also marked in black and the lower margins of the lobes are broadly bordered with blackish fuscous; the disk of the metazona is ferruginous or rufous, more or less infuscated laterally; median carina obsolete; front margin truncate (male) or gently and mesially arcuate (female), hind margin truncate; prozona very sparsely punctate, subquadrate, only a third longer (the principal sulcus arcuate, opening backward) than the finely punctate metazona. Prosternal spine short, conical, blunt; interspace between mesosternal lobes half as long again as broad (male) or a little broader than long (female). Tegmina wanting. Fore and middle femora considerably swollen in the male, ferrugineo-flavous; hind femora varying from flavo-testaceous to ferruginous and very broadly bifasciate with black, the fasciations so confused on the outer face, especially in the female, that this often becomes wholly black with more or less pronounced flavous incisures, the lower margin of the outer face flavous, sometimes linearly dotted with black, the lower face more or less sanguineous, the sides of the geniculation black except the flavous apical portion of the lower genicular lobe; hind tibiae more or less feebly incurved apically, fusco-glaucous with a black patellar annulus, the spines black in their apical half, ten, rarely nine or eleven, in number in the outer series. Abdomen with meso- and metathorax dull flavo-testaceous, heavily overlaid with black in more or less broken continuation of the pronotal stripes and bands, the slender mediodorsal flavous stripe of the prozona also repeated on the

abdomen in the female; the extremity strongly clavate in the male and considerably recurved, the supraanal plate triangular with blunt apex, the sides nearly straight, feebly emarginate just before the middle, but scarcely at all elevated, the median carina very deep in the basal half between high and sharp walls, beyond shallow and feeble but percurrent; furcula consisting of a pair of approximate, minute, slender, parallel, blunt fingers, no longer than the last dorsal segment; cerci very long and slender, exteriorly a little tumid, bent arcuate, tapering gradually to the middle to less than half the basal breadth, then bent roundly inward and thereafter equal, blunt-tipped, their tips meeting over the apex of the supraanal plate; subgenital plate short, slightly broader apically than at base, almost twice as long as broad, the lateral margins strongly rounded at base, with the apical margin, as seen from above, very strongly rounded, not elevated, entire.

Length of body, male, 18 mm., female, 22 mm.; antennae, male, 8.75 mm., female, 8 mm.; pronotum, male, 4.2 mm., female, 5.25 mm.; hind femora, male, 10.5 mm., female, 12.5 mm.

Two males, 4 females. Comancho, Zacatecas, Mexico (L. Bruner); San Luis Potosi, Mexico, E. Palmer; Mount Alvarez, San Luis Potosi, Mexico, E. Palmer.

By the kindness of Doctor Aurivillius of Stockholm, I am able to illustrate the male abdomen of Stål's type (fig. 9), which I should have been unable to identify with certainty from the rather meager description. I do not find the apex of the hind tibiae black, as Stål states them to be.

30. APTENOPEDES.

(*Ἀπτενήν*, unfledged; *πηδάω*, to leap.)

Aptenopedes SCUDDER, Proc. Bost. Soc. Nat. Hist., XIX (1877), pp. 83-84.

Body compressed, especially in the female, where it is also feebly fusiform, feebly pilose. Head projecting, front strongly oblique, whole summit of head horizontal, scarcely convex, triangular; eyes nearly meeting above, especially in the male, where they are separated by a space not wider than the narrowest part of the frontal costa, the fastigium in front of them laterally expanded and slightly tumid; front subappressed, particularly in the female, almost straight; eyes long oval, moderately prominent, in the female depressed and tapering above; antennae moderately slender, linear, subdepressed, about as long as (female) or slightly longer than (male) the head and pronotum together; palpi rather small, the last joint nearly cylindrical, not in the least expanded. Pronotum regularly expanding posteriorly in the female, only expanding at the very tip and then but slightly in the male; front margin slightly convex, hind margin slightly and angularly excised; surface uniformly rugulose, tectiform, especially in the female, the median carina distinct but not prominent, the lateral carinae wholly

wanting; metazona less than half as long as the prozona, the latter divided a little behind the middle by a scarcely perceptible sinuate sulcus; lateral lobes nearly twice as long as broad, narrowing downward, the inferior margin very broadly angulate, the posterior margin roundly excised. Prosternal spine blunt, conico-cylindrical; inner margin of mesosternal lobes broadly convex, the lobes subapproximate (male) or distant from each other by half their width (female); metasternal lobes subcontiguous in both sexes. Tegmina linear, about as long as the pronotum, or absent. Hind femora extending nearly to (female) or a little beyond (male) the tip of the abdomen, the superior margin unarmed, the hind tibiae with their outer edges smooth, the spines similar in length on the two sides, those of the outer series nine to ten in number; first and third tarsal joints equal, the second less than half as long as either. Abdomen indistinctly carinate throughout, the extremity scarcely enlarged in the male; subgenital plate ampliate at base, short, not projecting far beyond the tip of the small supraanal plate, and in particular so little elevated posteriorly as to expose the recumbent pallium more or less to a posterior view; furcula feeble; cerci styliform; infracercal plates highly developed.

In general appearance the species of this genus most nearly resemble those of *Gymnoscirtetes* Bruner, *Paradichroplus* Brunner, and *Scopas* Giglio Tos. The distinctions of the genus from the first, besides its ampliate subgenital plate, are pointed out under that genus. From *Paradichroplus* it differs in its more compressed body, the more tapering vertex, the slenderer tegmina (when they are present), the lack of any enlargement of the tip of the male abdomen, with the shorter subgenital plate, the ampliate basal margin of the same, the posteriorly exposed pallium, and the wholly simple cerci. From *Scopas*, which I have not seen, it appears to differ in its more prominent prosternal spine, its narrower labrum, more declivent face, less cylindrical pronotum, with its excised posterior margin, besides its simple cerci. Its subconical head, especially in the female, gives it a peculiar aspect.

A. sphenarioides Scudder, is the type.

Three species occur in the Southern States along the borders of the Gulf of Mexico, and may be separated as follows:

ANALYTICAL KEY TO THE SPECIES OF APTENOPEDES.

A¹. Tegmina present in one or both sexes; frontal costa no broader at base than in the middle.

b¹. Tegmina present in both sexes; furcula of male as long as the last dorsal segment; anal cerci tapering only on basal half. 1. *sphenarioides* (p. 400).

b². Tegmina present in female only; furcula of male not more than half as long as the last dorsal segment; anal cerci tapering almost uniformly throughout. 2. *rufovittata* (p. 401).

A². Tegmina present in neither sex; frontal costa much broader at base than in middle, at least in the male 3. *aptera* (p. 402).

I. APTENOPEDES SPHENARIOIDES.

(Plate XXVI, fig. 10.)

Aptenopedes sphenarioides SCUDDER!, Proc. Bost. Soc. Nat. Hist., XIX (1877), pp. 81-85; Ent. Notes, VI (1878), p. 25.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 55.

Body green, the upper surface a little infuscated in the male. Head and whole front flecked with fuscous or blackish puncta; antennae with the first two joints pale or greenish, beyond growing testaceous, the apical third blackish fuscous. Pronotum uniformly dull rugulose, more obscurely on the lateral lobes than above, and furnished with very scattered, inconspicuous, delicate, short, white hairs found also on the head, and with a white or very pale pink, straight lateral stripe, running from the upper posterior border of the eye to the hinder edge of the pronotum; this stripe is bordered more (male) or less (female) distinctly with black beneath; lower edges of lateral lobes a little pale, especially in the male. Prosternal spine terminating bluntly. Tegmina reaching the end of the first abdominal segment, white above, black below, in continuation of the lateral stripe. Metapleura more or less distinctly striped with black and white in imitation of the tegmina. Hind femora green exteriorly, more or less infuscated in the female, especially above, the upper carina of the outer face obscurely marked with black, the outer half of the upper face more or less distinctly testaceous in the male; hind tibiae green with a plumbeous tinge, the spines black tipped. Abdomen obscurely punctate on the basal half with small, indistinct, laterodorsal spots of mingled white and blue-black dots on the posterior extremity of the segments, which in the male lie at the outer limit of a broad dorsal testaceous stripe, which is bordered externally with blackish and so obscures the spots; supraanal plate of male slender, elongate, equal as far as the middle, beyond subtriangular, acutangulate at tip, the margins elevated, with a slender, sharp, median sulcus, bordered basally by slight ridges; furcula consisting of a pair of subattinent, parallel, blunt, cylindrical processes, extending but a short distance over the plate; cerci rather small, laminate, tapering rapidly in the basal half, beyond equal and slender, but at tip acuminate by the excision of the upper margin, the whole feebly incurved; infracercal plates large, broad apically, extending slightly beyond the supraanal plate and very broadly rounded at tip.

Length of body, male, 17 mm., female, 25 mm.; antennae, male and female, 7 mm.; tegmina, male, 3 mm., female, 4 mm.; hind femora, male, 10 mm., female, 11.25 mm.

Three males, 5 females. Fort Reed, Orange County, Florida, April 8-28, J. H. Comstock; Jacksonville, Duval County, Florida, April, C. J. Maynard; The same, August, W. H. Ashmead (U.S.N.M.); Key West, Florida, C. J. Maynard; Biscayne Bay, Dade County, Florida, E. Palmer.

2. APTENOPEDES RUFOVITTATA.

(Plate XXVI, fig. 11.)

Aptenopedes rufovittata SCUDDER¹, Proc. Bost. Soc. Nat. Hist., XIX (1877), pp. 85-86; Ent. Notes, VI (1878), p. 26.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 55.

Body green, more or less infuscated above. Face minutely and rather sparsely dotted with blackish fuscous, the mouth-parts and the lower part of the face often decidedly pink; antennae with the first two joints green, beyond either dull green more or less infuscated (male) or with the basal half reddish or pinkish brown and the apical half olivaceous-fuscous (female); eyes as in *A. sphenarioides*. Pronotum rugulose, much more heavily in the male than in the female, and the dorsum of the other thoracic joints and the basal abdominal joints similarly marked; pronotum with a distinct (female) or inconspicuous (male) median carina, obscurely infuscated in the male, generally marked distinctly but narrowly with testaceous in the female, the surface of the whole pronotum with a few scattered hairs, even more sparsely distributed than in *A. sphenarioides*; upper limit of the lateral lobes marked by a slender black stripe, followed above by a somewhat broader rufous band, fading to yellowish, and narrowed in the female; this stripe does not extend upon the head. Tegmina wanting in the male, very slender, linear, straight and green in the female. Legs green, the hind femora tipped, at least in the male, with rufo-testaceous and black; hind tibiae glaucous; hind tarsi red, with black-edged arolium and black-tipped red claws. Abdomen, in the female, with an obscure testaceous mediodorsal stripe, extending upon the thorax, and, on the abdomen, followed by an obscure laterodorsal series of small dark spots; or, in the male, with a similar distinct stripe, bordered by a more or less distinct narrow or broad edging of black, fading laterally into fuscous; supraanal plate of male moderately long and slender, tapering from the base, at first gently, near tip rapidly, the apex slightly obtusangulate, the margins elevated, a median sulcus extending over the basal half, bounded by pronounced but rounded ridges which unite in the middle of the plate and then continue halfway to the tip; furcula consisting of a pair of short, cylindrical lobes diverging at right angles, projecting but little over the supraanal plate; cerci regularly conical except that they are feebly compressed, acuminate, straight, reaching the tip of the supraanal plate; infracercal plates broad, sulcate, broadly rounded apically, but acutely subacuminate at the middle line, extending just beyond the supraanal plate.

Length of body, male, 15.5 mm., female, 20.5 mm.; antennae, male, 6.5 mm., female, 5.4 mm.; tegmina, female, 1.85 mm.; hind femora, male, 8.5 mm., female, 10 mm.

Two males, 1 female. Fort Reed, Orange County, Florida, April 10-21, J. H. Comstock.

3. APTENOPEDES APTERA.

(Plate XXVI, fig. 12.)

Aptenopedes aptera SCUDDER!, Proc. Bost. Soc. Nat. Hist. (1877), p. 86; Ent. Notes, VI (1878), p. 27.—BRUNER, Rep. U. S. Ent. Comm., III (1883), p. 55.

Body green; head green; eyes narrower, at least in the female, than in *A. sphenarioides*, more closely approximated above, and the fastigium in advance of them less swollen. Thorax with sculpturing similar to that in *A. sphenarioides*, but wholly devoid of any lateral stripe or with feeblest signs of the same in the female; in the male, however, there is a faint pallid stripe, edged feebly, narrowly, and interruptedly beneath with very dark green. Tegmina wholly wanting in both sexes. Legs as in the other species, except in wanting the testaceous color on the outer half of the upper face of the hind femora. Abdomen green, with a mediodorsal testaceous stripe with obscurely infuscated edges, extending also over the meso- and meta-nota; supraanal plate of male subtriangular, with slightly convex sides, the apex acutely angulate, the surface tolerably flat except that the lateral margins are elevated on the basal half, the extreme tip is suddenly raised to a higher level, and the median basal sulcus, which reaches to the middle of the plate, is flanked by heavy parallel walls which unite beyond its tip and extend nearly to the apex of the plate; furcula consisting of a pair of minute, rounded, divergent lobes, seated upon the ridges bounding the median sulcus of the supraanal plate; cerci much as in *A. ruforittata*, but tapering a little more rapidly on the basal than on the apical half; infracercal plates very broad, concave, tapering, extending beyond the supraanal plate by their slightly thickened, bluntly pointed, slightly separated apices.

Length of body, male, 19.5 mm., female, 24 mm.; antennae, male, 8 mm., female, 6.5 mm.; hind femora, male, 11.25 mm., female, 10.5 mm.

One male, 3 females. Fort Reed, Orange County, Florida, April 27, J. H. Comstock; Jacksonville, Duval County, Florida, August, W. H. Ashmead (U.S.N.M.); Texas (U.S.N.M.).

APPENDIX.

I. LIST OF HERETOFORE-DESCRIBED SPECIES OF NORTH AMERICAN MELANOPLI, IN THEIR ORIGINAL AND PRESENT NOMENCLATURE, ALPHABETICALLY ARRANGED BY SPECIES UNDER THE FORMER.

1877. *Pezotettix abditum* Dodge = *Melanoplus dawsoni*.
 1875. *Pezotettix acutipennis* Scudder = *Campylacantha acutipennis*.
 1876. *Pezotettix alba* Dodge = *Hypochlora alba*.
 1877. *Caloptenus angustipennis* Dodge = *Melanoplus angustipennis*.
 1877. *Aptenopedes aptera* Scudder = *Aptenopedes aptera*.
 1870. *Caloptenus arcticus* Walker = ? *Melanoplus borealis*.
 1879. *Pezotettix aridus* Scudder = *Melanoplus aridus*.
 1879. *Melanoplus arizonæ* Scudder = *Melanoplus arizonæ*.
 1879. *Pezotettix aspirans* Scudder = *Podisma dodgei*.
 1875. *Caloptenus atlantis* Riley = *Melanoplus atlantis*.
 1877. *Paroxya atlantica* Scudder = *Paroxya atlantica*.
 1876. *Pezotettix autumnalis* Dodge = *Phoetaliotes nebrascensis*.
 1861. *Platyphyma aztecum* Saussure = *Aidemona azteca*.
 1870. *Caloptenus bilituratus* Walker = *Melanoplus bilituratus*.
 1825. *Gryllus bivittatus* Say = *Melanoplus bivittatus*.
 1878. *Pezotettix bohemani* Stål = *Podisma dodgei*.
 1861. *Acridium (Podisma) borekii* Stål = *Melanoplus borekii*.
 1868. *Pezotettix borealis* Scudder = *Melanoplus fasciatus*.
 1854. *Caloptenus borealis* Fieber = *Melanoplus borealis*.
 1879. *Melanoplus bowditchi* Scudder = *Melanoplus bowditchi*.
 1874. *Ommatolampis brevipennis* Thomas = *Hesperotettix brevipennis*.
 1891. *Melanoplus cenchri* McNeill = *Melanoplus flavidus*.
 1878. *Melanoplus cinereus* Scudder = *Melanoplus cinereus*.
 1877. *Caloptenus clypeatus* Scudder = *Melanoplus clypeatus*.
 1878. *Melanoplus collaris* Scudder = *Oedaleonotus enigma*.
 1878. *Melanoplus collinus* Scudder = *Melanoplus collinus*.
 1861. *Peopedetes corallinus* Saussure. Undetermined; perhaps not belonging to this group.
 1879. *Melanoplus curtus* Scudder = *Melanoplus fasciatus*.
 1875. *Pezotettix dawsoni* Scudder = *Melanoplus dawsoni*.
 1875. *Caloptenus deletor* Scudder = *Melanoplus deletor*.
 1878. *Melanoplus devastator* Scudder = *Melanoplus devastator*.
 1875. *Caloptenus devorator* Scudder = *Melanoplus femur rubrum*.
 1865. *Acridium differentiale* Uhler = *Melanoplus differentialis*.
 1879. *Pezotettix discolor* Scudder = *Melanoplus discolor*.
 1871. *Caloptenus dodgei* Thomas = *Podisma dodgei*.
 1879. *Pezotettix dumicolus* Scudder = *Melanoplus dumicola*.
 1861. *Pezotettix edax* Saussure = *Melanoplus femoratus*.
 1876. *Pezotettix enigma* Scudder = *Oedaleonotus enigma*.
 1788. *Gryllus (Locusta) erythropus* Gmelin = *Melanoplus femur rubrum*.
 1870. *Caloptenus extremus* Walker = *Melanoplus extremus*.
 1870. *Caloptenus fasciatus* Walker = *Melanoplus fasciatus*.
 1875. *Caloptenus fasciatus* Scudder = *Melanoplus packardii*.
 1791. *Acridium femorale* Olivier = *Melanoplus femur rubrum*.
 1838. *Caloptenus femoratus* Burmeister = *Melanoplus femoratus*.
 1773. *Acridium femur rubrum* De Geer = *Melanoplus femur rubrum*.
 1879. *Pezotettix flabellatus* Scudder = *Melanoplus flabellatus*.
 1879. *Melanoplus flabellifer* Scudder = *Melanoplus flabellifer*.
 1879. *Melanoplus flavidus* Scudder = *Melanoplus flavidus*.
 [1877. *Pezotettix flavoannulatus* La Munyon = *Dactylotum pictum*.]
 1874. *Caleoptenus [sic] flavolineatus* Thomas. Undetermined.
 1841. *Acridium flavovittatum* Harris = *Melanoplus bivittatus*.
 1874. *Caloptenus floridianus* Thomas = *Paroxya floridana*.

1879. *Melanoplus foedus* Scudder = *Melanoplus foedus*.
 1872. *Aceridium frontalis* Thomas = *Hesperotettix speciosus*.
 1862. *Pezotettix glacialis* Scudder = *Podisma glacialis*.
 1875. *Caloptenus glaucipes* Scudder = *Melanoplus glaucipes*.
 1876. *Pezotettix gracilis* Bruner = *Melanoplus gracilis*.
 1872. *Caloptenus grisens* Thomas = *Melanoplus punctulatus*.
 1875. *Caloptenus helluo* Scudder = *Melanoplus punctulatus*.
 1893. *Melanoplus herbaceus* Bruner = *Melanoplus herbaceus*.
 1885. *Pezotettix hispidus* Bruner = *Bradynotes hispida*.
 1892. *Pezotettix hoosieri* Blatchley = *Paroxya hoosieri*.
 1875. *Pezotettix humphreysii* Thomas = *Melanoplus humphreysii*.
 1879. *Melanoplus infantilis* Scudder = *Melanoplus infantilis*.
 1879. *Melanoplus interior* Scudder = *Melanoplus femur rubrum*.
 1876. *Pezotettix jucundus* Scudder = *Oedaleonotus enigma*.
 1876. *Pezotettix junius* Dodge = *Melanoplus extremus*.
 1874. *Caloptenus keeleri* Thomas = *Melanoplus keeleri*.
 1878. *Melanoplus kennicottii* Scudder = *Melanoplus kennicottii*.
 1879. *Pezotettix lakinus* Scudder = *Melanoplus lakinus*.
 1837. *Locusta leucostoma* Kirby = ? *Melanoplus extremus*.
 1861. *Pezotettix longicornis* Saussure = ? *Melanoplus obovatipennis*.
 1891. *Dendrotettix longipennis* Riley MS. Bruner = *Dendrotettix quercus*.
 1876. *Caloptenus lurida* Dodge = *Melanoplus luridus*.
 1868. *Pezotettix manca* Smith = *Melanoplus mancus*.
 1876. *Pezotettix marginatus* Scudder = *Melanoplus marginatus*.
 1875. *Pezotettix marshallii* Thomas = *Podisma marshallii*.
 1879. *Pezotettix marshallii* Scudder = *Melanoplus altitudinum*.
 1872. *Pezotettix megacephala* Thomas MS. Dodge = *Phoetaliotes nebrascensis*.
 1861. *Pezotettix mexicana* Saussure. Undetermined.
 1861. *Platyphyma mexicanum* Bruner = *Paradichroplus mexicanus*.
 1870. *Caloptenus mexicanus* Walker = *Paradichroplus mexicanus*.
 1838. *Aceridium milberti* Serville = *Melanoplus femoratus*.
 1875. *Caloptenus minor* Scudder = *Melanoplus minor*.
 1876. *Pezotettix minutipennis* Thomas = *Melanoplus gracilis*.
 1873. *Platyphyma montana* Thomas = *Melanoplus montanus*.
 1885. *Bradynotes montanus* Bruner = *Asemoplus montanus*.
 1872. *Pezotettix nebrascensis* Thomas = *Phoetaliotes nebrascensis*.
 1877. *Caloptenus nigrescens* Scudder = *Melanoplus nigrescens*.
 1875. *Pezotettix nigrovittatus* Stål = *Philocleon nigrovittatus*.
 1879. *Pezotettix nudus* Scudder = *Paraidemona punctata*.
 1872. *Pezotettix obesa* Thomas = *Bradynotes obesa*.
 1894. *Pezotettix obovatipennis* Blatchley = *Melanoplus obovatipennis*.
 1872. *Caloptenus occidentalis* Thomas = *Melanoplus occidentalis*.
 1876. *Pezotettix occidentalis* Bruner = *Melanoplus blatchleyi*.
 1875. *Pezotettix olivacea* Scudder = *Campylacantha olivacea*.
 1881. *Bradynotes opimus* Scudder = *Bradynotes obesa*.
 1875. *Pezotettix oregonensis* Thomas = *Podisma oregonensis*.
 1881. *Pezotettix pacificus* Scudder = *Melanoplus pacificus*.
 1878. *Melanoplus packardii* Scudder = *Melanoplus packardii*.
 1876. *Caloptenus parvus* Provancher = *Melanoplus extremus*.
 [1870. *Pezotettix pieta* Thomas = *Dactylotum pictum*.]
 1877. *Caloptenus* (*Hesperotettix*) *picticornis* Thomas = *Poecilotettix picticornis*.
 1878. *Pezotettix pilosus* Stål = *Rhabdotettix pilosus*.
 1876. *Pezotettix plagosus* Scudder = *Aeoloplus plagosus*.
 1878. *Pezotettix plebejus* Stål = *Melanoplus plebejus*.
 1877. *Caloptenus plumbum* Dodge = *Melanoplus plumbens*.
 1875. *Caloptenus ponderosus* Scudder = *Melanoplus robustus*.
 1877. *Pezotettix puer* Scudder = *Melanoplus puer*.
 1878. *Pezotettix punctatus* Stål = *Paraidemona punctata*.
 1862. *Caloptenus punctulatus* Uhler MS. Scudder = *Melanoplus punctulatus*.
 1879. *Pezotettix pupaeformis* Scudder = *Melanoplus plebejus*.
 1888. *Dendrotettix quercus* Riley = *Dendrotettix quercus*.
 1877. *Paroxya recta* Scudder = *Paroxya floridana*.
 1878. *Melanoplus rectus* Scudder = *Melanoplus fasciatus*.
 1876. *Caloptenus regalis* Dodge = *Aeoloplus regalis*.
 1870. *Caloptenus repletus* Walker. Probably indeterminate.
 1875. *Caloptenus robustus* Scudder = *Melanoplus robustus*.
 1877. *Pezotettix rotundipennis* Scudder = *Melanoplus rotundipennis*.

1877. *Aptenopedes rufovittata* Scudder = *Aptenopedes rufovittata*.
 1878. *Pezotettix rusticus* Stål = *Melanoplus rusticus*.
 1877. *Caloptenus sanguinocephalus* La Munyon = *Phoetaliotes nebrascensis*.
 1877. *Caloptenus sanguinolentus* Provancher = *Melanoplus femur rubrum*.
 1870. *Caloptenus scriptus* Walker. Determinable only by comparison with types in the British Museum.
 1864. *Pezotettix scudderi* Uhler = *Melanoplus scudderi*.
 1870. *Caloptenus selectus* Walker. Determinable only by study of types in the British Museum.
 1861. *Pezotettix septentrionalis* Saussure = *Melanoplus borealis*.
 1872. *Pezotettix speciosa* Scudder = *Hesperotettix speciosus*.
 1872. *Aptenopedes sphenarioides* Scudder = *Aptenopedes sphenarioides*.
 1865. *Acridium spretis* Uhler MS. Thomas = *Melanoplus spretus*.
 1876. *Pezotettix stupefactus* Scudder = *Podisma stupefacta*.
 1861. *Pezotettix sumichrasti* Saussure = ? *Melanoplus bivittatus*.
 1876. *Pezotettix tellustris* Scudder = *Melanoplus dawsoni*.
 1879. *Melanoplus tenebrosus* Scudder = *Melanoplus keeleri*.
 1879. *Pezotettix texanus* Scudder = *Melanoplus texanus*.
 1872. *Caloptenus turnbulli* Thomas = *Aeoloplus turnbulli*.
 1873. *Pezotettix unicolor* Thomas = *Melanoplus scudderi*.
 1878. *Pezotettix varicolor* Stål = *Paradichroplus varicolor*.
 [1879. *Pezotettix variegatus* Scudder = *Dactylotum variegatum*.]
 1879. *Melanoplus variolosus* Scudder = *Melanoplus occidentalis*.
 1876. *Pezotettix viola* Thomas = *Melanoplus viola*.
 1861. *Pedies virescens* Saussure. Undetermined; perhaps not belonging to this group.
 1872. *Caloptenus viridis* Thomas = *Hesperotettix viridis*.
 1876. *Pezotettix vivax* Scudder = *Campylacantha vivax*.
 1877. *Caloptenus volucris* Dodge = *Phoetaliotes nebrascensis*.
 1885. *Pezotettix washingtonianus* Bruner = *Melanoplus washingtonianus*.
 1875. *Caloptenus yarrowii* Thomas = *Melanoplus yarrowii*.
 1861. *Pezotettix zimmermanni* Saussure = ? *Melanoplus nigrescens*.

2. UNDETERMINED FORMS.

1. *Poepedetes corallinus* Saussure, Rev. Mag. Zool., 1861, p. 158. Mexico temperata. It is doubtful if this Mexican species, unknown to me, belongs in the Melanopli; it seems to be more nearly allied to *Dactylotum*.
 2. *Pezotettix fauriei* Bolivar, Anal. Soc. Esp. Hist. Nat., XIX (1890), pp. 322-323. This species from Yesso, Japan, seems to be a *Podisma*, but it is described from the female alone, so that I can not place it more closely.
 3. *Caloptenus* (*sic*) *flavolineatus* Thomas, Bull. U. S. Geol. Surv. Terr., I, 1st series, No. 2 (1874), p. 68. I am unable to determine this southern California species, and am tolerably confident I have not seen it; for in this case there is apparently sufficient in the description to fix the species when specimens are obtained. It has been thought by some to be *Oedaleonotus enigma collaris*, but that is scarcely possible.
 4. *Pezotettix mexicana* Saussure, Rev. Mag. Zool., 1861, p. 160. Mexico temperata. From the description it is impossible to determine which of the many Mexican species this may be, but I suspect it may prove to be *Melanoplus atlantis*.
 5. *Pezotettix mikado* Bolivar, Ann. Soc. Esp. Hist. Nat., XIX (1890), p. 323. Yesso, Japan. Like the other species of Bolivar, No. 2, this is described from the female only, and I can not place it. It is presumably a *Podisma*.
 6. *Caloptenus repletus* Walker, Cat. Derm. Salt. Brit. Mus., IV (1870), pp. 678-679. I had thought this species to be probably *Melanoplus bilituratus*, but there was little in Walker's description whereon to base an opinion. Mr. Samuel Henshaw, however, kindly compared *bilituratus* with the specimens placed under *repletus* in the British Museum and found them distinct. Walker credited it to "U. States" and "Vancouver's Island," one specimen each, but Mr. Henshaw found no specimens from Vancouver, but two males and a female from "North America," one specimen being further labeled "Illinois." The two males were different species, one being *Melanoplus femoratus*, the other (Illinois) distinct, but allied to it by the cerci, though with short tegmina (probably *Melanoplus viola*). It was further doubtful whether the female belonged with either of the males. Certainly, then, we shall be obliged to consign Walker's species to merited oblivion. Probably no one of these specimens is one of the original types.
 7. *Calliptamus sanguineipes* Serville, Rev. Méth. Orth. (1831), pp. 93-94 [*Acrydium sanguineipes* Olivier, Encycl. Méth., VI (1791), p. 231]. Surinam. It is very doubtful if this belongs in the Melanopli. If De Geer's *Acridium aeneo-oculatum* is the same¹ his figure would lead us to presume it did not. I have not seen the species.

¹ See Serv., Orth., p. 670.

8. *Caloptenus scriptus* Walker, Cat. Derm. Salt. Brit. Mus., IV (1870), pp. 680-681. The only form to which I was inclined to refer this was that described here as *Melanoplus bilituratus*, but from Mr. Henshaw's examination of the types (see that species, p. 176) it can not be that, and I therefore find it at present indeterminate. I have specimens from Vancouver, the origin of Walker's species, which may possibly be referred to *scriptus*, since they differ from *Melanoplus bilituratus* in the points specified by Mr. Henshaw, but as I possess only females I do not feel satisfied of their specific validity.

9. *Caloptenus selectus* Walker, Cat. Derm. Salt. Brit. Mus., IV (1870), p. 682. Walker's types (from Oajaca, Mexico) were examined at my request by Mr. Henshaw to see whether they belong in the group *Melanopli* at all, and he states that they do. It is quite impossible by Walker's description even to guess to what genus it belongs, much less to determine the species without a direct comparison with the types. I know of no species with a broad, interrupted, piceous stripe along the costa of the tegmina.

10. *Pedies virescens* Saussure, Rev. Mag. Zool., 1861, pp. 157-158. Mexico. I have not been able to determine this species among my material, and question very much whether it belongs in the *Melanopli*. I am more inclined to think it allied to *Dactyloptomus*.

11. *Podisma viridis* Blanchard, Gay, Faun. Chil., Zool., VI (1851), pp. 75, 76. Chile. This is not one of the *Melanopli*, but belongs to *Antandrus* Stål.

Several other species have not been definitely determined, but have been placed in the synonymy of the described species with a mark of doubt. Such are *Caloptenus arcticus* Walker, *Loeusta leucostoma* Kirby, *Pezotettix longicornis* Saussure, *P. sumichrasti* Saussure, and *P. zimmermanni* Saussure, for which see the last preceding list (Appendix 1).

3. LIST OF SOUTH AMERICAN MELANOPLI.¹

1. *Atrachelacris unicolor* Giglio Tos, Boll. Mus. Tor., IX, Ort. Viaggi. Borelli, 1894, p. 21. Argentine Republic, Paraguay.

2. *Dichroplus amoenus* [*Pezotettix amoenus* Stål, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 8.] (Locality?)

3. *Dichroplus arrogans* [*Aceridium* (*Podisma*) *arrogans* Stål, Eug. Resa, Orth., 1860, p. 333; *Pezotettix* (*Dichroplus*) *arrogans* Stål, Rec. Orth., I (1873), p. 78; *Pezotettix arrogans* Stål, Obs. Orthopt., III, (1878), p. 6; *Aceridium strobilii* Brunner (MS.?)]. Argentine Republic, Uruguay.

4. *Dichroplus bergii* [*Pezotettix bergii* Stål, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), pp. 6, 7; *Aceridium crassipes* Brunner (MS.?)]. Argentine Republic, Paraguay, Brazil.

5. *Dichroplus bicolor* Giglio Tos, loc. cit., 1894, pp. 21-22. Argentine Republic, Paraguay.

6. *Dichroplus cliens* [*Aceridium* (*Podisma*) *cliens* Stål, Eug. Resa, Orth., 1860, p. 335; *Pezotettix* (*Dichroplus*) *cliens* Stål, Rec. Orth., I (1873), p. 78; *Pezotettix cliens* Stål, Obs. Orthopt., III (1878), p. 6]. Uruguay.

7. *Dichroplus distinguendus* Giglio Tos, loc. cit., 1894, pp. 22-23. Paraguay.

8. *Dichroplus elongatus* Giglio Tos, loc. cit., 1894, pp. 23-24. Argentine Republic, Paraguay.

9. *Dichroplus exilis* Giglio Tos, loc. cit., 1894, p. 23; Argentine Republic, Paraguay.

10. *Dichroplus fuscus* [*Gryllus fuscus* Thunberg, Mém. Acad. St. Petersb., V (1815), p. 235; *Pezotettix* (*Trigonophymus*) *fuscus* Stål, Rec. Orth., I (1873), p. 78]. Argentine Republic, Nova Cambria.

11. *Dichroplus lemniscatus* [*Aceridium* (*Podisma*) *lemniscatum* Stål, Eug. Resa, Orth., 1860, p. 334; *Pezotettix* (*Dichroplus*) *lemniscatus* Stål, Rec. Orth., I (1873), p. 78; *Pezotettix lemniscatus* Stål, Obs. Orthopt., III (1878), p. 6]. Argentine Republic, Brazil.

12. *Dichroplus patruelis* [*Aceridium* (*Podisma*) *patruelis* Stål, Eug. Resa, Orth., 1860, p. 334; *Pezotettix* (*Dichroplus*) *patruelis* Stål, Rec. Orth., I (1873), p. 78; *Pezotettix patruelis* Stål, Obs. Orth., III (1878), p. 6; *Aceridium vittigerum* Blanchard, Gay, Faun. Chil., Zool., VI (1851), pp. 73-74 (not *Acerid. vittigerum* Blanchard, Voy. pole sud., Zool., IV (1853), pp. 371-372, pl. III, fig. 9)]. Argentine Republic, Paraguay, Uruguay. If Blanchard's Chilean *vittigerum* belongs here it must take precedence.

13. *Dichroplus peruvianus* [*Pezotettix peruvianus* Stål, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), pp. 7-8]. Peru.

14. *Dichroplus punctulatus* [*Gryllus punctulatus* Thunberg, Mém. Acad. St. Petersb., IX (1824), p. 408; *Pezotettix punctulatus* Stål, Obs. Orth., III (1878), p. 6; *Aceridium* (*Podisma*) *fraternum* Stål, Eug. Resa, Orth., 1860, p. 333]. Argentine Republic, Uruguay, Brazil, New Grenada, Colombia.

15. *Dichroplus robustulus* [*Pezotettix robustulus* Stål, Bih. K. Sv. Vet.-Akad. Handl., V, No. 9 (1878), p. 7]. Southern Brazil.

16. *Paradichroplus aberrans* Giglio Tos, loc. cit., 1894, p. 28. Paraguay.

17. *Paradichroplus bipunctatus* Giglio Tos, loc. cit., 1894, pp. 26-27. Paraguay.

18. *Paradichroplus borellii* Giglio Tos, loc. cit., 1894, pp. 27-28. Paraguay.

19. *Paradichroplus brunneri* Giglio Tos, loc. cit., 1894, pp. 25-26. Argentine Republic, Paraguay.

20. *Pezotettix antisanae* Bolivar, Anal. Soc. Esp. Hist. Nat., X, Notes Ent. (1881), pp. 36-37. Antisana, Ecuador.

21. *Scopas obesus* Giglio Tos, loc. cit., 1894, p. 29. Paraguay.

22. *Scotussa impudica* Giglio Tos, loc. cit., 1894, p. 25. Uruguay.

¹Not including those mentioned in the body of this memoir.

EXPLANATION OF PLATES.

With the exception of a few figures specially noted below, all the drawings for these plates were made by Mr. J. Henry Blake, of Cambridge, Massachusetts, and the expense met by a special grant for the purpose from the ELIZABETH THOMPSON SCIENCE FUND, which is here gratefully acknowledged.

Unless otherwise stated (under the names of individuals or institutions placed in parentheses), all the drawings of American species were made from specimens in my own collection. Plate I illustrates the venation of the tegmina in a few species, and the figures are here magnified five diameters. The remaining plates show the abdominal appendages of the males of all but two or three of the species, and these are magnified four diameters.

PLATE I.

- FIG. a. *Melanoplus dawsoni completus*, male. Clifford, North Dakota (L. Bruner).
 b. *Melanoplus gladstoni*, male. Medicine Hat, Assiniboia.
 c. *Melanoplus fasciatus volaticus*, male. Charlevoix, Michigan (L. Bruner).
 d. *Melanoplus borealis*, male. Labrador coast, latitude 59°.
 e. *Phoetaliotes nebrascensis volucris*, male. Dallas, Texas.
 f. *Melanoplus extremus scandens*, male. Mount Washington, New Hampshire.
 g. *Melanoplus extremus junius*, male. Jackson, New Hampshire.
 h. *Melanoplus femur rubrum*, male. Adirondacks, New York.
 i. *Melanoplus marginatus amplus*, male. California (U.S.N.M.).
 k. *Melanoplus paroxyoides*, male. Key West, Florida.

PLATE II.

- FIG. 1. *Gymnoscirtetes pusillus*. Jacksonville, Florida (L. Bruner). From a type specimen.
 2. *Netrosoma fusiformis*. Montelovez, Mexico.
 3. *Netrosoma nigropleura*. Lerdo, Mexico (L. Bruner). From a type specimen.
 4. *Paradichroplus mexicanus*. Orizaba, Mexico. From Walker's type of *Caloptenus mexicanus*, the drawings obtained at the British Museum by Mr. S. Henshaw; magnification unknown; the specimen is a nymph.
 5. *Paradichroplus mexicanus*. Orizaba, Mexico.
 6. *Paradichroplus varicolor*. Columbia.
 7. *Phaedrotettix angustipennis*. Mount Alvarez, Mexico.
 8. *Conalcaea miguelitana*. Sierra de San Miguelito, Mexico.
 9. *Conalcaea neomexicana*. Silver City, New Mexico (L. Bruner).
 10. *Barytettix crassus*. Lower California (L. Bruner).
 11. *Phaulotettix compressus*. Montelovez, Mexico.

PLATE III.

- FIG. 1. *Cephalotettix parvulus*. Otoyac, Mexico (L. Bruner). From a type specimen.
 2. *Rhabdotettix concinnus*. Waco, Texas (Mus. Comp. Zool.).
 3. *Rhabdotettix palmeri*. Montelovez, Mexico.
 4. *Cyclocercus bistrigata*. Venis Mecas, Mexico.
 5. *Cyclocercus accola*. Goliad, Texas.
 6. *Cyclocercus valga*. Sierra Nola, Mexico.
 7. *Sinaloa behrensii*. Sinaloa, Mexico.
 8. *Paraidemona punctata*. Texas.
 9. *Paraidemona punctata*. Texas. From a type of *Pezotettix nudus*.
 10. *Paraidemona mimica*. Uvalde, Texas.

PLATE IV.

- FIG. 1. *Aidemona azteca*. San Luis Potosi, Mexico.
 2. *Hypochlora alba*. Colorado.
 3. *Campylacanthus acutipennis*. Dallas, Texas.

- FIG. 4. *Campylacantha olivacea*. Texas.
 5. *Campylacantha similis*. Lerdo, Mexico (L. Bruner).
 6. *Campylacantha vivax*. Northern New Mexico. From the type specimen.
 7. *Eotettix signatus*. East Florida (J. McNeill). From the type specimen.
 8. *Hesperotettix viridis*. Lakin, Kansas.
 9. *Hesperotettix meridionalis*. Guanajuato, Mexico. (U.S.N.M.)
 10. *Hesperotettix festivus*. Salt Lake Valley, Utah.

PLATE V.

- FIG. 1. *Hesperotettix pacificus*. Los Angeles, California (L. Bruner). From a type specimen.
 2. *Hesperotettix brevipennis*. Wellesley, Massachusetts.
 3. *Hesperotettix pratensis*. Dallas, Texas.
 4. *Hesperotettix speciosus*. Nebraska.
 5. *Aeoloplus tenuipennis*. Fort Grant, Arizona (U.S.N.M.).
 6. *Aeoloplus elegans*. Las Cruces, New Mexico (U.S.N.M.).
 7. *Aeoloplus regalis*. Lakin, Kansas.
 8. *Aeoloplus californicus*. California (S. Henshaw).
 9. *Aeoloplus chenopodii*. Grand Junction, Colorado. From a type specimen.
 10. *Aeoloplus turnbulli*. Newcastle, Wyoming (L. Bruner).

PLATE VI.

- FIG. 1. *Aeoloplus plagosus*. Northern New Mexico. From the type specimen.
 2. *Aeoloplus uniformis*. Fort Whipple, Arizona.
 3. *Aeoloplus arizonensis*. Fort Whipple, Arizona.
 4. *Aeoloplus oculatus*. Mohave, New Mexico (L. Bruner).
 5. *Bradynotes hispida*. Colville Valley, Washington (L. Bruner). From a type specimen.
 6. *Bradynotes caurus*. Yakima River, Washington (U.S.N.M.).
 7. *Bradynotes expleta*. Easton, Washington (U.S.N.M.).
 8. *Bradynotes pinguis*. Washington (?) (S. Henshaw).
 9. *Bradynotes obesa*. Helena, Montana.
 10. *Bradynotes referta*. Soldier, Idaho (L. Bruner).

PLATE VII.

- FIG. 1. *Bradynotes satur*. Placer County, California (U.S.N.M.).
 2. *Dendrotettix quercus*. Travis County, Texas (U.S.N.M.).
 3. *Podisma glacialis*. Mount Washington, New Hampshire.
 4. *Podisma variegata*. Ithaca, New York.
 5. *Podisma nubicola*. Mount Lincoln, Colorado.
 6. *Podisma stupefacta*. New Mexico.
 7. *Podisma dodgei*. Pikes Peak, Colorado.
 8. *Podisma ascensor*. American Fork Canyon, Utah.
 9. *Podisma marshallii*. Mount Lincoln, Colorado.
 10. *Podisma oregonensis*. Henry Lake, Idaho (L. Bruner).

PLATE VIII.

- FIG. 1. *Podisma pedemontana*. Europe. Drawn by J. Redtenbacher.
 2. *Podisma cobellii*. Europe.
 3. *Podisma parnassica*. Mount Parnassus, Greece. From a type specimen.
 4. *Podisma pyrenaea*. Pic du Midi, France.
 5. *Podisma salamandra*. Europe.
 6. *Podisma baldensis*. Europe.
 7. *Podisma dairisama*. Japan (U.S.N.M.).
 8. *Podisma fieberi*. Europe.
 9. *Podisma schmidtii*. Europe.
 10. *Podisma pedestris*. Vienna, Austria.

PLATE IX.

- FIG. 1. *Podisma alpina alpina*. Villars, Vaud, Switzerland.
 2. *Podisma frigida*. Lapland.
 3. *Podisma (Eupodisma) primnoa*. Verschneydinsk, Siberia.
 4. *Paratylotropidia brunneri*. Dakota (L. Bruner). The specimen is partly damaged.
 5. *Paratylotropidia brunneri*. Texas. From a pen-and-ink sketch by Hofrath Brunner von Wattenwyl. Natural size.

PLATE X.

- FIG. 1. *Melanoplus marculentus*. Sierra de San Miguelito, Mexico.
 2. *Melanoplus lakinus*. Colorado. From a type specimen.
 3. *Melanoplus sonora*. Sonora, Mexico.
 4. *Melanoplus occidentalis*. Lakin, Kansas.
 5. *Melanoplus cuneatus*. Silver City, New Mexico. (U.S.N.M.)
 6. *Melanoplus flubellifer*. South Park, Colorado. From the type specimen.
 7. *Melanoplus discolor*. Texas. From a type specimen.
 8. *Melanoplus simplex*. Colorado.
 9. *Melanoplus rileyanus*. Los Angeles, California. (U.S.N.M.)
 10. *Melanoplus herbaceus*. El Paso, Texas (L. Bruner). From a type specimen.

PLATE XI.

- FIG. 1. *Melanoplus flavescens*. San Diego, California. (U.S.N.M.)
 2. *Melanoplus pictus*. Bradshaw Mountain, Arizona (L. Bruner).
 3. *Melanoplus bowditchi*. Pueblo, Colorado. From a type specimen.
 4. *Melanoplus flavidus*. Morrison, Colorado. From a type specimen.
 5. *Melanoplus elongatus*. Bledos, Mexico.
 6. *Melanoplus glaucipes*. Dallas, Texas.
 7. *Melanoplus brunneri*. Fort McLeod, Alberta (L. Bruner).
 8. *Melanoplus kennicottii*. Yukon River, Alaska. From a type specimen.
 9. *Melanoplus excelsus*. Mount Lincoln, Colorado.
 10. *Melanoplus utahensis*. Salt Lake Valley, Utah. (U.S.N.M.) From the type specimen. The central figure shows the tip of the supraanal plate from behind.

PLATE XII.

- FIG. 1. *Melanoplus alaskanus*. Alaska (U.S.N.M.).
 2. *Melanoplus affinis*. Salt Lake Valley, Utah (L. Bruner). From a type specimen.
 3. *Melanoplus intermedius*. White River, Colorado.
 4. *Melanoplus intermedius*. Yellowstone (L. Bruner).
 5. *Melanoplus bilituratus*. Vancouver Island, British Columbia (U.S.N.M.).
 6. *Melanoplus defectus*. Colorado (L. Bruner).
 7. *Melanoplus atlans*. Salt Lake Valley, Utah.
 8. *Melanoplus sprctus*. Salt Lake Valley, Utah.
 9. *Melanoplus diminutus*. Monterey, California.
 10. *Melanoplus consanguineus*. Sonora County, California (U.S.N.M.).

PLATE XIII.

- FIG. 1. *Melanoplus sierranus*. Truckee, California.
 2. *Melanoplus ater*. San Francisco, California (L. Bruner).
 3. *Melanoplus devastator obscurus*. California (L. Bruner).
 4. *Melanoplus devastator obscurus*. Sissons, California.
 5. *Melanoplus devastator typicalis*. Tighes Station, San Diego County, California.

- FIG. 6. *Melanoplus devastator affinis*. California (S. Henshaw).
 7. *Melanoplus devastator conspicuus*. Sacramento, California (U.S.N.M.).
 8. *Melanoplus virgatus*. Sacramento, California (U.S.N.M.).
 9. *Melanoplus uniformis*. Sacramento County, California (U.S.N.M.).
 10. *Melanoplus angelicus*. Los Angeles, California (U.S.N.M.).

PLATE XIV.

- FIG. 1. *Melanoplus impudicus*. Georgia.
 2. *Melanoplus nitidus*. Tepic, Mexico (L. Bruner).
 3. *Melanoplus aridus*. Arizona (L. Bruner).
 4. *Melanoplus indigens*. Salmon City, Idaho (L. Bruner).
 5. *Melanoplus scudderi*. Lexington, Kentucky.
 6. *Melanoplus scudderi*. Dallas, Texas.
 7. *Melanoplus gillettei*. Rabbit's Ear Pass, Colorado (C. P. Gillette).
 8. *Melanoplus artemisiae*. Salmon City, Idaho. From a type specimen.
 9. *Melanoplus mancus*. Speckled Mountain, Maine.
 10. *Melanoplus caneri*. Cape St. Lucas, Lower California.

PLATE XV.

- FIG. 1. *Melanoplus reflexus*. Valle del Maiz, Mexico.
 2. *Melanoplus meridionalis*. Mount Alvarez, Mexico.
 3. *Melanoplus militaris*. Soldier, Idaho (L. Bruner).
 4. *Melanoplus nigrescens*. Georgia. From the type specimen.
 5. *Melanoplus dawsoni tellustris*. Jefferson County, Iowa.
 6. *Melanoplus gladstoni*. Medicine Hat, Assiniboia. From a type specimen.
 7. *Melanoplus palmeri*. Fort Whipple, Arizona.
 8. *Melanoplus montanus*. Montana (L. Bruner).
 9. *Melanoplus washingtonianus*. Colville Valley, Washington (Mus. Comp. Zool.). From a type specimen.
 10. *Melanoplus walshii*. Michigan.

PLATE XVI.

- FIG. 1. *Melanoplus altitudinum*. Sheridan, Wyoming.
 2. *Melanoplus gracilipes*. San Diego, California.
 3. *Melanoplus geniculatus*. Mexico.
 4. *Melanoplus rusticus*. Texas. From the type specimen, the drawing furnished by Doctor Aurivillius. (Mus. Stockh.)
 5. *Melanoplus pacificus*. Sissons, California. From the type specimen.
 6. *Melanoplus boreckii*. Marin County, California.
 7. *Melanoplus tenuipennis*. Los Angeles, California (L. Bruner).
 8. *Melanoplus missionum*. Los Angeles County, California (U.S.N.M.).
 9. *Melanoplus fuscipes*. San Luis Obispo, California.
 10. *Melanoplus scitulus*. Mount Alvarez, Mexico.

PLATE XVII.

- FIG. 1. *Melanoplus flabellatus*. Dallas, Texas. From a type specimen.
 2. *Melanoplus puer*. Fort Reed, Florida. From a type specimen.
 3. *Melanoplus inornatus*. Mexico (?). From a type specimen.
 4. *Melanoplus viridipes*. Moline, Illinois.
 5. *Melanoplus decorus*. Dingo Bluff, North Carolina.
 6. *Melanoplus attenuatus*. Smithville, North Carolina.
 7. *Melanoplus amplectens*. Bee Spring, Kentucky (Mus. Comp. Zool.).
 8. *Melanoplus saltator*. Portland, Oregon.
 9. *Melanoplus rotundipennis*. Florida. From the type specimen.
 10. *Melanoplus obovatipennis*. Indiana.

PLATE XVIII.

- FIG. 1. *Melanoplus juveneus*. Fort Reed, Florida.
 2. *Melanoplus fasciatus curtus*. Salmonier, Newfoundland.
 3. *Melanoplus fasciatus curtus*. Colorado.
 4. *Melanoplus fasciatus volaticus*. Charlevoix, Michigan (L. Bruner).
 5. *Melanoplus borealis*. Labrador, latitude 59°.
 6. *Melanoplus alleni*. Crawford County, Iowa.
 7. *Melanoplus snowii*. Magdalena, New Mexico (Univ. Kans.).
 8. *Melanoplus plumbeus*. Colorado.
 9. *Melanoplus propinquus*. Fort Reed, Florida.
 10. *Melanoplus extremus junius*. Jackson, New Hampshire.

PLATE XIX.

- FIG. 1. *Melanoplus femur rubrum*. Williamstown, Massachusetts.
 2. *Melanoplus femur rubrum*. Dallas, Texas. From a type of *Caloptenus decorator*.
 3. *Melanoplus femur rubrum*. Salt Lake Valley, Utah. From a type of *Melanoplus interior*.
 4. *Melanoplus femur rubrum*. Sissons, California.
 5. *Melanoplus monticola*. Sierra Blanca, Colorado.
 6. *Melanoplus bispinosus*. San Antonio, Texas (L. Bruner).
 7. *Melanoplus terminalis*. Gulf Coast of Texas.
 8. *Melanoplus cyanipes*. Pasadena, California.
 9. *Melanoplus cinereus*. Wallawalla, Washington. From a type specimen.
 10. *Melanoplus complanatus*. Cape St. Lucas, Lower California.

PLATE XX.

- FIG. 1. *Melanoplus canonicus*. Grand Canyon of the Colorado, Arizona (L. Bruner).
 2. *Melanoplus comptus*. Sidney, Nebraska (L. Bruner).
 3. *Melanoplus coccineipes*. Sand Hills, Nebraska.
 4. *Melanoplus coccineipes*. Barber County, Kansas (L. Bruner).
 5. *Melanoplus coccineipes*. Colorado.
 6. *Melanoplus angustipennis*. Fort Robinson, Nebraska (L. Bruner).
 7. *Melanoplus impiger*. Barber County, Kansas (L. Bruner).
 8. *Melanoplus impiger*. Dallas, Texas.
 9. *Melanoplus foedus*. Pueblo, Colorado. From a type specimen.
 10. *Melanoplus corpulentus*. Sierra de San Miguelito, Mexico.

PLATE XXI.

- FIG. 1. *Melanoplus packardii*. Dallas, Texas. (Specimen with blue hind tibiae.)
 2. *Melanoplus packardii*. West Point, Nebraska (L. Bruner). (Specimen with blue hind tibiae.)
 3. *Melanoplus packardii*. Soda Springs, Idaho (L. Bruner). (Specimen with red hind tibiae.)
 4. *Melanoplus packardii*. Poudre River, Colorado (L. Bruner). (Specimen with blue hind tibiae.)
 5. *Melanoplus conspersus*. Southwest Nebraska (L. Bruner).
 6. *Melanoplus compactus*. Dakota (U.S. N.M.). From a type specimen.
 7. *Melanoplus dumicola*. Texas. From a type specimen.
 8. *Melanoplus variabilis*. City of Mexico. From a type specimen.
 9. *Melanoplus lepidus*. Truckee, California.
 10. *Melanoplus blatchleyi*. (Locality unknown)

PLATE XXII.

- FIG. 1. *Melanoplus texanus*. Texas. From a type specimen.
 2. *Melanoplus plebejus*. Dallas, Texas. From a type specimen of *Pezotettix pupaeformis*.

- FIG. 3. *Melanoplus gracilis*. Dallas County, Iowa.
 4. *Melanoplus inops*. Florida (L. Bruner).
 5. *Melanoplus marginatus*. Southern California. From a type specimen.
 6. *Melanoplus paroxyoides*. Key West, Florida.
 7. *Melanoplus alpinus*. Henry Lake, Idaho (U.S.N.M.). The central figure represents the posterior view of the subgenital plate.
 8. *Melanoplus infantilis*. South Park, Colorado. From a type specimen.
 9. *Melanoplus minor*. Crawford County, Iowa.
 10. *Melanoplus confusus*. Munson's Hill [Kentucky?] (Mus. Comp. Zool.).

PLATE XXIII.

- FIG. 1. *Melanoplus keeleri*. North Carolina. From a type specimen of *Melanoplus tenebrosus*.
 2. *Melanoplus deletor*. Georgia.
 3. *Melanoplus differentialis*. Agua Caliente, California.
 4. *Melanoplus differentialis*. Pueblo, Colorado.
 5. *Melanoplus robustus*. Dallas, Texas. From a type specimen.
 6. *Melanoplus collinus*. Provincetown, Massachusetts.
 7. *Melanoplus luridus*. Nebraska.

PLATE XXIV.

- FIG. 1. *Melanoplus viola*. Illinois. From a type specimen.
 2. *Melanoplus clypeatus*. Georgia. From a type specimen.
 3. *Melanoplus furcatus*. Jacksonville, Florida (L. Bruner).
 4. *Melanoplus femoratus*. Massachusetts.
 5. *Melanoplus bivittatus*. Dallas, Texas.

PLATE XXV.

- FIG. 1. *Melanoplus thomasi*. Lerdo, Mexico (L. Bruner). From a type specimen.
 2. *Melanoplus yarrowii*. Grand Junction, Colorado (C. P. Gillette).
 3. *Melanoplus olivaceus*. Los Angeles, California (L. Bruner). From a type specimen.
 4. *Melanoplus punctulatus*. Ellenville, New York.
 5. *Melanoplus arboreus*. Dallas, Texas.
 6. *Phoetaliotes nebrascensis nebrascensis*. Dallas, Texas.
 7. *Phoetaliotes nebrascensis volucris*. Dallas, Texas.
 8. *Paroxya atlantica*. Sanford, Florida.
 9. *Paroxya hoosieri*. Indiana.
 10. *Paroxya floridana*. Fort Reed, Florida.

PLATE XXVI.

- FIG. 1. *Poecilotettix picticornis*. Arizona (L. Bruner).
 2. *Poecilotettix sanguineus*. Bradshaw Mountain, Arizona (L. Bruner).
 3. *Poecilotettix coccinatus*. Los Angeles, California (U.S.N.M.).
 4. *Oedaleonotus enigma jucundus*. Agua Caliente, California. From a type specimen of *Pezotettix jucundus*.
 5. *Oedaleonotus enigma enigma*. Santa Barbara, California. From a type specimen of *Pezotettix enigma*.
 6. *Oedaleonotus enigma collaris*. Tipton, California. From a type specimen of *Melanoplus collaris*.
 7. *Asemoplus montanus*. Montana.
 8. *Philocleon nigrovittatus*. Comancho, Mexico (L. Bruner).
 9. *Philocleon nigrovittatus*. Mexico. From a type specimen, the drawing obtained through Doctor Aurivillius. (Mus. Stockh.)
 10. *Aptenopedes sphenarioides*. Fort Reed, Florida. From a type specimen.
 11. *Aptenopedes rufovittata*. Fort Reed, Florida. From a type specimen.
 12. *Aptenopedes aptera*. Jacksonville, Florida. (U.S.N.M.)

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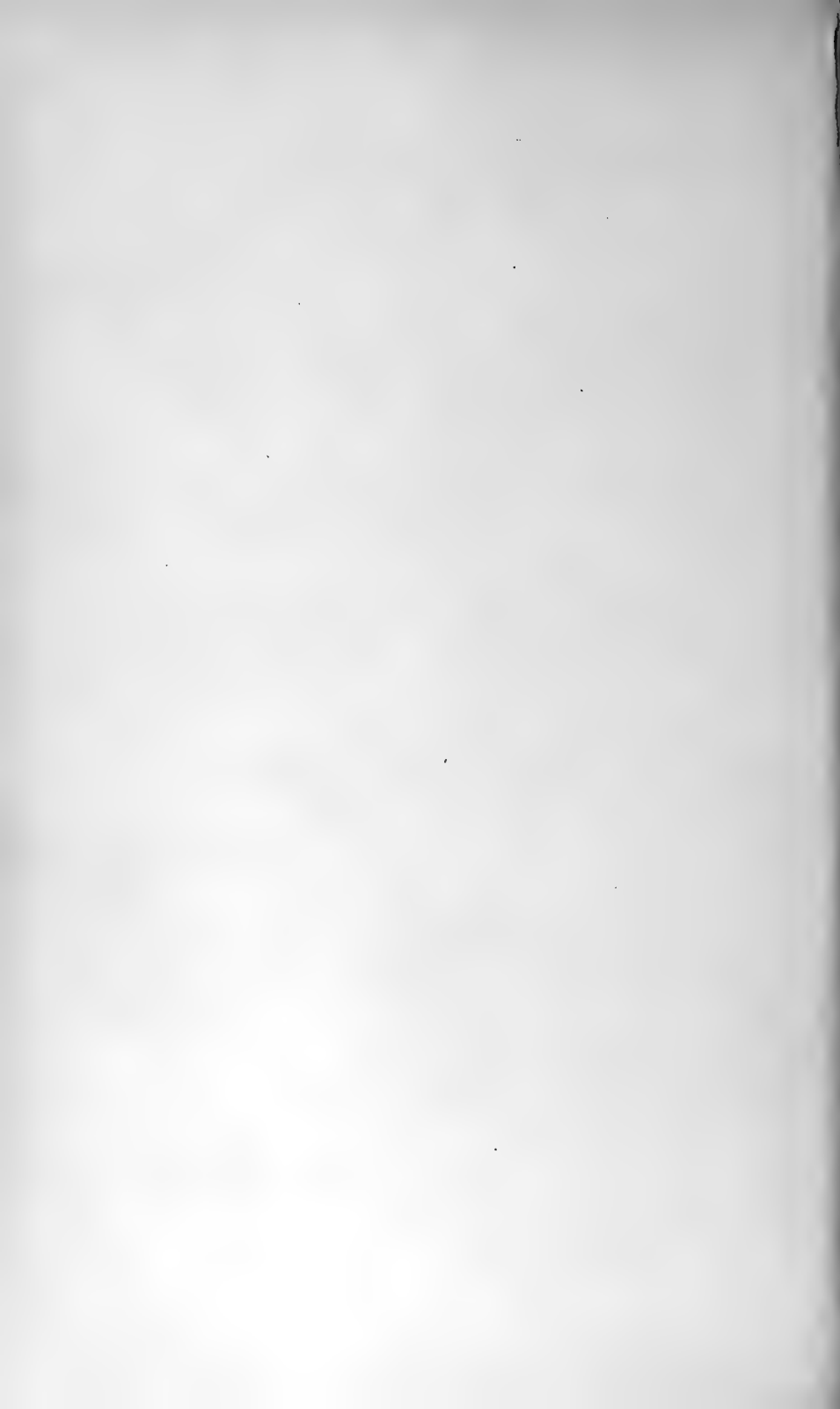
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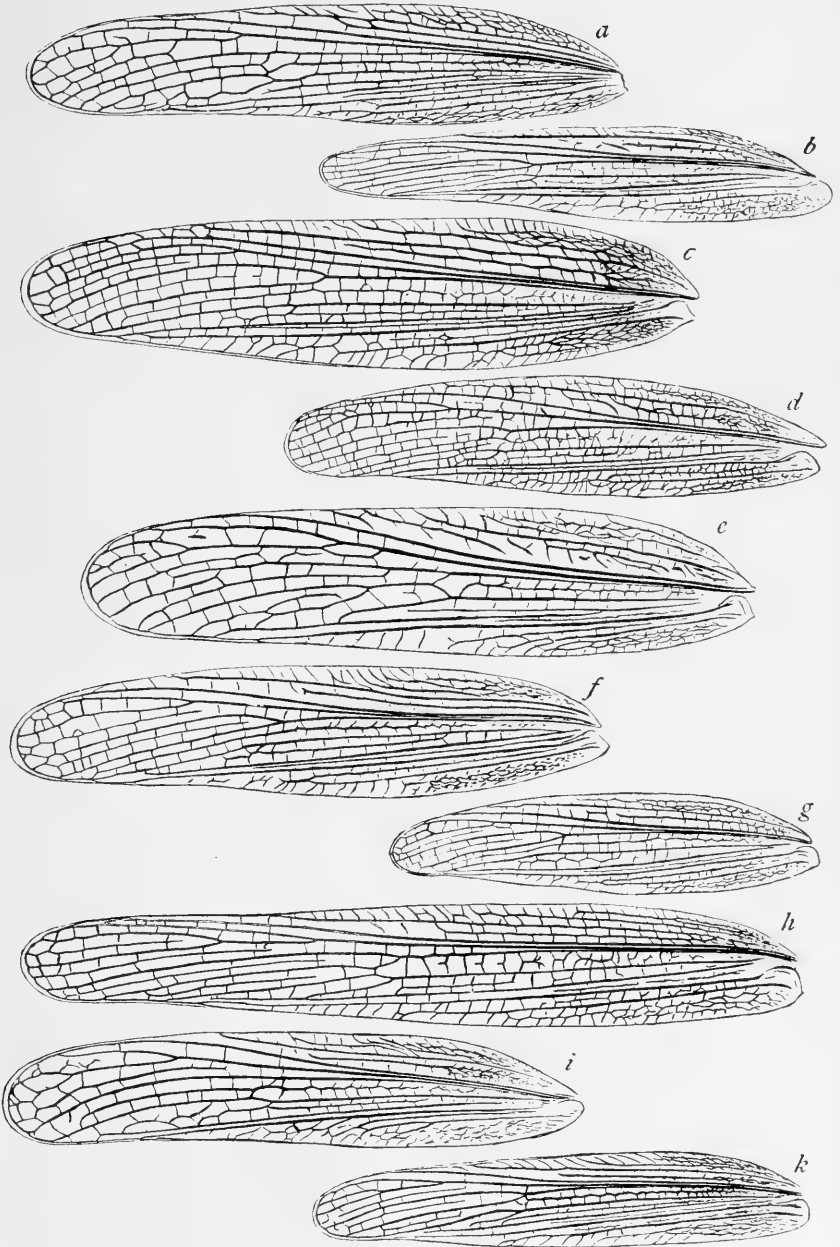
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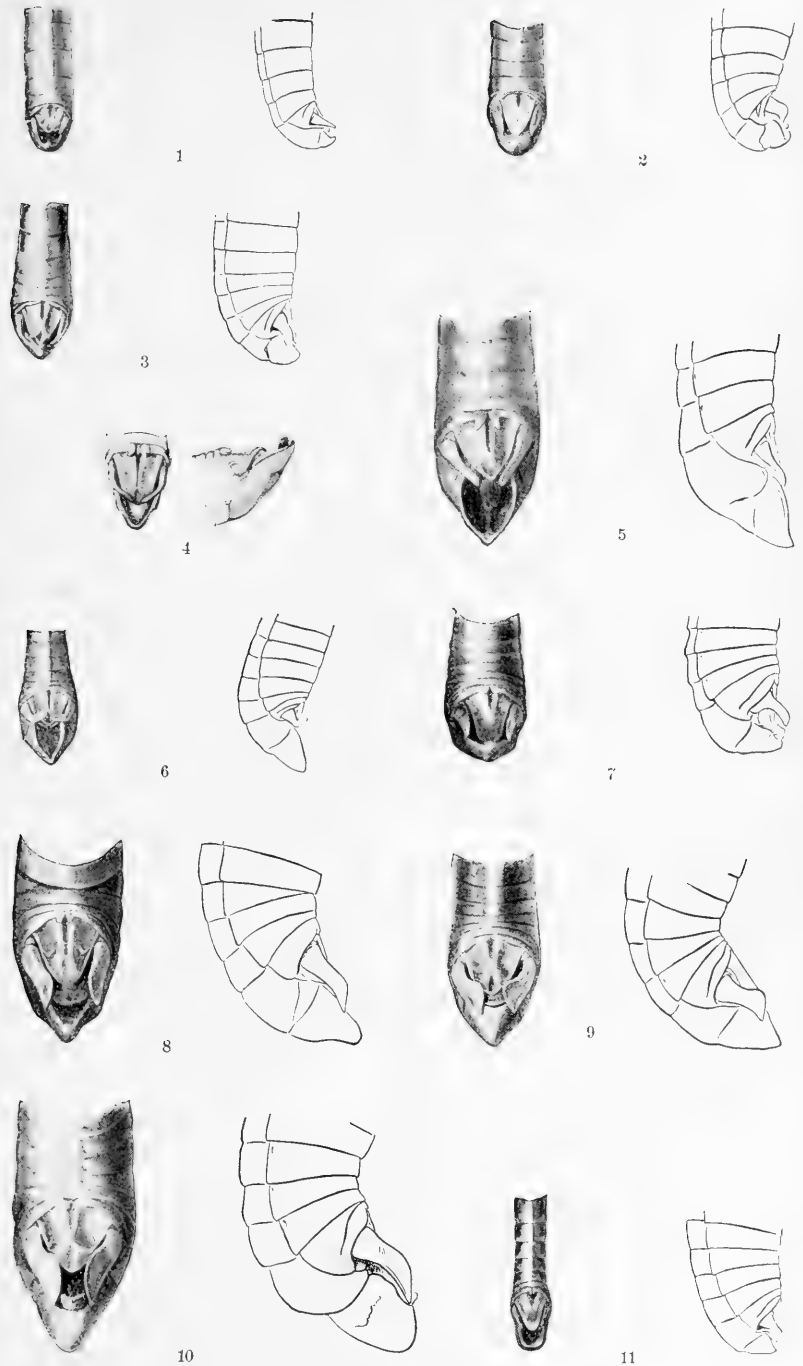




TEGMINA OF SPECIES OF MELANOPLUS AND PHOETALIOTES.

FOR EXPLANATION OF PLATE SEE PAGE 407.





MALE ABDOMINAL APPENDAGES OF GYMNO SCIRTETES, NETROSOMA, PARADICHRPLUS, PHAEDROTETTIX, CONALCAEA, BARYTETTIX, AND PHAULOTETTIX.

FOR EXPLANATION OF PLATE SEE PAGE 407.





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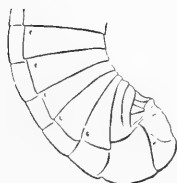
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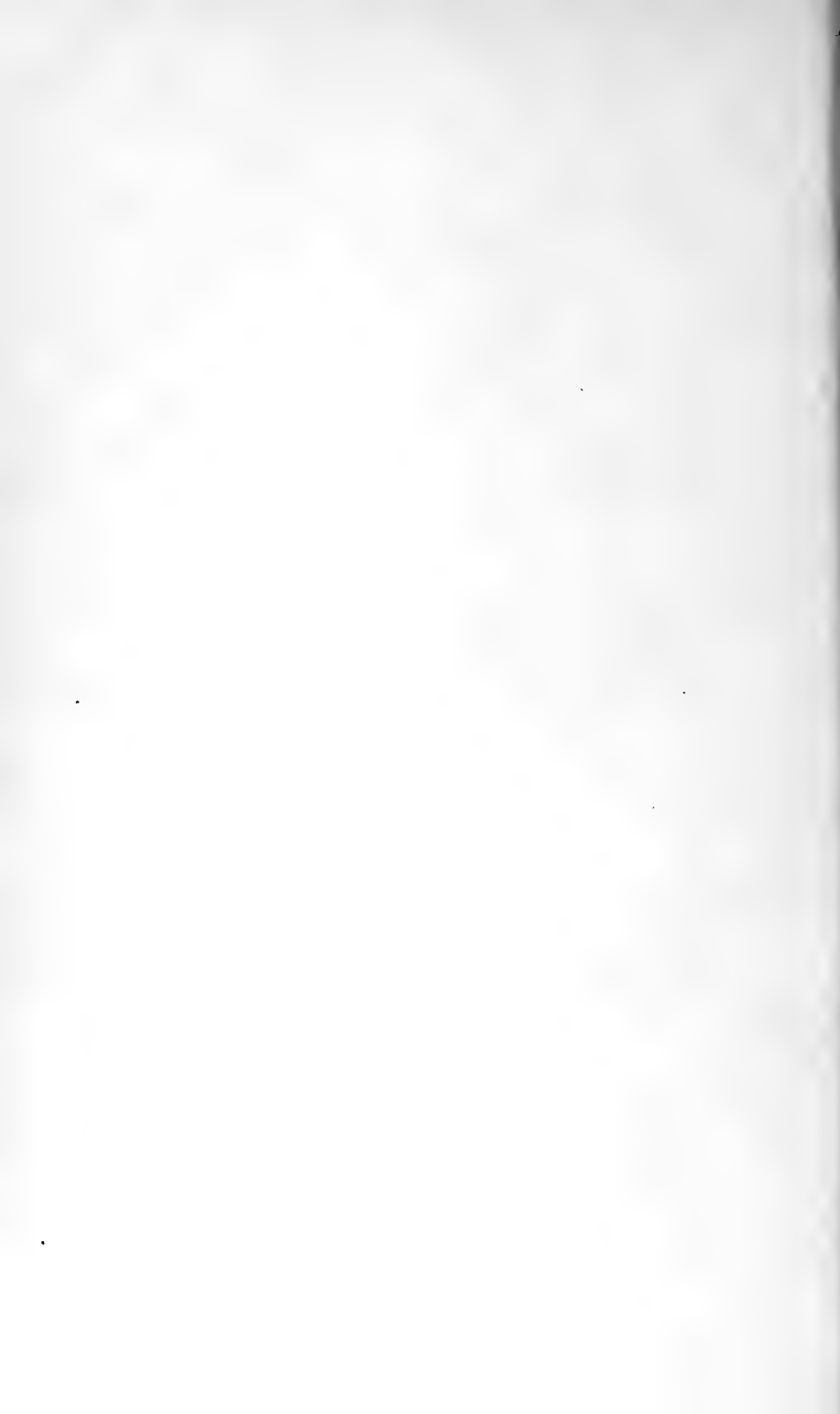


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MALE ABDOMINAL APPENDAGES OF CEPHALOTETTIX, RHABDOTETTIX, CYCLOCERCUS, SINALOA, AND PARAIDEMONA.

FOR EXPLANATION OF PLATE SEE PAGE 407.





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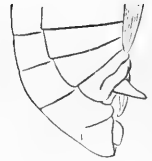
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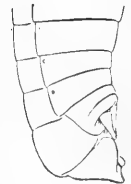
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MALE ABDOMINAL APPENDAGES OF AIDEMONA, HYPOCHLORA, CAMPYLACANTHA, EOTETTIX, AND HESPEROTETTIX.

FOR EXPLANATION OF PLATE SEE PAGES 407, 408.





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MALE ABDOMINAL APPENDAGES OF HESPEROTETTIX AND AEOLOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 408.





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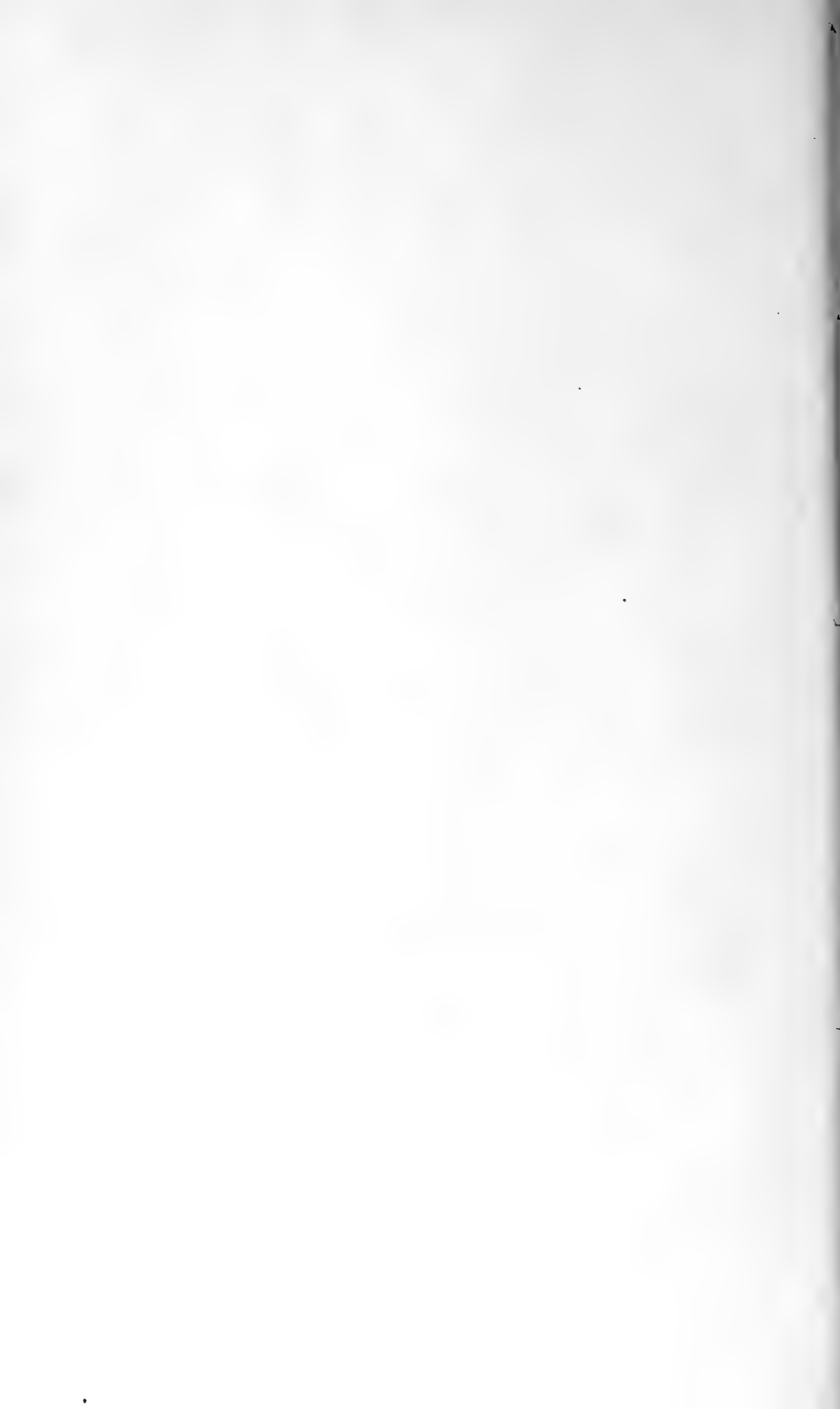


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MALE ABDOMINAL APPENDAGES OF AEOLOPLUS AND BRADYNOTES.

FOR EXPLANATION OF PLATE SEE PAGE 408.





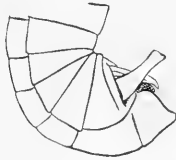
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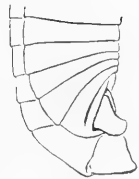
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MALE ABDOMINAL APPENDAGES OF BRADYNOTES, DENDROTETTIX, AND PODISMA.

FOR EXPLANATION OF PLATE SEE PAGE 408.





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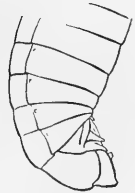
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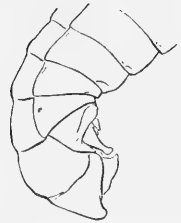
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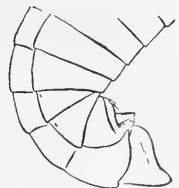
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MALE ABDOMINAL APPENDAGES OF OLD WORLD SPECIES OF PODISMA.

FOR EXPLANATION OF PLATE SEE PAGE 408.





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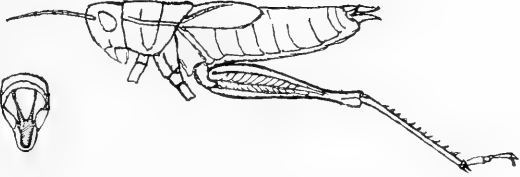
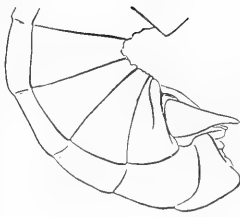
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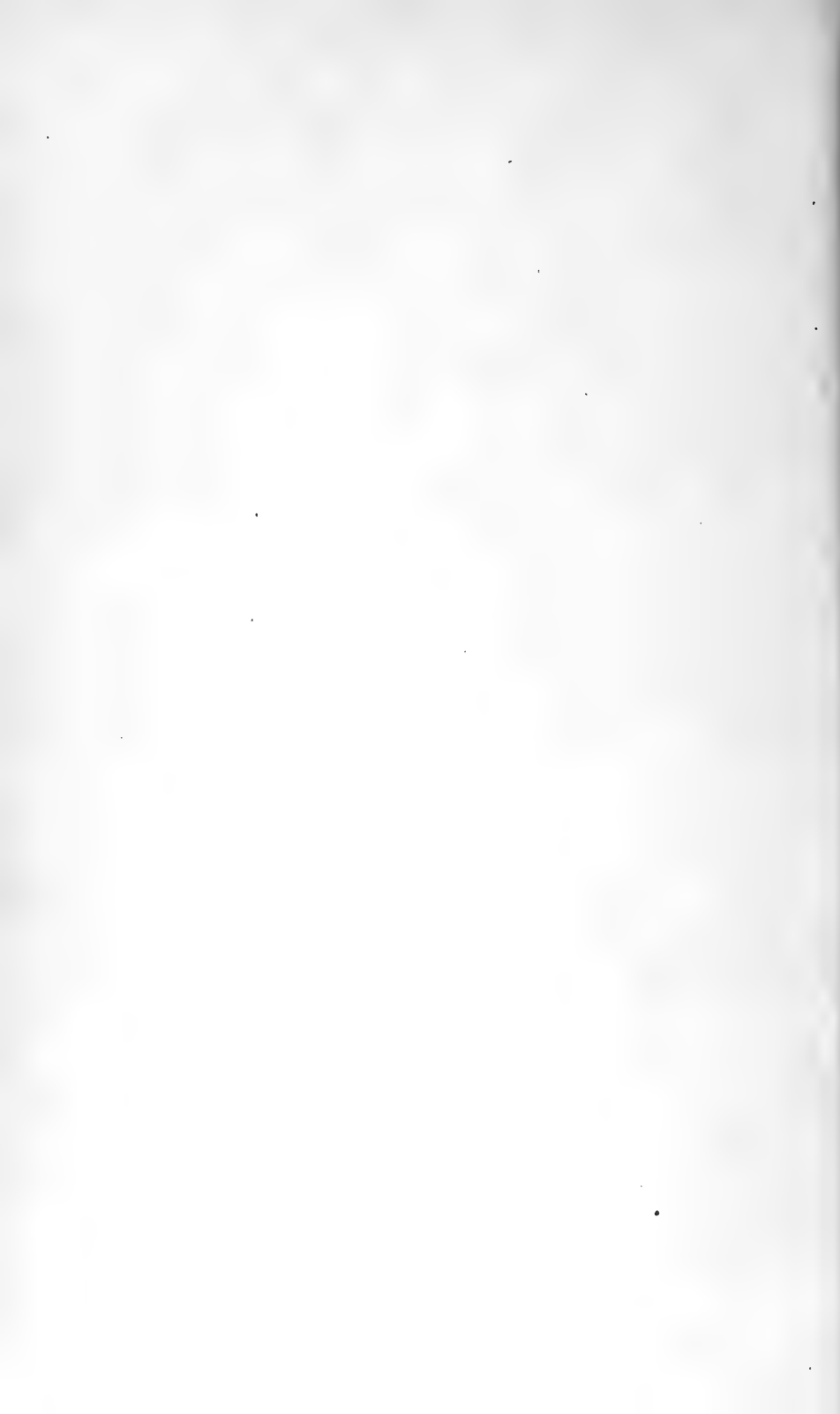
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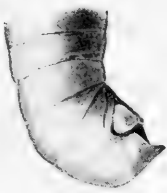


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MALE ABDOMINAL APPENDAGES OF *PODISMA* AND *PARATYLOTROPIDIA*;
PARATYLOTROPIDIA BRUNNERI.

FOR EXPLANATION OF PLATE SEE PAGE 409.





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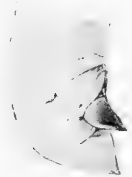
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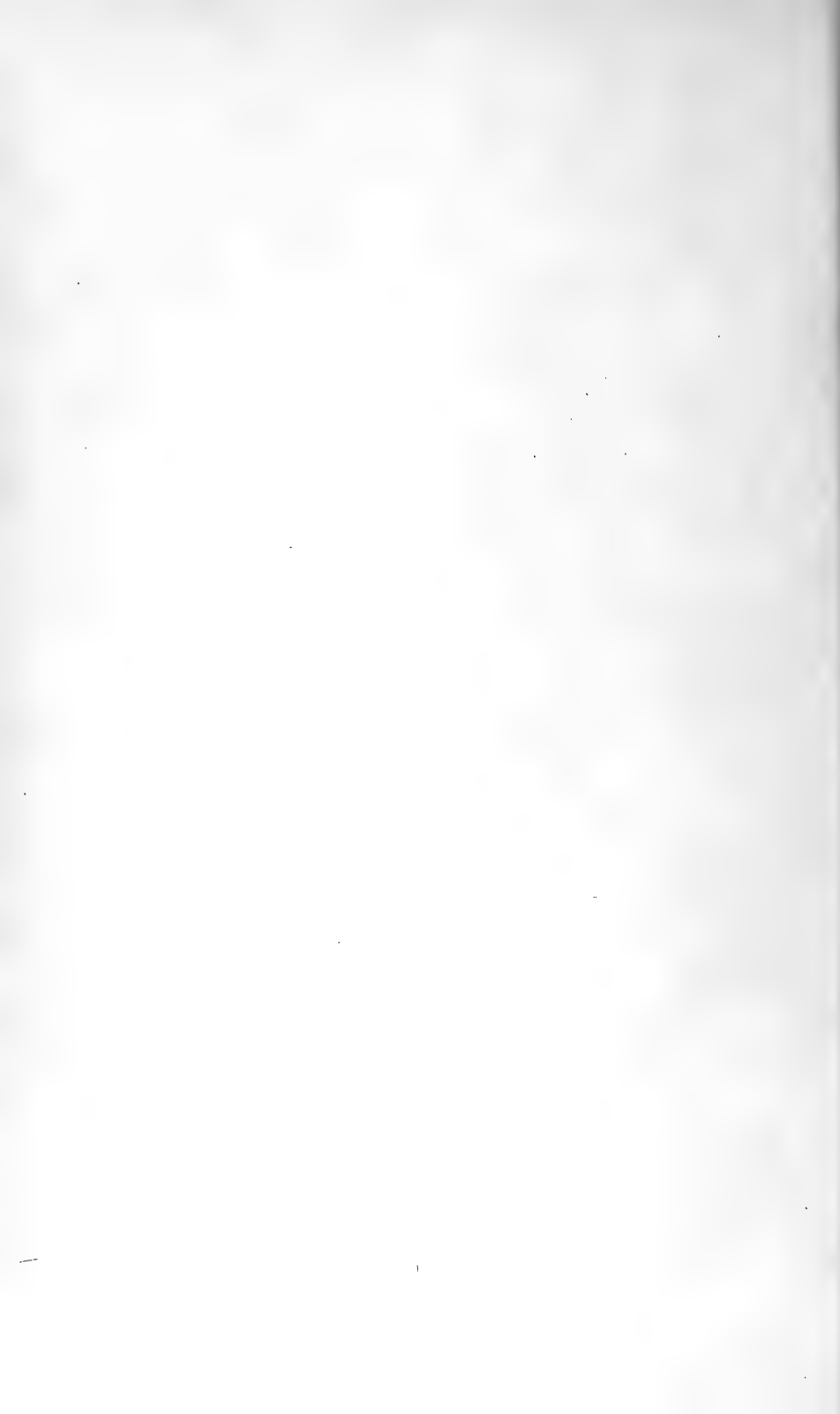
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MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 409.





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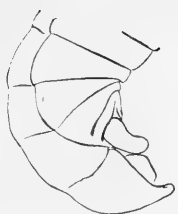
MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 409.





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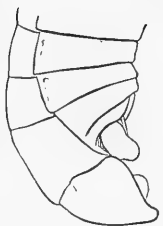
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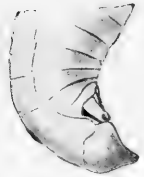
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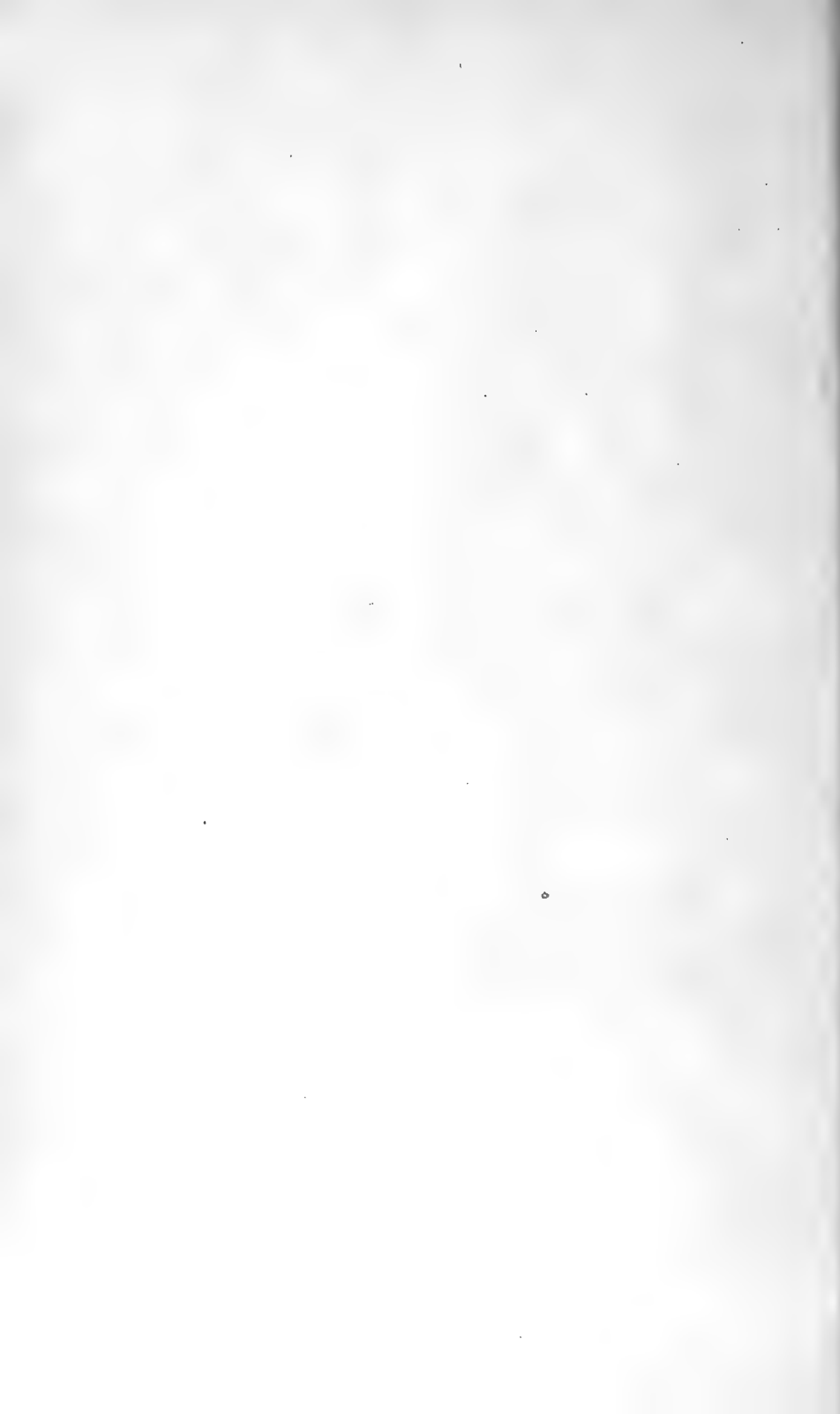


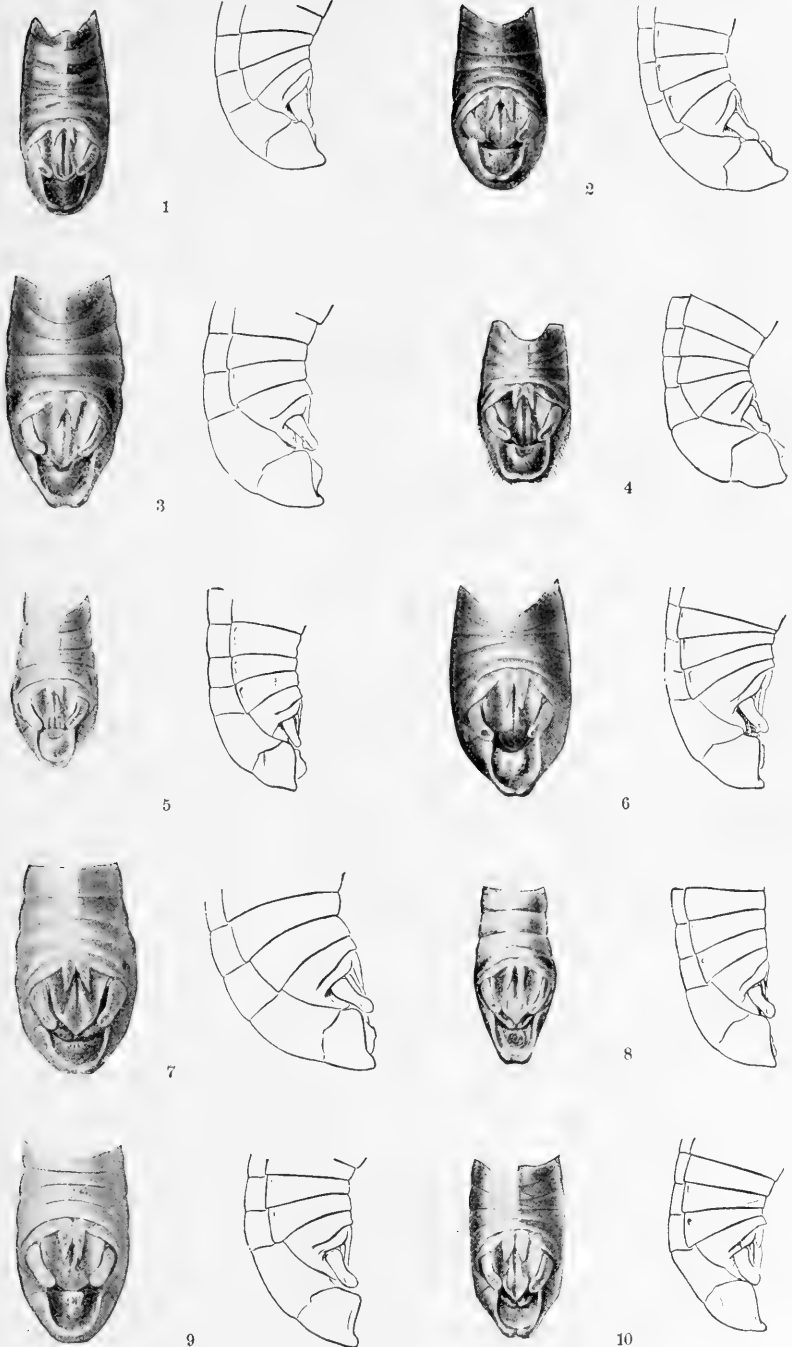
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MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 409





MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGES 409, 410.





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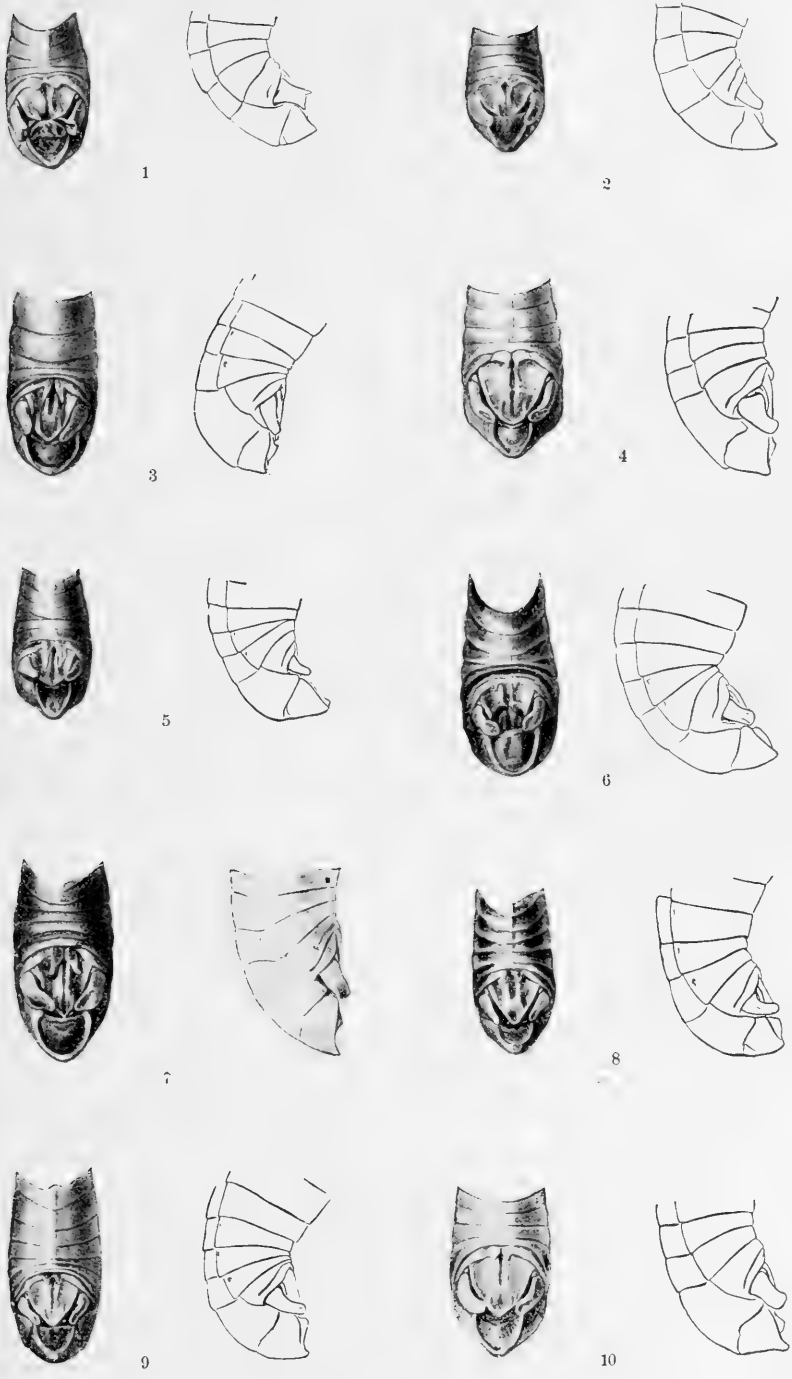
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MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 410.





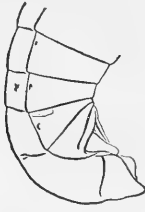
MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 410.





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MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 410.





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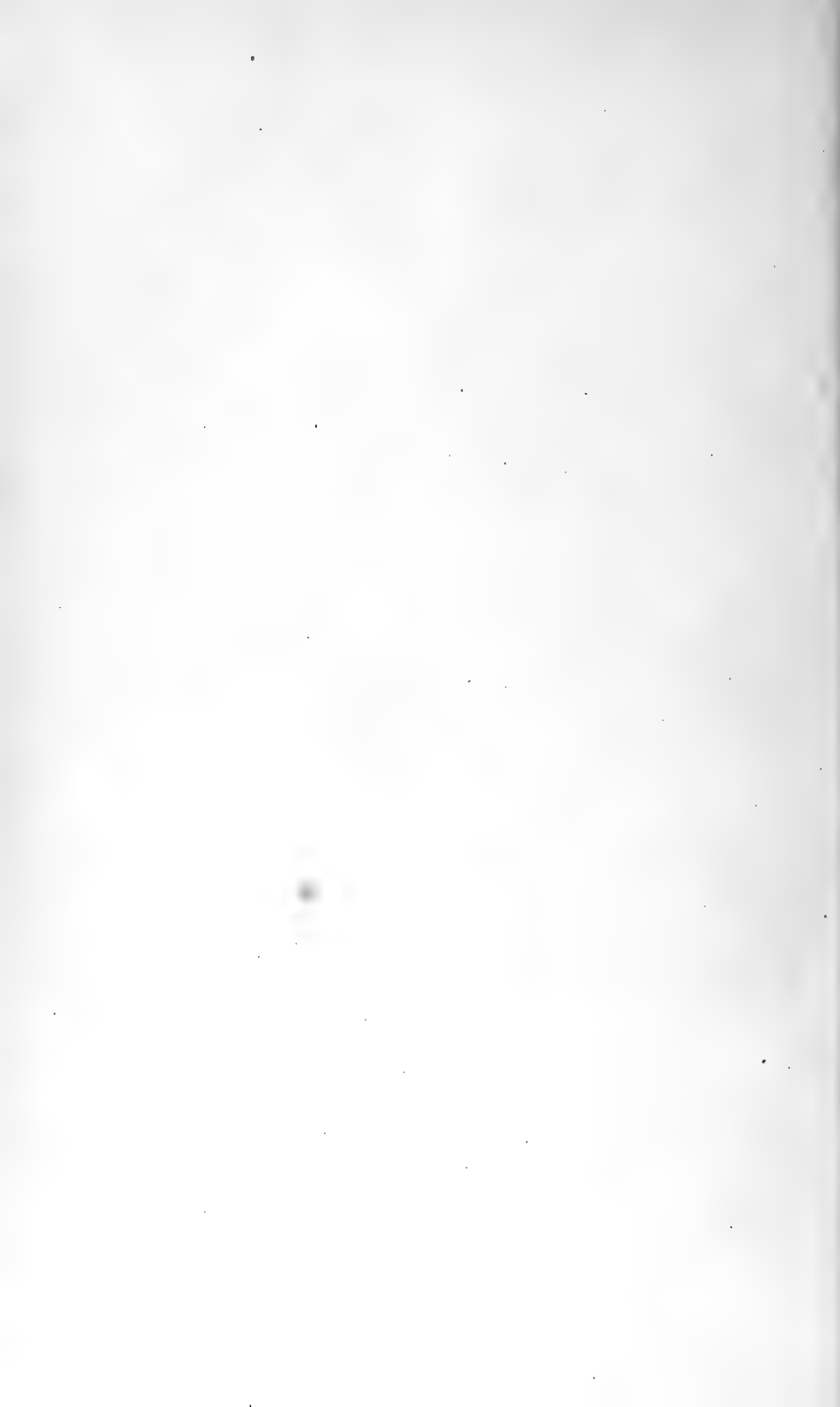
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MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 410.





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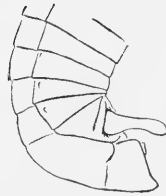
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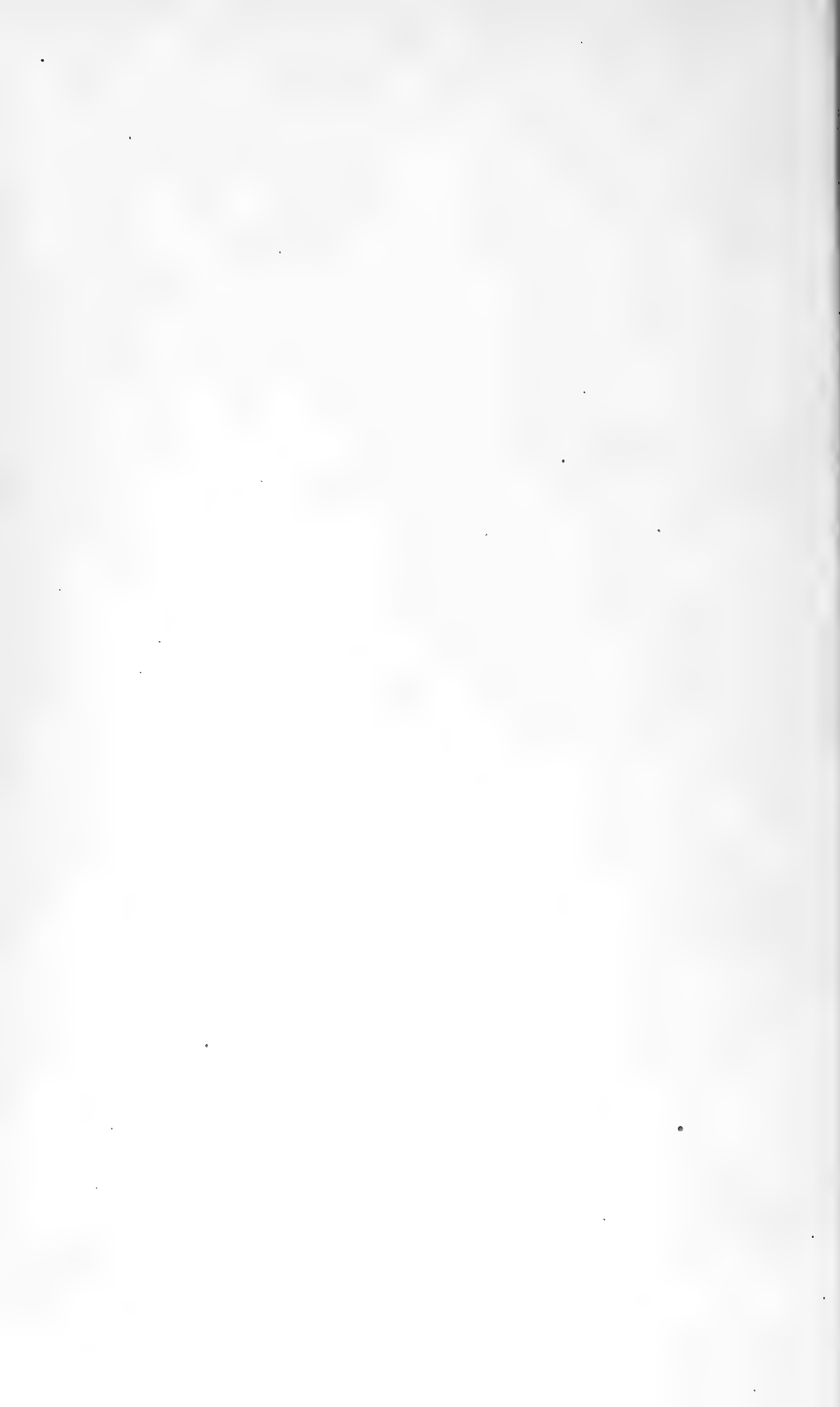


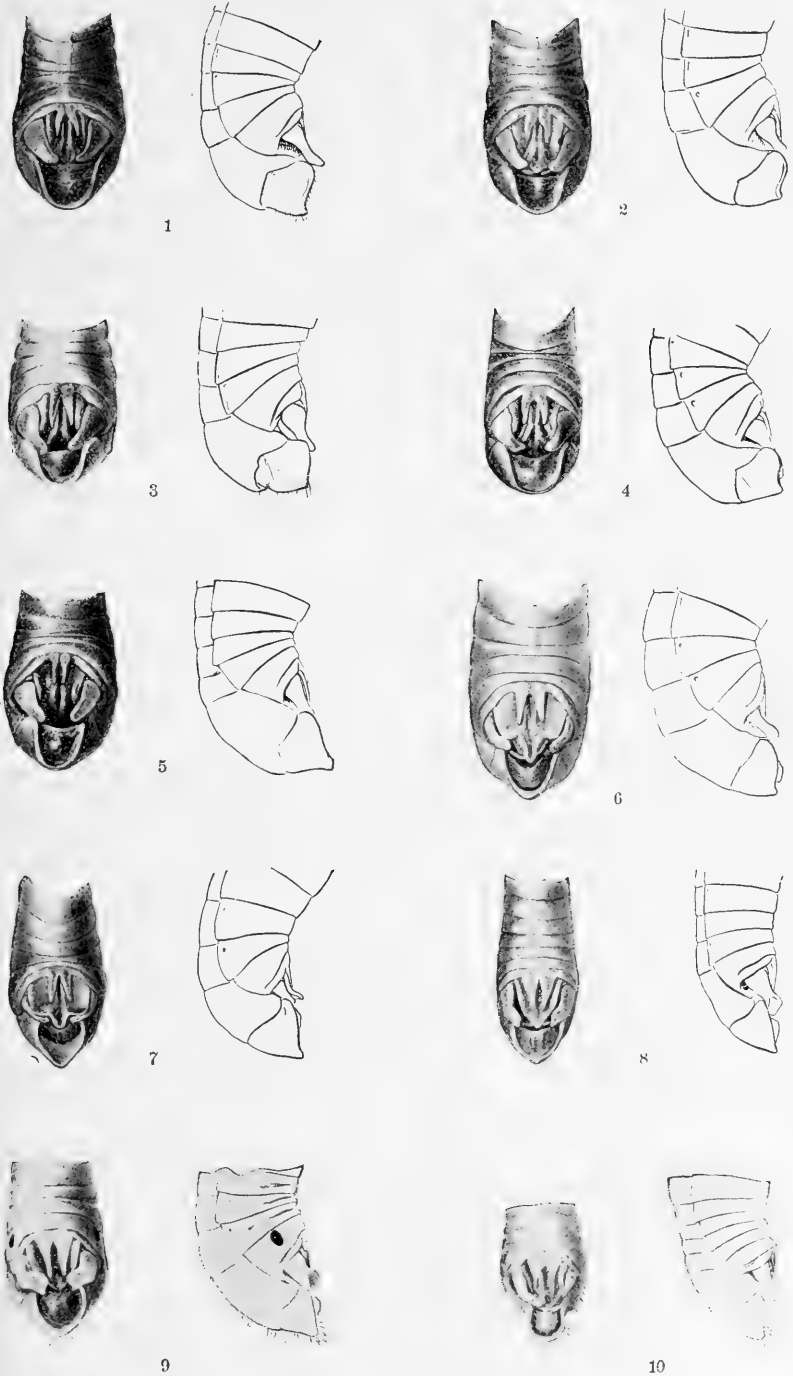
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MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

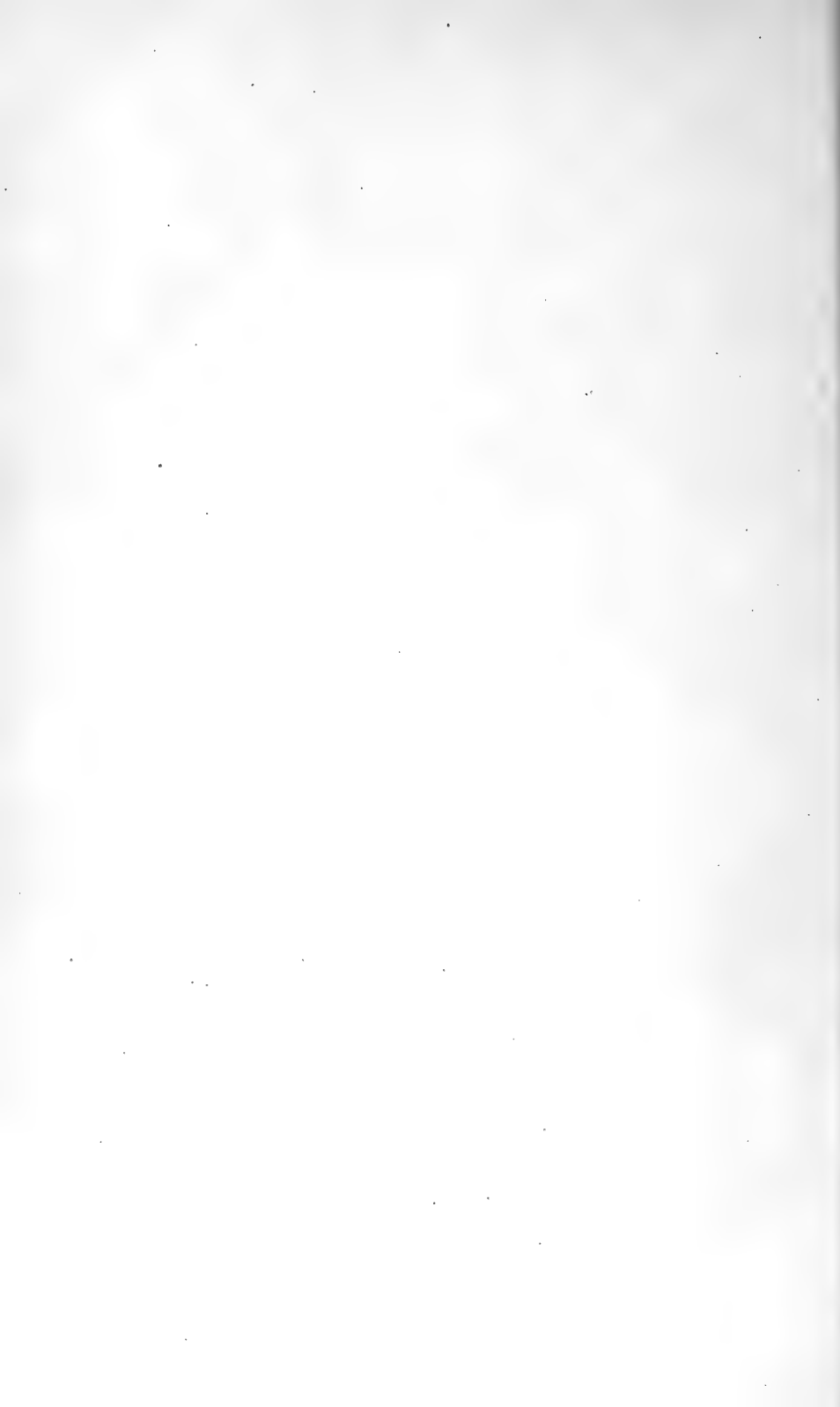
FOR EXPLANATION OF PLATE SEE PAGE 411.





MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 411.





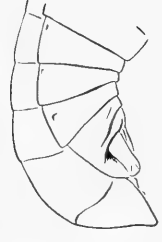
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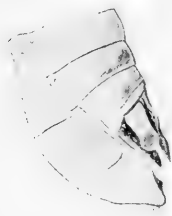
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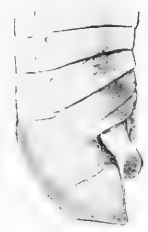
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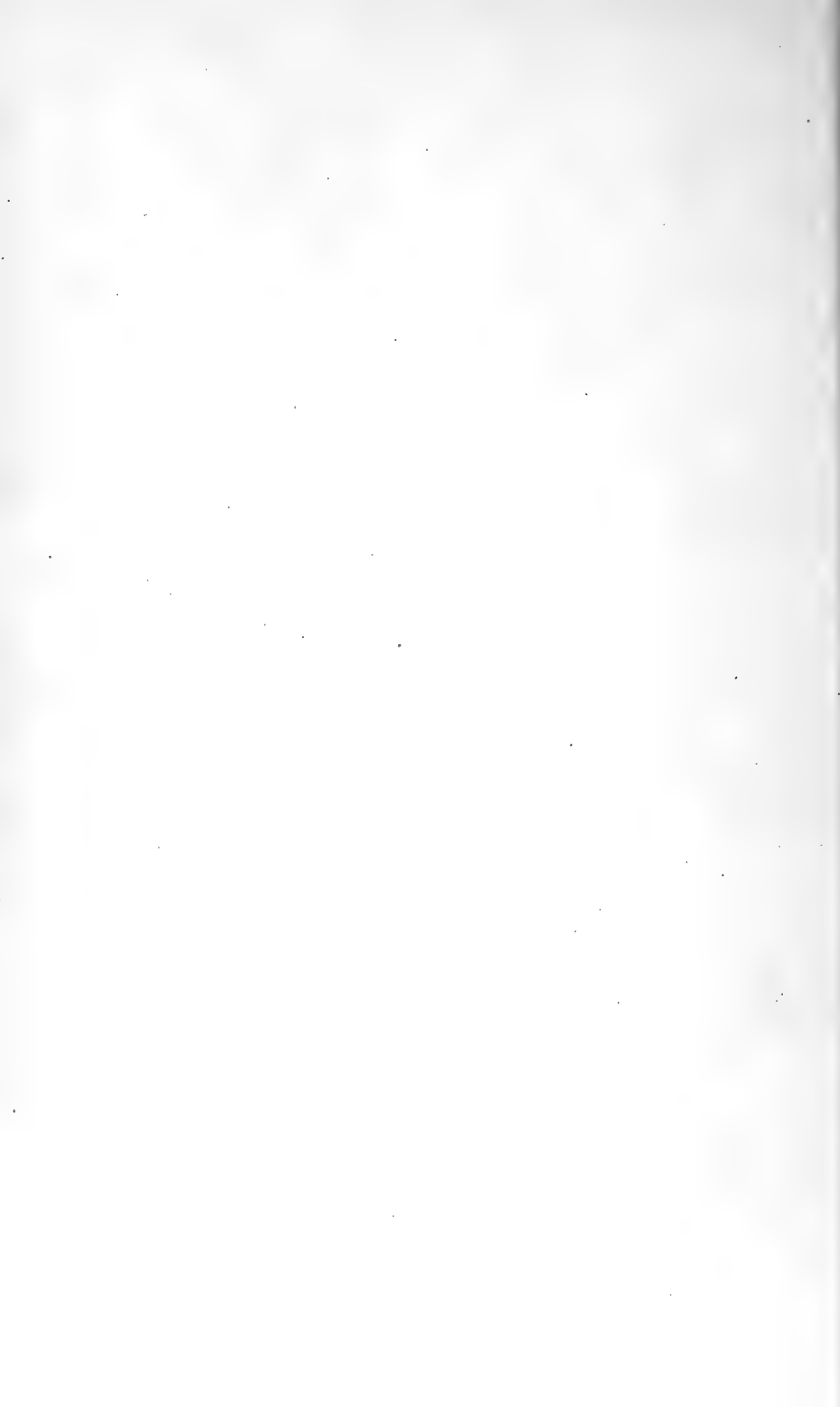
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MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 411.





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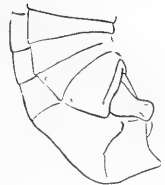
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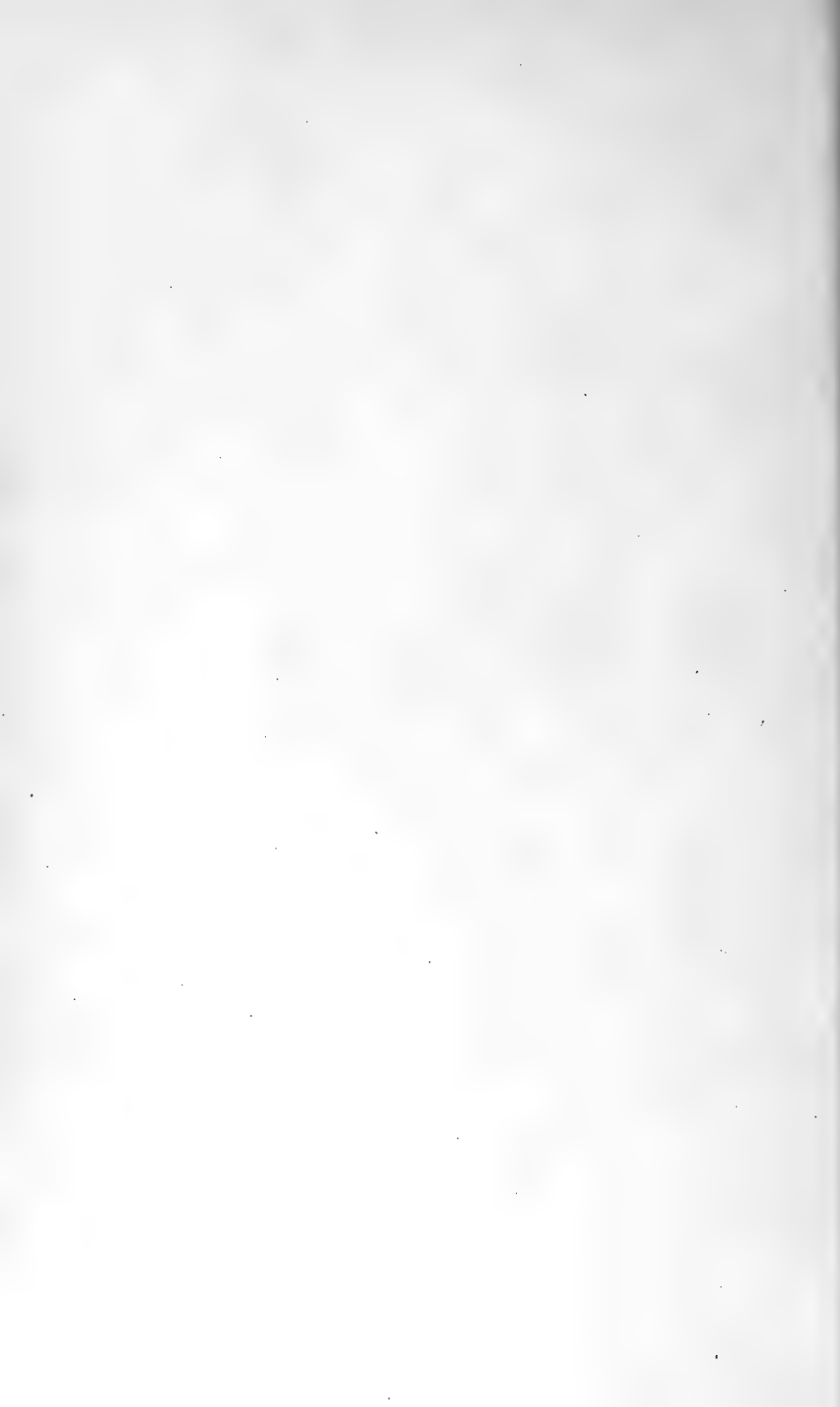
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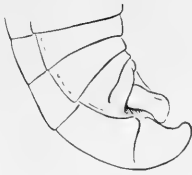
MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 411.

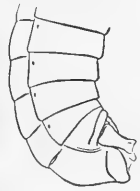




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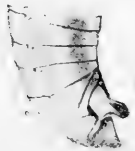
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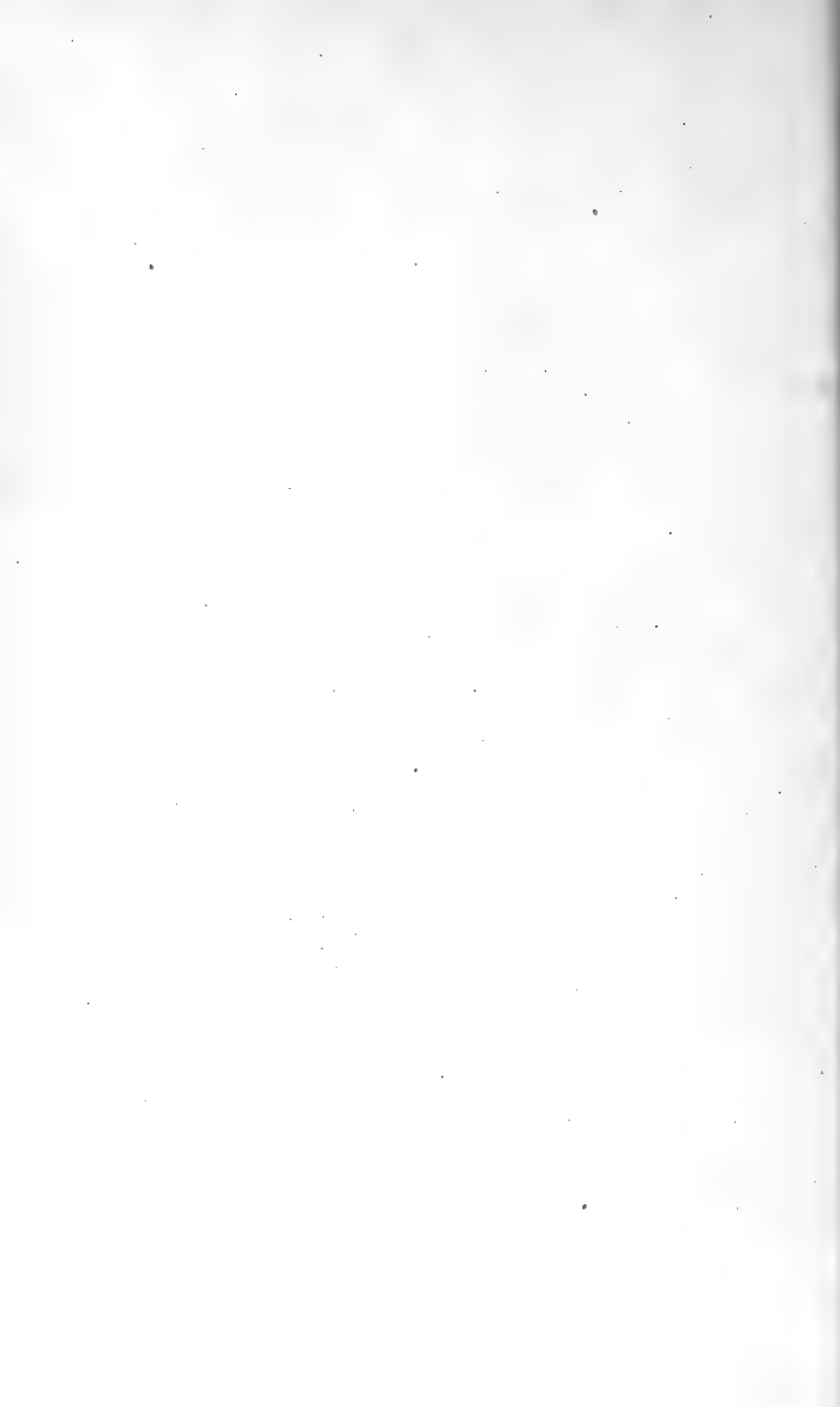


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MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGES 411, 412.





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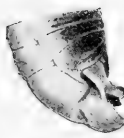
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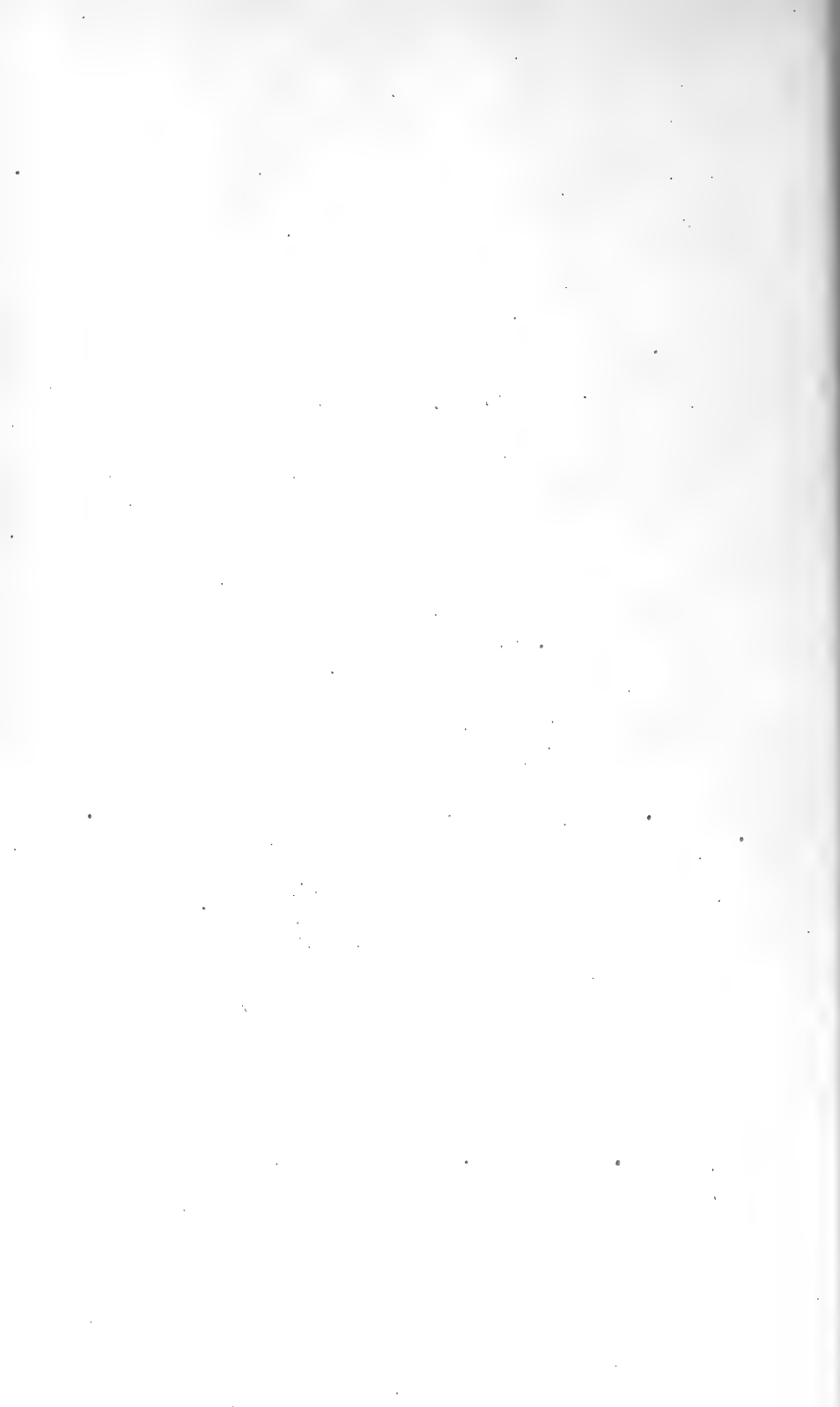


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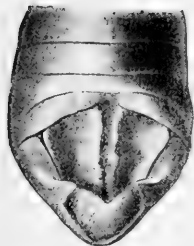
MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 412.

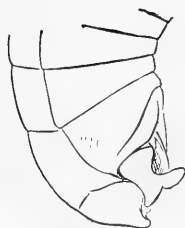
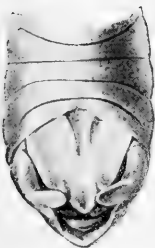




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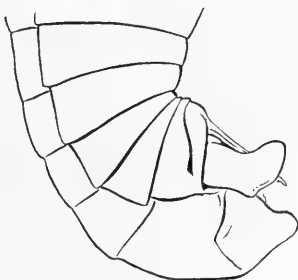
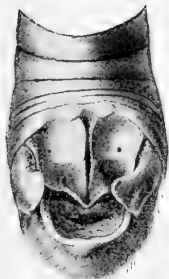
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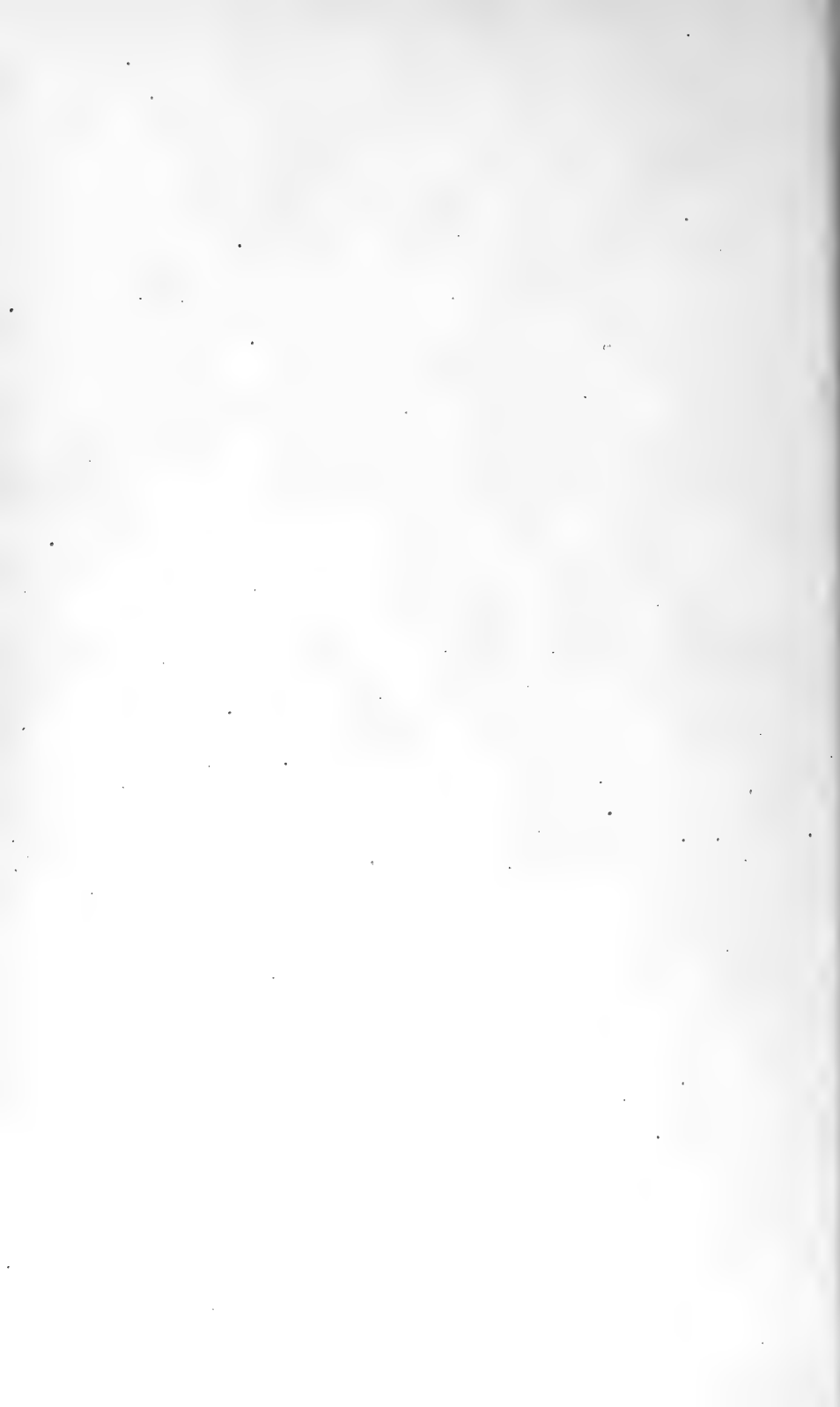
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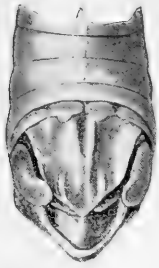


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MALE ABDOMINAL APPENDAGES OF MELANOPLUS.

FOR EXPLANATION OF PLATE SEE PAGE 412.





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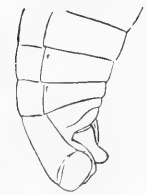
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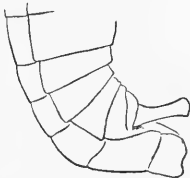
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MALE ABDOMINAL APPENDAGES OF MELANOPLUS, PHOETALIOTES, AND PAROXYA.

FOR EXPLANATION OF PLATE SEE PAGE 412.





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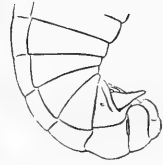
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MALE ABDOMINAL APPENDAGES OF POECILOTETTIX, OEDALEONOTUS, ASEMOPLUS, PHILOCLEON, AND APTENOPEDES.
FOR EXPLANATION OF PLATE SEE PAGE 412.



NOTES ON CESTODE PARASITES OF FISHES.

By EDWIN LINTON, Ph. D.,

Professor of Biology, Washington and Jefferson College.

THESE notes are based on two collections. First, a collection made by the author at Woods Holl, Massachusetts, in July and August, 1889; and second, a collection belonging to the United States National Museum.

It is a matter of regret on the part of the author that fuller accounts of some of the species described are not given; particularly is this true of new species, and of those concerning whose identification there is some doubt. The excuse, in nearly every case, is, either the small amount or unsatisfactory condition of the material.

Following is a list of parasites and hosts mentioned in this paper:

No.	Parasite.	Host.	Plate.	Figure.
1	<i>Tenia salvelini</i>	<i>Cristivomer namaycush</i>	XXVII	1-5
2	<i>dilatata</i> Linton	<i>Anguilla chrysope</i>		
3	<i>ocellata</i> Rudolphi	<i>Ambloplites rupestris</i>	XXVII	6-11
4	<i>Monobothrium hexacotyle</i> , new species.	<i>Catostomus</i> , sp.	XXVII	12-19
5	<i>Schistocephalus dimorphus</i> Crepin	<i>Cottus bairdii</i>	XXVIII	1-3
6	<i>Cyathocephalus truncatus</i> Pallas	<i>Coregonus clupeiformis</i>	XXVIII	3-5
7	<i>Dibothrium manubriiforme</i> Linton	<i>Tetrapturus imperator</i>		6-8
8	<i>Dibothrium punctatum</i> Rudolphi	<i>Bothus maculatus</i>		
9	<i>plicatum</i> Rudolphi	<i>Xiphias gladius</i>		
10	<i>rugosum</i> Rudolphi	<i>Gadus callarias</i>	XXVIII	9-10
			XXIX	1-4
11	<i>hastatum</i> , new species	<i>Polyodon spathula</i>	XXX	5-11
			XXX	1, 2
12	sp. (fragment)	<i>Mustelus canis</i>		
13	<i>cordiceps</i> Leidy	<i>Salmo mykiss</i>		
14	<i>infundibuliforme</i> Rudolphi.	<i>Lota maculosa</i>	XXX	3-6
		<i>Cristivomer namaycush</i>		
15	<i>laciniatum</i> , new species	<i>Tarpon atlanticus</i>	XXX	7-16
16	<i>occidentale</i> , new species	<i>Sebastodes</i>	XXXI	1-7
		<i>Catostomus latipinnis</i> or <i>C. insignis</i> .	XXXII	1-11
17	<i>ligula</i> Donnadieu	<i>Osmerus mordax</i>		
		<i>Hybognathus nuchale</i>		
		<i>Notropis cornutus</i>		
18	sp. (larva)	<i>Cynoscion regalis</i>		
19	<i>Anthobothrium laciniatum</i> Linton	<i>Prionace glauca</i>		
20	<i>pulvinatum</i> Linton	<i>Dasyatis centrura</i>	XXXIII	1
21	<i>Echeneibothrium variabile</i> Beneden	<i>Raja erinacea</i>		
22	<i>Paratenia medusa</i> Linton	<i>Dasyatis centrura</i>		
23	<i>Rhinebothrium longicolle</i> Linton	<i>Myliobatis freminvillei</i>	XXXIII	2-4
24	<i>minimum</i> Beneden	<i>Raja levis</i>	XXXIII	5

List of parasites and hosts—Continued.

No.	Parasite.	Host.	Plate.	Figure.
25	<i>Spongiobothrium variabile</i> Linton....	<i>Dasyatis centrura</i>		
26	<i>Phyllobothrium foliatum</i> Linton....	<i>Dasyatis centrura</i>	XXXIII	6
27	<i>Orgyatobothrium angustum</i> Linton....	<i>Prionace glauca</i>		
28	<i>paulum</i> , new species.	<i>Galeocerdo tigrinus</i>	XXXIII	7, 8
29	<i>crenulatum</i> , new species.	<i>Dasyatis centrura</i>	{XXXIII {XXXIV	9-12 1
30	<i>Crossobothrium laciniatum</i> Linton....	<i>Carcharias littoralis</i>		
31	<i>Onchobothrium uncinatum</i> Diesing....	<i>Dasyatis centrura</i>	XXXIV	2-5
32	<i>Calliobothrium eschrichtii</i> Beneden....	<i>Mustelus canis</i>		
33	<i>verticillatum</i> Rudolphi.....	<i>Mustelus canis</i>	XXXIV	6, 7
34	<i>Phoreiobothrium lasium</i> Linton....	<i>Prionace glauca</i>		
35	<i>Thysanocephalum crispum</i> Linton....	<i>Galeocerdo tigrinus</i>		
36	<i>Rhynchobothrium bulbifer</i> Linton....	<i>Mustelus canis</i>		
37	<i>tumidulum</i> Linton....	<i>Mustelus canis</i>		
38	<i>tenuispine</i> Linton....	<i>Prionace glauca</i>	XXXIV	8
39	<i>imparispine</i> Linton....	<i>Raja erinacea</i>		
40	<i>longicornis</i> Linton....	<i>Carcharias littoralis</i>		
41	<i>brevispine</i> , new species.	<i>Rhinoptera bonasus</i> (?).....	XXXIV	9-11
42	<i>agile</i> , new species....	<i>Rhinoptera bonasus</i>	XXXIV	12-15
43	<i>Tetrarhynchus robustum</i> Linton....	<i>Rhinoptera bonasus</i>		
44	<i>bisulcatum</i> Linton....	<i>Carcharinus obscurus</i> (?).....		
45	<i>tenue</i> Linton....	<i>Dasyatis centrura</i>		

1. TÆNIA SALVELINI, new species.

(Plate XXVII, figs. 1-5.)

Type.—No. 4811, U.S.N.M. From intestine of Great Lake trout (*Cristiomer namaycush*); Outer Island, Lake Superior; J. W. Milner.

In this lot are several small *Tænie*; scolices with few roundish or oblong segments, in some of which the male genitalia were developed, otherwise immature; length from 3 to 5 mm.

These specimens bear some resemblance to the young of *T. torulosa*, Batch, as described by Zschokke.¹

Head usually rounded in front, with suckers directed anteriorly. The diameter of the head varies according to mode of contraction, usually 0.3 to 0.4 mm.; suckers relatively large, usually directed forward, prominent, rather deep, 0.15 to 0.18 mm. in diameter, aperture 0.1 mm. in diameter. Neck assuming various contraction shapes; in some continuous with head and merging imperceptibly in body; in others separated by a constriction behind the head; in others not separated from head by constriction but with segments beginning abruptly; numerous calcareous bodies in neck behind head. Usually first segments indistinct, broader than long. Oldest segments longer than broad; genital aperture near middle of lateral margin a little nearer anterior margin. Vitellaria making a narrow border along lateral margins; beginning of germ gland at posterior end; central region in front of rudimentary germ gland occupied by prominent testicular lobes; cirrus-bulb oblong, elliptical, convex on posterior, straight or slightly concave on anterior surface; cirrus enters from inner anterior edge of bulb, then traverses middle of bulb to orifice; length of bulb, 0.26 mm.; diameter, 0.14 mm.; largest segments, 1.5 mm. in length and 0.75 mm. in breadth.

¹ Rech. Vers Parasit. des Poissons d'eau douce, 1884, p. 20.

2. *TÆNIA DILATATA* Linton.

Tenia dilatata LINTON, U. S. Fish Com. Rept., 1886, pp. 488-489, pl. v, figs. 14-16.

No. 4812, U.S.N.M. From common eel (*Anguilla chrysope*). Several strobiles but in bad state of preservation; no scolices; anterior ends have been exceedingly long and slender. The characteristic dilations of this species can not be proved from these specimens. The general appearance of the strobiles, as well as the character of the segments, however, agrees with this species.

It may be added that the segments of these specimens agree with Molin's description of his *T. hemispherica*. With the evidence at hand, however, I do not feel justified in uniting the two species of *T. dilatata* and *T. hemispherica*.

3. *TÆNIA OCELLATA* Rudolphi (?).

(Plate XXVII, figs. 6-11.)

Tenia ocellata DIESING, Syst. Helm., I, p. 513; Revis. d. Cephal., Cycl., pp. 376-377.—VON LINSTOW, Troesch. Archiv., 1875, I, p. 184.—ZSCHOKKE, Rech. Vers Parasit. des Poissons d'eau douce, pp. 13-14.

No. 4742, U.S.N.M. Two tapeworms from rock-bass (*Ambloplites rupestris*); J. W. Milner. Doctor Joseph Leidy describes a tapeworm from this fish¹ under the name of *Tenia ambloplitis*, which he states resembles *T. ocellata* Rudolphi of the European perch (*Perca fluviatilis*) and perhaps is the same.

My specimens agree with Doctor Leidy's pretty well except in the character of the neck. In *T. ambloplitis* the neck is described as "short or none." In my specimens the neck is long.

There is need of special systematic work to be done on species of the genus *Tenia* infesting the fresh-water fishes of North America. Of the specimens that have fallen under my observation, thus far only alcoholic, there are present so many characters that seem to unite them with some established European species, at the same time with so many contradictory characters, that satisfactory identifications can not be made.

The two specimens in this lot are 310 and 470 mm. in length, respectively. Other dimensions of the larger specimens are: Diameter of head, 0.75 mm.; breadth of neck, 0.55; thickness of neck, 0.5; diameter of sucker, 0.4.

Head squarish, depressed, bothria orbicular, prominent, with strong muscular structure. The head is slightly prominent at apex and is terminated by a small pore, which may and probably does function as a sucker. Neck narrower than head, subcylindrical, increasing in breadth uniformly for the first 15 mm., where, in the larger specimen its breadth is 1.35 mm.; it is unjointed, but is moderately wrinkled transversely, transparent, with somewhat delicate tissue. The first segments are about 30 mm. back of the head; 1.5 broad and 0.25 long; indistinct.

¹Proc. Acad. Nat. Sci., Phila., 1887, pp. 22-23, figs. 7-8.

Toward the posterior end the segments become somewhat squarish. The strobile does not vary much in breadth, but is a little broader in median than in anterior region and narrows a little posteriorly. The segments are rather firmly united. The reproductive apertures are near the lateral margins of the segments near the anterior end; while they are irregularly alternate, there are frequently several in succession on the same side. The angles of the segments are bluntly rounded, and there is a slight tendency to convexity in the lateral margins, thus making the strobile weakly crenulate in places.

In postero-median segments the ovary is seen as an elongated transverse body lying near the posterior end of the segment; the vagina passes forward along the median line, passing in front of the cirrus bulb not far from the anterior border of the segment. The cirrus bulb is spacious, pyriform, equaling in length a little over the breadth of the segment. The vitellaria were seen mainly near the lateral margins and the testes in the antero-median region of the segment. In posterior segments ova were very numerous in racemose clusters along the middle portion of the segment, small, nearly globular, with thin, transparent shell and from 0.02 to 0.025 mm. in diameter.

The apex of the head in one of the specimens is somewhat elevated, and there appears to be a small terminal pore or depression, but it could not be called a sucker. In the other specimen the prominent suckers were directed forward so that the apex of the head was partly concealed. When the head was made transparent, no terminal sucker could be seen. If there be a fifth or terminal sucker, as in some of this series of *Tenia*, it must be exceedingly weak and ill-defined.

The head may assume diverse shapes with different degrees of contraction.

The length of the median segments in the larger specimens was 0.4 mm., breadth, 2.6; toward the posterior end, length 1, breadth 1.8. The last segment was 1 mm. in length, 1.3 broad at anterior end, tapering posteriorly to a blunt point. The cirrus was exerted in this segment and was 0.75 mm. in length, 0.07 in diameter at base, and 0.04 in diameter at apex.

This reference of these *Tenia* of *Ambloplites* to the species *T. ocellata* is provisional only. I think, however, that there can be little doubt but that my specimens are identical with *T. ambloplitis* Leidy. The apparent absence of neck in Leidy's species may be ascribed to the presence of strong transverse wrinkles, due probably to the action of the preserving fluid.

4. MONOBOTHRUM HEXACOTYLE, new species.

(Plates XXVII, figs. 12-19; XXVIII, figs. 1-3.)

Type.—No. 4793, U.S.N.M. Label reads: "From sucker (*Catostomus* sp.) inhabiting the Gila River and Salt River, Arizona; E. Palmer."

Eight specimens; largest about 14 mm. in length and 1.5 in breadth and 0.3 thick; smallest about 8 long, 1 broad, and 0.25 thick.

Dimensions of one of the larger specimens: Length, 14.5 mm.; breadth of head, 0.72; breadth immediately back of head, 0.68; greatest breadth, 1; breadth near posterior end, 0.7; breadth at posterior end, 0.3; length of head, 0.7.

Genital aperture, 2.8 mm. from posterior end. Ova collected in folds of the uterus near the posterior end of the body, 0.038 to 0.040 mm. in larger diameter and about 0.2 in shorter diameter.

Bothrium terminal, somewhat two-lobed, lobes lateral, namely, corresponding to flat surfaces of body; each lobe divided by two longitudinal ribs into three loculi. The six loculi meet at the apex of the head and form a central papilla which may project forward as a sharp conical elevation or be contracted to a low eminence; doubtless other and diverse shapes may be assumed by this versatile organ; body flattened, not divided into segments. In specimen made transparent by oil of cloves the anatomy of the reproductive organs was seen to agree closely with that made out for *Monobothrium terebrans* Linton, found in a sucker (*Catostomus ardens*) from Heart Lake, Yellowstone National Park, Wyoming.¹ Testes arranged along central space; vitelline gland along lateral margins and at posterior end; both vitellaria and testes beginning near the head; ovary with lateral folds extending nearly to cirrus; uterus with ova lying in folds behind the genital aperture, also a few folds near the posterior end behind ovary; genital aperture about posterior fifth; cirrus about 0.1 mm. in diameter; cirrus-bulb about 0.27 in diameter. Cirrus extended in one specimen presented the following dimensions: Length, 1 mm.; diameter at apex, 0.043; diameter near middle, 0.055; diameter at tumid base, 0.086. Lateral vessels communicate with a posterior terminal pore.

The ovary lies nearest the face on which the genital aperture is situated, the median portion showing first in longitudinal sections. Calling this side ventral then at the posterior end the vitelline gland is dorsal to the posterior folds of the uterus, which in turn pass dorsally to the central portion of the ovary.

5. SCHISTOCEPHALUS DIMORPHUS Crepin (?)

(Plate XXVIII, figs. 4-5.)

Schistocephalus dimorphus DIESING, Syst. Helm., I, pp. 484-485; Revis. d. Ceph. Par., pp. 232-233.—WILLEMOES-SCHM, Zeitschr. f. w. Zool., XIX, p. 469-472, pl. XXXV, figs. 1-3.—SHAUINSLAND, Embryonalentwicklung, pp. 36-39, pl. III, figs. 8-10.

No. 4727, U.S.N.M. From abdominal cavity of the blob (*Cottus bairdii*), Swan River, Montana, August 3, 1891; B. W. Everman, collector.

Three specimens, 32, 30, and 5 mm. in length and 6, 5, and 1.5 in breadth, respectively. Dimensions of larger specimen: Length, 32 mm.; greatest breadth, middle, 6; breadth, 2.5, from anterior end, 3;

¹U. S. Fish Com. Rept., 1889-1891, pp. 548-552, pls. LXIII-LXV, figs. 1-21.

breadth near posterior end, 2.50; length of median segments, 0.25; breadth of head, anterior end, 0.40; breadth of head, base, 1.30; length of head, 0.80. Body lanceolate, depressed, articulate. Head short-triangular, obtuse, with median, terminal pore, and two flat, leaflike flaps (bothria) on lateral margins, separated from each other on flat surface by a broad, shallow sulcus. First segment much broader than head, its posterior border much broader than its anterior border; subsequent segments increasing in breadth rapidly, their posterior borders greater than their anterior, until maximum breadth is attained; lateral margins of anterior segments with a distinct emargination, which character also appertains to the bothrial flaps of one of the specimens (Fig. 4).

S. dimorphus is described as having in the larval state a longitudinal median furrow on each face. These specimens do not exhibit this character; neither do they have anything that can properly be called a costa dividing the two bothria. I do not find any mention of emarginations on the segments in any of the descriptions of *S. dimorphus* to which I have access. On account of these differences I refer these specimens to *S. dimorphus* with some doubt. Diesing records *S. dimorphus* from the following hosts (genera only given here): Larval state from three genera of fish, *Gasterosteus*, *Cottus*, and *Salmo*; one bird, *Totanus*; one seal, *Phoca*. Adult state from the following genera of birds: *Corvus*, *Recurvirostra*, *Ardea*, *Ciconia*, *Sterna*, *Colymbus*, *Podiceps*, *Larus*, *Anas*, *Mergus*, *Uria*, *Alca*. The structure of the body resembles that of the genus *Dibothrium* (Fig. 5). Beginning with the outer layer the successive layers are (1) cuticle, (2) a fibro-granular layer with small bundles of longitudinal muscle fibers in the inner part, (3) a layer of circular fibers, (4) a glandular muscular layer, with radiating fibers. The outer part of this contains the incipient vitellaria, the central part contains large bundles of coarse longitudinal muscle-fibers; radiating fibers cross the layer separating the bundles of muscles from each other and passing between the glandular bodies; (5) a layer of circular fibers thicker than (2); (6) a central core surrounded by the layers of circular fibers and containing the incipient genitalia embedded in granulo-fibrous tissue. In the central core the testes could be made out; also a longitudinal vessel (nerve) (Fig. 5*n*). The only part examined in sections was the anterior, in which the genitalia were no further developed than is indicated in Fig. 5.

6. CYATHOCEPHALUS TRUNCATUS Pallas.

(Plate XXVIII, figs. 6-8.)

Tenia truncata PALLAS, 1781, Neue Nordische Beiträge, I, p. 105, pl. III, fig. 7.

Cephalocotyleum DIESING, Syst. Helm., I, p. 620.

Cyathocephalus truncatus KESSLER, 1868, Beiträge zur Fauna des Onega-Sees, p. 135, pl. VIII, fig. 3.—GRIMM, Zeitschrift f. w. Zool., XXI, pp. 502-504.—LÖNNBERG, K. Svenska Vet.-Akad. Handlingar, XIV, Afd. 4, No. 9 (1889).

Cyathocephalus truncatus PALLAS, Zschokke, Rech. sur les Vers Parasites des Pois. d'eau douce, pp. 37-40, pl. IX, fig. 9.

Cyathocephalus truncatus (PALLAS) KESSLER and KREMER, 1892, Zeitschrift f. w. Zoologie, LIII, 4, Heft (sep. abdr., pp. 6-35, XXVII, figs. 1-14).

No. 4782, U.S.N.M. From pyloric cœca of common white-fish (*Coregonus clupeiformis*) Outer Island, Lake Superior; J. W. Milner; several fragments, not in good state of preservation.

Body fusiform flattened, head funnel-shape. Dimensions of typical specimen: Length, 7 mm.; diameter of head at apex, 0.8; diameter of head at base, 0.45; length of head, 0.8; maximum diameter of body, 1.2. Genital apertures along middle of flat surface of body from 0.2 to 0.6 mm. apart.

The bodies of these specimens appear to be unsegmented, or, at best, with only very faint indication of division into segments. In this respect they differ from Zschokke's figure of the species, but agree well enough with his written account of it. "The segments are almost twice as broad as long. They are firmly attached to each other, their limits being seen with difficulty."¹

Calcareous bodies numerous, many shapes, but usually irregularly oblong, from 0.01 to 0.02 mm. in length and showing concentric structure. Genital apertures about middle of segments. Ova were seen lying in clusters near middle of segments (specimen in oil of cloves and viewed on flat surface of body) behind and to one side of cirrus bulb, germ gland farther back at posterior edge of segment; testes median; vitelline glands lateral, voluminous in transverse lobules. The nucleated cells in the germ-gland are 0.01 mm. in diameter; cirrus-bulb pyriform with thick, muscular wall, transverse diameter, 0.135; longitudinal diameter, 0.12; uterus mainly dorsal. Musculature appears like that of the genus *Dibothrium*. Longitudinal muscle fibers stronger and more numerous in anterior part of body, somewhat scattered in posterior parts of body.

Ova in specimen in acetic acid, typical, 0.05 and 0.032 mm. in two principal diameters.

This, I believe, is the first notice of this rare parasite on this continent.

7. DIBOTHRIUM MANUBRIFORME Linton.

Dibothrium manubriforme LINTON, U. S. Fish Com. Rept., 1886, pp. 456-458, pl. I, figs. 1-4; 1887, pp. 728-731.

No. 4711, U.S.N.M. Label reads: "From rectum of *Tetrapterus*, B. G. Wilder, August 5, Penikese."

Numerous specimens, fifty or more, tangled in a mass and in a poor state of preservation. Largest complete specimen noted measured 115 mm. in length and 3.5 in greatest breadth. Heads of diverse shapes. Dimensions of heads: Length of one, 2 mm.; breadth, 1; length of another, 2.5; breadth, 1; length of another, 1.5; breadth, 1.2.

¹ Rech. sur les Vers Parasites des Pois. d'eau douce, p. 38.

8. *DIBOTHRIMUM PUNCTATUM* Rudolphi.

Dibothrium punctatum RUDOLPHI, U. S. Fish Com. Rept., 1887, pp. 731-736, pl. II, figs. 1-4.

From intestine of sand flounder (*Bothus maculatus* Mitchell), Woods Holl, Massachusetts, July 23, 1889.

Three specimens, longest, in alcohol, 223 mm.

Nos. 4703, 4702, 4705, 4701, 4730, 4704, 4784. There are nine lots of specimens belonging to this species in the National Museum collection.

1. Five specimens from stomach of sea raven (*Hemitripterus americanus*); largest about 300 mm. in length.

2. Three specimens, same host, Casco Bay, Maine, United States Fish Commission collection; slender, length, 400, 505, and 630 mm., respectively; breadth, 1.75, 3, and 3 mm., respectively.

3. Same host, Woods Holl, Massachusetts, November 9, 1886; V. N. Edwards, collector; several specimens; length of typical one, 290 mm., and breadth, 3.

4. Same host and locality; October 12, 1887; largest specimen, 280 mm. in length and 2 in breadth. These specimens were peculiar in having a pellucid cordate or peltate caudal segment, preceded by three or four narrowing segments. One of these terminal segments was 2 mm. in length and 1.5 in breadth.

5. Same host and locality; December 1, 1887; twelve specimens in lot. The dimensions of four typical specimens, in millimeters, from this lot follow: Length 740, greatest breadth 4; length 280, greatest breadth 5; length 530, greatest breadth 4.5; length 480, greatest breadth 6.

6. Same host and locality; one specimen; length, 575 mm.; breadth, 4.

7. Same host and locality; December 12, 1885; ten specimens; heads presenting variety of shapes; one specimen with anterior segments for first 30 or 40 mm. filiform.

8. Same host and locality; December 5, 1885; largest specimen in this lot measured 950 mm. in length and 4.5 in breadth; length of one head, 0.9; breadth, 0.3; length of another head, 1.2; breadth, 0.4.

Numbers 3 to 8 were collected by Mr. V. N. Edwards.

9. United States Fish Commission, off Block Island, 1880, from intestine of sand dab (*Limanda ferruginea*), three specimens.

9. *DIBOTHRIMUM PLICATUM* Rudolphi.

Dibothrium plicatum RUDOLPHI, U. S. Fish Com. Rept., 1887, pp. 746-750, pl. III, figs. 1-6.

No. 4736, U.S.N.M. Label reads: "Trawl line near station 2091, United States Fish Commission steamer *Albatross*, 1883. Stomach or intestine of swordfish (*Xiphias gladius*)."

The specimen is a fragment 90 mm. long and 8 in greatest breadth. Since the usual position of this species is in the rectum of its host,

where the head and anterior portion of the body become imbedded in the intestinal walls, it is altogether probable that this specimen had a like position.

10. *DIBOTHRIMUM RUGOSUM* Rudolphi.

(Plates XXVIII, figs. 9-10; XXIX, figs. 1-4.)

Dibothrium rugosum RUDOLPHI, U. S. Fish Com. Rept., 1887, pp. 750-754, pl. III, figs. 7-10.

Nos. 4712, 4726, 4728, U.S.N.M. Ten lots of this species all from the intestine of the cod (*Gadus callarias*):

1. Intestine of cod, Woods Holl, Massachusetts; V. N. Edwards, collector; December 3, 1887. Several specimens, two with heads imbedded in pyloric cœca. Largest 188 mm. in length, 36 of which imbedded; tissue degenerate surrounded by waxy secretion. Body of nearly uniform size, 3 mm. broad and 1 thick; length of segments near posterior end 0.6.

2. Same as No. 1; December 10, 1887. Four fragments.

3. Same as No. 1; November 28, 1887. One specimen 36 mm. long, 1.5 broad; anterior end impacted in pyloric cœcum and surrounded with waxy secretion.

4. Same as No. 1; January 4, 1888. Fragments, largest 212 mm. long and 3.5 broad; some slender fragments, one 76 long and 1.5 broad, tapering anteriorly; no scolices.

5. Same as No. 1; November 28, 1887. Several specimens with heads impacted in pyloric cœca. Largest specimen 250 mm. long and 4.75 broad; some slender forms, one 165 long and 2 broad: heads of all degenerate.

6. Same as No. 1; November 25, 1887. One small fragment.

7. Same as No. 1; January 20, 1888. Two fragments. The posterior segment of one was exceptional in having the postero-lateral angles projecting in curved processes (Plate XXVIII, fig. 9).

8. Same as No. 1; November 14, 1887. Six fragments: largest 72 mm. long and 2 broad.

9. Same as No. 1; December 24, 1887. Three specimens; longest 215 mm., slender, head very little degenerated, as is usually the case on account of habit of worm to become impacted in pyloric cœca of host.

10. Same as No. 1; November 26, 1887. Four fragments.

All the above specimens collected at Woods Holl, Massachusetts, by Mr. V. N. Edwards.

Some portion of the anatomy of this species is shown in Plate XXVIII, fig. 10; Plate XXIX, figs. 1-4.

11. *DIBOTHRIMUM HASTATUM*, new species.

(Plates XXIX, figs. 5-11; XXX, figs. 1, 2.)

Types.—Nos. 4724, 4783, U.S.N.M. From intestine of paddlefish (*Polyodon spathula*). The fish from which these worms were taken was caught in the Ohio River, near Bellaire, Ohio, about March 13, 1889.

The worms were collected on March 15, when they were still active. There were one hundred and nine specimens in all; twenty-three were found on the viscera and in the stomach; twenty-six in pyloric cœca; ten in pylorus, and fifty in spiral intestine. Only the viscera had been brought to the laboratory. It is likely, therefore, that the specimens which were found on the viscera had escaped from the stomach after the viscera had been taken from the host. Two pits were found excavated in the mucous and submucous layers of the pylorus near the spiral valve, in which the heads of a number of *Dibothria* were inserted. The color was at first lemon-yellow; after lying in water for a few minutes the bodies became colorless or faintly bluish translucent, while the heads remained yellowish. Length of most of the specimens, when first removed, from 25 to 35 mm.; a few were a little longer than this. After lying in water for an hour four of the larger specimens measured 48, 60, 73 and 78 mm. in lengths, respectively. The specimens were at first very active, the lateral pits and the heads themselves changing their shape incessantly.

A specimen that had lain in water about an hour, the head being quiet, was measured and the following dimensions noted: Length, 60 mm.; length of head, 2.75; breadth of head at base, 2; breadth of head near apex, 1.8; length of pit, 1.6; diameter of pit, 0.8; breadth of neck near head, 11; length of last segments (average of fifteen), 1.13; breadth of last segments, 2.

Head sagittate (when at rest and contracted), terminated anteriorly with a button-shaped tip which is bluntly rounded in front and marked off from remainder of head by slight constriction, in life angled posteriorly; pits variable in life but usually elliptical, often with anterior margin acuminate and sometimes with posterior margin indistinct. The head is angled posteriorly both laterally and marginally, presenting a quite characteristic appearance in the living worm. Neck sub-cylindrical, narrower than head. The segments begin some distance (6 or 8 mm.) back of the head, as faint transverse lines. The first distinct segments are closely crowded, much broader than long, median segments squarish, posterior segments usually a little longer than broad, rectangular, apparently separating rather easily. The specimens were all young, so that the character of the ripe proglottides could not be made out. Posterior angles of the segments slightly projecting. Genital apertures on lateral margins, a little in front of the middle; a zigzag line of minute pores traverses the median region of one of the broad faces of the strobile, each pore being near the middle of its segment.

Outline of most of the strobiles nearly linear and about the same breadth as the head. All the segments were remarkably regular in outline, no irregularities being observed.

In the United States National Museum collection there is one lot of specimens belonging to this species, No. 4783, from *Polyodon spathula*; C. H. Gilbert, collector, 1885; eight specimens in lot. The strobiles are older than those in the lot collected by myself. Three of them bore

each a single ripe proglottis and one bore two ripe proglottides. (Figs. 9, 10.) The ripe proglottides were attached by a slender pedicel, so that if there were a number of them they would make a decidedly moniliform chain. When viewed on the flat surface they are irregularly circular in outline, in some cases longer than broad, in others broader than long. They are loosely attached. In each case they begin abruptly. These strobiles were from 40 to 56 mm. in length. Dimensions of one: Length, 45 mm.; length of head, 1.85; breadth of head at base, 1.7; thickness of head at base, 1.3; breadth of neck behind head, 1; thickness of neck, 0.4; length of median segments, 0.35; breadth of median segments, 2.5; length of segments near posterior end, 0.55; breadth of segments near posterior end, 2.7; length of ripe proglottis, 1.4; breadth of ripe proglottis, 1.7.

The genital apertures are about the middle of the lateral margins, irregularly alternate, usually two or three on same lateral margin of successive segments; an emargination at lateral margin indicates position of aperture. The genital aperture is cup-shaped, 0.07 mm. deep and 0.06 in diameter. The cirrus-pouch in the specimens examined measured 0.22 mm. in length and 0.14 in diameter. No sections were made. In a specimen cleared up in oil of cloves there appeared in some of the segments a slender, somewhat sinuous tube lying beside the cirrus, which I take to be the vagina. If this is correct, then the pores on the flat surface of the segments are for the escape of ova. The posterior segments are filled with ova, especially the round terminal, loosely attached segments. The ova are nearly spherical, with thin shells. They are about 0.04 mm. in the greatest diameter. The segments contain numerous calcareous bodies, which exhibit a concentric structure.

12. *DIBOTHRIMUM* species.

Fragment No. 1473, U.S.N.M. From intestine of dogfish (*Mustelus canis*); Woods Holl, Massachusetts, July 21, 1887.

A chain of proglottides, 11 mm. in length and consisting of nine proglottides, breadth 5.5; ova escaping from median pores near anterior ends of segments; reproductive aperture on lateral margin about middle of length; all on same side of chain, the aperture a prominent cloaca; dimensions of ova, 0.053 and 0.035 mm. in two principal diameters.

Careful search was made for other fragments, so that if any had been present they certainly would have been found. These segments, without much doubt, had been introduced in their present state of development along with food.

13. *DIBOTHRIMUM* *CORDICEPS* Leidy.

Dibothrium cordiceps LEIDY, Hayden's Prelim. Rept. U. S. Geolog. Survey, 1871, pp. 381-382.—LINTON, Bull. U. S. Fish Com., IX, 1889, pp. 72-76, pls. xxv-xxvii; pp. 337-358, pls. cvii-cxix; 1889-1891, p. 547.

No. 4739, U.S.N.M. Neither host nor locality are given; numerous Proc. N. M. vol. xx—28

fragments. These specimens resemble the larva of *D. cordiceps* from the Rocky Mountain trout (*Salmo mykiss*). Upon comparison with specimens taken from the abdominal cavity of that fish they appear to be identical. The largest fragments were something over 30 mm. in length and 2.5 in greatest breadth.

14. DIBOTHRIMUM INFUNDIBULIFORME Rudolphi.

(Plate XXX, figs. 3-6.)

Dibothrium infundibuliforme DIESING, Syst. Helm., I, pp. 590-591.—WILLEMOES-SUHM, Zeitschr. f. w. Zool., XXIII, pl. XVII, fig. 10.

Bothriocephalus infundibuliformis RUDOLPHI, Entoz., II, Pt. 2, p. 46.

B. proboscideus RUDOLPHI, Zschokke, Recherches, pp. 21-25, pl. IX, fig. 3.

Nos. 4744, 4710, 4709, U.S.N.M. I have identified as *Dibothrium infundibuliforme* three lots of parasites, one from the ling (*Lota maculosa*) and the others from the Great Lake trout (*Cristivomer namaycush*).

1. Two specimens from *Lota maculosa*, Sebago Lake, Maine, January 7, 1887; collected by Professor L. A. Lee, of Bowdoin College, Brunswick, Maine. No. 4744, U.S.N.M. Dimensions of one of the specimens: Length, 109 mm.; length of head, 0.9; diameter of head, marginal view, in front, 0.35; middle, 0.28; base, 0.47; distance to first segment, 1.5; length of first segment, 0.37; diameter of first segment, middle, 0.28; breadth of posterior segment, 0.8; length of posterior segment about 0.38; no mature segments.

The two scolices, as well as the anterior portion of each strobile, present considerable differences, which, however, appear to be due to different states of contraction. In one the fossettes reach the extreme anterior border of the head, so that in front view the head is oblong, with very deep lateral emarginations. In the other the anterior border of each fossette is limited by an overhanging cushion. One is considerably larger than the other. The neck in the larger specimen is about two-thirds of the length of the head and conical; the first segments longer than broad, a few of them presenting the characteristic funnel-form of the species. The worm throughout is narrow, nowhere becoming more than 1 mm. broad. The segments are somewhat irregular and in places exhibit a grouping together noted especially in *D. punctatum*.

2. No. 4710, U.S.N.M. Label reads: "Intestinal worms *Salmo amethystus*; Shoal Island, Lake Superior, Wisconsin; J. W. Milner."

Specimens too much broken to get length, evidently long. Heads of different shapes due to contraction. Length of head about 1 mm. In most cases the head was squarish, truncate in front, neck short, first segments distinct, as long as broad and funnel-form; greatest breadth of strobile about 2 mm.; segments short and transversely rugose, with a shallow median, longitudinal sulcus. Ova 0.06 and 0.032 mm. in two principal diameters.

3. No. 4709, U.S.N.M. Label reads: "*Salmo siscoonet*. intestine; Outer Island, Lake Superior; J. W. Milner."

Numerous fragments, not in good state of preservation; some of the strobiles have evidently been long. Heads of diverse shapes. A few dimensions follow: Length of head and neck, 0.8 mm.; breadth of head, 0.45; breadth of neck, 0.38; first segments broader than long; length of head proper, 0.45; length of head and neck of another, 0.9; diameter, 0.35; diameter of neck, 0.3; length of head proper, 0.6; first segments as long or longer than broad.

A curiously tangled mass of strobiles about 8 mm. in length and 4 in breadth occurred in this lot. It appeared to be made up of the ends of probably a dozen or more strobiles. One strobile which protruded about 12 mm. from the mass was separated from it. The part that had partaken in the entanglement was found to be about 4 mm. in length, very slender and irregular in outline from pressure. The fore part was 2 mm. in diameter; the part that had been woven in the mass, 0.5 mm. in diameter. The end of the slender part was slightly enlarged. This was characteristic of the other pieces that made up the mass. The slender portion was at the posterior end of the larger fragment. All in this lot had distinct necks.

15. *DIBOTHRIMUM LACINIATUM*, new species.

(Plates XXX, figs. 7-16; XXXI, figs. 1-7.)

Type.—No. 4741, U.S.N.M. From tarpum (*Tarpon atlanticus*).

Two specimens, 142 and 154 mm. in length, respectively. Largest specimen about 4 mm. broad at broadest place, near middle, from which point it tapers to about 2 at posterior end.

Head clavate, outline varying with state of contraction, truncate and somewhat four-lobed in front. Fossettes marginal as to head, corresponding to flat surface of body. Flat surfaces of head with profound median depression at apex and extending posteriorly about half length of head. These depressions, with the fossettes (bothria), give the front aspect of the head a four-lobed appearance. Head contracted near the base with salient posterior margin; fossettes extend posteriorly to constriction. Segments begin immediately behind the head. First funnel-shaped with salient posterior border. The salient posterior border of head and of the first segments have a distinct emargination on the middle of the border which lies on the flat surface of the body. This emarginate character is very distinct in the first segments, but becomes indistinct in the median segments. The median segments are much crowded, breadth as much as ten times the length; posterior segments with breadth one and a half times the length.

Body very rugose, due to the prominent thin posterior edges of the segments. The segments are not uniform; one segment with a salient posterior border followed by about two with less salient borders.

Further dimensions: Length of head, 2 mm.; breadth of head, anterior, 0.8; middle, 0.4; posterior, 0.6; at constriction, 0.25; thickness of head, anterior, 0.5; middle, 0.55; at constriction, 0.25; posterior, 0.35; length

of first segment, 0.7; breadth of first segment, anterior, 0.3; posterior, 0.65; length of median segments, 0.3; breadth, 3; length of posterior segments, 1; breadth, 1.5.

Ova numerous, in clusters along median line. 0.052 and 0.035 mm. in two principal diameters.

Thin sections made in the three principal directions reveal the following anatomical details: The reproductive cloacæ lie along the median line of one of the flat surfaces of the body. The external openings of the uterus lie along the median line of the opposite surface. The cirrus-bulb is very muscular, long pyriform, its inner end deflected to the right, where it communicates with the vas deferens, which lies in numerous folds in front and to the right of the cirrus-bulb. The length of one cirrus-bulb to the point of deflection was 0.4 mm., its greatest diameter 0.14. The vagina lies immediately behind the cirrus-bulb and follows a course parallel to it. Near the external aperture it expands into a napi-form muscular body; in the one measured, 0.05 mm. in length and 0.07 in transverse diameter. My sections were made from segments already mature, and the folds of the uterus containing ova occupied a considerable part of the interior, obliterating the communication between vagina and uterus. Calling that surface ventral which bears the reproductive apertures, then the apertures of the uterus are along the dorsal surface. The uterus near these apertures becomes capacious and is lined with cilia. The ovary lies near the dorsal surface and near the posterior part of the segment. The segments are not separable and not even sharply outlined. The structure of the body is as follows: Beginning with the external layer, (1) cuticle, (2) layer made up of radiating fibers with scattered delicate longitudinal fibers, (3) layer of glandular bodies, vitellaria, (4) thin layer of circular fibers from which fibers radiate into both contiguous layers, (5) layer of strong longitudinal muscle fibers, (6) circular layer, (7) central core consisting of transverse fibers, granular parenchyma, and containing the testes.

A body which lies about the middle of the posterior edge of each segment, behind the vaginal tube and near the ovary, I take to be either an enlargement of the vitelline duct or vitelline reservoir, or, in part at least, an internal vitelline gland. It has the same appearance in stained sections as the glands of the above-named third-body layer.

Numerous calcareous bodies with strongly marked concentric structure occur in different parts of the segments. They are mostly oval in shape. One of the smallest measured 0.017 mm. in length and 0.008 in breadth; one of the largest was 0.024 and 0.014 in the two principal diameters. Longitudinal vessels could not be made out in my sections. The laciniae are prolongations of the external cuticular layer and the underlying granulo-fibrous layer. In some cases a few of the glandular bodies of the third layer were observed in the substance of the laciniae, although, as a rule, they as well as the calcareous bodies were absent.

16. *DIBOTHRIUM OCCIDENTALE*, new species.

(Plate XXXII, figs. 1-11.)

This species appears to be near *Bothriocephalus angusticeps* Olsson.¹ The bothria in Olsson's species are said to be marginal, while the position of the genital apertures was not made out. It is therefore not possible to refer the specimens here described to that species.

Type.—No. 4740, U.S.N.M. Specimens sent to me by Doctor T. H. Bean for identification, received April 20, 1891. The specimens were taken from a so called rock cod (*Sebastes* sp.) at Whatcom, Washington.

The bottle contained two fragments and portion of pyloric cæca of fish. The fragments measured 190 and 310 mm. in length, respectively. Another fragment with scolex was found in one of the pyloric cæca; this was 115 mm. in length.

Head small, elongated truncate, and somewhat capitate, constricted near posterior end with prominent posterior margin; fossettes coincide with flat surface of body and extend posteriorly nearly to constriction; segments begin immediately behind head, somewhat funnel shaped, soon becoming densely crowded and much broader, ten to twenty or more times as broad as long, decreasing in breadth and increasing in length again toward posterior end. Posterior segments in groups of three or four, namely, divisions between segments of contiguous groups more distinctly marked than between other adjacent segments.

Dimensions of head and segments: Length of head, 1.30 mm.; breadth of head, apex, 0.46; middle, 0.46; base, 0.40; breadth of first segment, 0.42; length of first segment, 0.12; greatest breadth, 5.5; length of broadest segments, 0.25; breadth of posterior end, 2; length of posterior segments, 0.8.

Ova large, crowded along median line in oval or pyriform clusters. Two typical ova yielded the following measurements: Length, 0.076 mm.; breadth, 0.038; length, 0.072; breadth, 0.041.

The sides of the head which correspond with the lateral margins of the body are medianly depressed toward anterior end.

Only mature segments were sectioned, in which the uterus with its contained ova obliterated many details of structure. The cirrus and vagina open by a common aperture on the middle of one of the flat surfaces of the body. This surface may be regarded as the ventral aspect of the body. The vagina is behind the cirrus; in some cases directly behind it, in others a little to one side or the other of the median line. The cirrus is slender and the muscular pouch has rather weak walls. A central vitelline mass, as in *D. lacinatum*, and vitelline ducts were distinguished. The cells of the ovary are very large, with very conspicuous nuclei in carmine-stained sections. A subglobular

¹Lund's Univ. Årsskr., IX, p. 12, pl. III, figs. 67-69.

sphincter was made out on the oviduct near the ovary (Fig. 6). The uterus opens externally on the middle of the dorsal surface.

The structure of the body is in brief as follows: Named from the outside the layers are: 1, cuticle; 2, a granular layer which contains radiating horizontal and longitudinal fibers and carries in its meshes numerous small nucleated cells. The longitudinal fibers of this layer lie mainly near the cuticle; 3, a glandular layer containing the vitellaria with radiating connective fibers; 4, a thin layer of circular fibers; 5, a thick layer of coarse longitudinal fibers, gathered into bundles, with transverse connective fibers between the muscle bundles; 6, a layer of circular fibers which surrounds 7, the inner core of the body containing the testes, which consists of lobular glands in a granular and fibrous stroma.

Calcareous bodies are present in the central core and sparsely scattered elsewhere, but nowhere abundant in the sections that were examined.

17. DIBOTHRIMUM LIGULA Donnadieu.

Ligula digramma CREPLIN (larva) DIESING, Syst. Helm., I, pp. 580-581; Revis. d. Cephal. Param., pp. 231-232.—SCHAUINSLAND, Embryonalentwickl. pp. 31-36, pl. III, figs. 1-7.

Dibothrium ligula ZSCHOKKE, Rech., pp. 26-27.

Ligula catostomi LINTON, Bulletin U. S. Fish Com., IX, pp. 66-72, pl. XXIII, figs. 1-5; pl. XXIV, figs. 1-6; pl. XXV, fig. 1.

1. No. 4706, U.S.N.M. Label reads: "Taken from the sucker (*Catostomus latipinnis* or *C. insignis*) inhabiting the Gila River and Salt River, Arizona. Several are found in one fish. E. Palmer, one specimen."

Dimensions: Length, 280 mm.; greatest breadth, 11.5; breadth, 10 mm. from anterior end, 9; breadth, 10 mm. from posterior end, 11.

Body smooth, with median furrow along middle of each side. With lens, body seen to be divided into segments by fine transverse lines which are about 0.4 mm. apart in the middle region of the body; also minute pores can be distinguished in median furrow toward posterior end of body.

2. No. 4708, U.S.N.M. Label reads: "From intestine of river smelt (*Osmerus mordax*) Potomac River; C. E. Ridenour, Hagerstown, Maryland."

One specimen, length, 230 mm.; breadth near anterior end, 6.5; greatest breadth back of head, 8.5; breadth near posterior end, 3.

3. No. 4707, U.S.N.M. From silvery minnow (*Hybognathus nuchale*).

One specimen, length, 270 mm.; greatest breadth, 12; thickness, 3.5.

Minute transverse striae cross the body and there is a deep median furrow on one side.

4. No. 4725, U.S.N.M. Label reads: "From male red-fin (*Notropis cornutus* Rafinesque); Fourth Lake, Fulton Chain, Adirondacks; fish 4 inches long, but milt not developed; F. Mather, July 2, 1882."

Several fragments in bad state of preservation. Largest fragment: Length, 45 mm.; greatest breadth, 5; thickness, 2.5. Median furrow distinct.

I follow Donnadien's suggestion and Zschokke's example in referring the genus *Ligula* (larva) to the genus *Dibothrium*. There have been numerous species of *Ligula* described, but the distinctive characters of the species rest, in many cases certainly, merely upon the difference of habitat and the dimensions of the body of the worm. I do not see anything in the above example to lead me to think that they would develop into more than one different species of worm. The fact established by the interesting experiments of Donnadien that *Ligula* is the larval stage of a worm living in the adult stage in the intestine of different aquatic birds accounts for the very wide distribution of this species.

18. *DIBOTHRIUM* species; larva.

No. 4792, U.S.N.M. From peritoneum of squeteague (*Cynoscion regalis*); Woods Holl, Massachusetts, July 26, 1889.

Length of living specimen about 15 mm. ; breadth, 2.4; of nearly uniform breadth and narrowed about equally at each end; posterior end with terminal pore; body crossed with fine wrinkles.

19. *ANTHOBOTHRIMUM LACINIATUM* Linton.

Anthobothrium laciniatum LINTON, U. S. Fish Com. Rept., 1887, pp. 754-759, pl. III, figs. 10-13; pl. IV, figs. 1-3.

No. 4776, U.S.N.M. From the intestine of the blue shark (*Prionace glauca*); Woods Holl, Massachusetts, August 5, 1889, few; numerous free, mature proglottides, measuring as much as 3.5 mm. in length and 1.5 in breadth; one proglottis somewhat distorted, was 4.5 mm. long and 1 broad.

Dimensions of scolices and strobiles generally not materially different than those given in original description of specimens from *C. obscurus*.

20 *ANTHOBOTHRIMUM PULVINATUM* Linton.

(Plate XXXIII, fig. 1.)

Anthobothrium pulvinatum LINTON, U. S. Fish Com. Rept., 1887, pp. 759-765, pl. IV, figs. 4-9; pl. V, figs. 1, 2.

In the summer of 1889 I found this worm on two occasions in the sting ray (*Dasyatis centrura*); Woods Holl, Massachusetts, July 18, one specimen, length, 135 mm.; greatest breadth, 6. August 14, two specimens, length of longest 260 mm. The specimen collected on July 18 was slender for the first third of the entire length with nearly uniform diameter of 1.75 mm. It then thickened rapidly, reaching a maximum breadth of 6, whence it narrowed again gradually to the posterior end, where it was 2 broad. The thickness of the body throughout was about 2 mm. The thick part of the body was flesh color, the anterior slender part pale olive. Body crossed by fine transverse lines, i. e., segments in middle of body exceedingly short; segments near posterior end of body only about 0.2 mm. in length; length of last segment, 1.5.

The specimens collected on August 14 had heads and necks white and translucent, body thick, opaque, pale reddish-brown, or flesh color.

Fig. 1 is a sketch of the head of a living specimen introduced here to illustrate a common condition.¹

In the National Museum collection there are five lots of these parasites, Nos. 4716, 4737, 4717, and 4725.

1. Bottle contains no label to indicate either locality or host. The specimens are not in good condition, but are easily identified. Five specimens, besides a number of fragments. Longest specimen, 230 mm.; greatest breadth, 6.5; breadth of head, bothria appressed, 3.5; breadth of head with divergent, cruciform bothria, 4.5.

2. Label reads: "Big ray, No. 182." No locality.

The vial contains four specimens in good condition. Dimensions of longest: Length, 160 mm.; breadth, 3; diameter of head, 3.5; diameter of bothrium, 2.

The specimens are plump, almost cylindrical, bothria contracted, corrugated, cushion-shaped, appressed so as to make quadrangular head when viewed in front.

3. Label: "From long-tailed ray." No locality. Three specimens. Largest specimen, 165 mm.

4. Label: "Big ray, No. 83." No locality. Two specimens with a number of fragments. Average length, 180 mm.; greatest breadth, 4.5; other dimensions as above.

5. No. 4409, U.S.N.M. Label: "*Trygon centrura*." One specimen.

21. ECHENEIBOTHRIUM VARIABILE Beneden.

Echeneibothrium variable BENEDEN, U. S. Fish Com. Rept., 1886, pp. 460-462, pl. 1, figs. 9-13; 1887, pp. 766-767.

No. 4787, U.S.N.M. Twelve specimens of the common skate (*Raja erinacea*) were examined for parasites at Woods Holl, Massachusetts, July 23, 1889. Numerous examples of *E. variable* were found in the spiral intestines of most of the fish.

22. PARATÆNIA MEDUSIA Linton.

Paratænia medusia LINTON, U. S. Fish Com. Rept., 1897, pp. 862-866, pl. xv, figs. 5-9.

No. 4799, U.S.N.M. Two specimens which agree perfectly with my former observations on this species were found in the intestine of the sting ray (*Dasyatis centrura*); Woods Holl, Massachusetts, July 18, 1889.

The dimensions are not materially different from those given in the original description of the species.

¹ U. S. Fish Com. Rept., 1887, p. 759.

23. RHINEBOTHRIUM LONGICOLLE Linton.

(Plate XXXIII, figs. 2-4.)

Rhinebothrium longicolle LINTON, U. S. Fish Com. Rept., 1887, pp. 775-778, pl. VI, figs. 1-4.

Nos. 4805, 4802, 4804. A few fragments of strobile, no scolex, overlooked in first description of the species; collected in August, 1884, from intestine of *Myliobatis freminvillei* belong to this species.

In the summer of 1889 I encountered this worm on three different occasions, each time in the cow-nosed ray (*Rhinoptera bonasus*), habitat added. August 1, ten specimens (from one ray); August 14, one specimen; August 16, two specimens.

This species was also found in the United States National Museum collection—no catalogue number; label reads: "Intestine of small *Raia*, Penkese, July 13, 1874." The vial contains a number of fragments, three of them with scolices; length of longest about 25 mm.

A specimen in the lot collected on August 16 was at first taken to be a distinct species, but subsequent examination of the alcoholic specimen proves it to belong to this species. For some reason, probably on account of age, the bothrial costæ are very indistinct, which gave the specimen a very different appearance, especially in the living specimen. Length, 37 mm.; length of ripe proglottis, 1.3. Figs. 3 and 4 represent the ova of this species as they were observed on different occasions. The thin pellicle which surrounds the ovum is extended into a long filament, which is five or six times the length of the ovum. In the proglottis these filaments are felted together. When they are extended in water they remain in a mass for a time, but ultimately lose the filaments. At least, in a lot of ova which had been lying for some time in sea water filaments were found on only a part of the ova, while those which were seen in place through the walls of the proglottis were all provided with filaments.

The dimensions of the largest ova in one lot were 0.028 and 0.038 mm. in the two principal diameters. The filaments were five or six times as long as the ova.

This species was first found in *Myliobatis freminvillei*.

24. RHINEBOTHRIUM MINIMUM Beneden.

(Plate XXXIII, fig. 5.)

Echeneibothrium minimum BENEDEN, Diesing, Revis. d. Cephal. Param., p. 268.

No. 4803, U.S.N.M.; United States Fish Commission, collector; off Marthas Vineyard, Massachusetts, 1881, station 919. From stomach of *Raja lavis*.

The vial contains several fragments, among which are two strobiles with scolices.

Dimensions of one of these: Length, 9 mm.; length of bothrium, 0.5; breadth of bothrium, 0.2; diameter of neck, 0.2; length of postero-medial segments, 0.36; breadth of same, 0.4; length of posterior seg-

ment, 0.8; breadth of posterior segment, 0.38. The segments begin as fine transverse striae, immediately behind the head. Bothria with ten loculi arranged in four pairs with a single one at each extremity. The bothria are attached by short pedicels near their posterior ends, their anterior ends projecting in front, giving the head the appearance of a four-petaled flower. Some of the free segments, probably belonging to this species, were much longer than broad; length, 2.7 mm.; breadth, 0.37.

These specimens agree with Beneden's description and figures of *E. minimum*.

25. SPONGIOBOTHRIUM VARIABLE Linton.

Spongiobothrium variable LINTON, U. S. Fish Com. Rept., 1886, pp. 462-464, pl. II, figs. 13-19; 1887, pp. 778-780.

Nos. 4807, 4806, U.S.N.M. Three finds of this species have been made since the report of 1887; each in the sting ray (*Dasyatis centrura*); all at Woods Holl, Massachusetts, in 1889.

1. July 18; one specimen; length, 94 mm.; bothria exceedingly variable, extending to 1 mm. or more. The appearance of the bothria was somewhat different from what I had previously observed in this species. The bothria are flat, thin, and very flexible, surrounded by a finely crenulate muscular border and mounted on pedicels, the latter being very flexible. The bothria become much crumpled and the pedicels greatly shortened as the worm contracts. When first removed and placed in sea water the bothria resemble those of *Anthocephalum gracile* Linton, but there is no auxiliary acetabulum. The mature segments measured 7 mm. in length and 0.9 in breadth.

2. July 24; one specimen. The edges of the bothria were very versatile in life, extending into flexible digitate projections when first placed in sea water.

3. August 5; one specimen, with numerous free proglottides; the latter plump and swollen. The neck was coiled in a close spiral in life, which imparted a very deceptive appearance to the specimen. One specimen, belonging to the lot collected July 18 and placed at the time of collecting with two specimens of *Paratania medusia*, proves to be an immature *Spongiobothrium variable*. It was at first taken to be a specimen of *Paratania*, although a little larger than the other specimens in the vial, and had a broad top-shaped head, which, when examined closely was seen to lack bothria, while the retracted part was a folded plicated organ looking, in this condition, not unlike the characteristic tentacles of *Paratania*. The segments resemble those of *Spongiobothrium*; the first very short, becoming as long as broad, then roundish, moniliform, and then longer than broad.

Dimensions: Length, about 4 mm.; breadth of head, 0.5; length of head, 0.33; breadth of neck, 0.1; length of last segment, 0.3; breadth of last segment, 0.14.

26. PHYLLOBOTHRIMUM FOLIATUM Linton.

(Plate XXXIII, fig. 6.)

Phyllobothrium foliatum LINTON, U. S. Fish Com. Rept., 1887, pp. 787-794, pl. VI, figs. 5-10.

Nos. 4733, 4840, U.S.N.M. The following additional discoveries of this parasite are here recorded; all collected at Woods Holl, Massachusetts, from the spiral intestine of the sting ray (*Dasyatis centrura*), in the summer of 1889.

July 24, one specimen, one ray examined; August 9, several specimens, in each of two rays examined; August 14, three specimens, small, from one ray examined; August 16, two specimens, from one ray examined.

One of the rays examined on August 9 had begun to decompose slightly, there being a strong ammoniacal odor given off from the intestine. In this intestine the worms were exceedingly attenuate, as much as 260 mm. in length, and filiform; they were dead, and I infer that the attenuate, filiform condition represents a post mortem change. The worms from the other, slightly fresher intestine were normal in shape, and when placed in sea water were moderately active.

Fig. 6 represents a segment which was free when collected and which appears to belong to this species. It was observed after the free proglottides had lain in sea water for some twelve hours that a large mass of ova had been discharged from one or more of them and was lying spread out on the bottom of the dish. The mass adhered so tightly to the glass that it could not be removed by the suction of a pipette; when gently separated from the dish the ova were found to be held together by a mucilaginous substance. The adhesive material appears to be soluble in alcohol. The ova, at least many of them, were collapsed on one side, boat-shaped; 0.038 and 0.024 mm. in the two principal diameters.

27. ORYGMATOBOTHRIMUM ANGUSTUM Linton.

Orygmatobothrium angustum LINTON, U. S. Fish Com. Rept., 1886, pp. 468-469, pl. III, figs. 1-3; 1887, pp. 796-799, pl. VII, fig. 3.

No. 4796, U.S.N.M. Numerous examples of this species were found in the intestine of the blue shark (*Prionace glauca*); Woods Holl, Massachusetts, August 5, 1889.

Although I am not satisfied with this disposition of the species, and am convinced that when the much-needed revision of the Tetrabothriidæ is made, *O. angustum* Linton must take the place of a synonym, I have retained the name which I have used in previous papers, in order to avoid confusion.

28. *ORYGMATOBOTHRIMUM PAULUM*, new species.

(Plate XXXIII, figs. 7, 8)

Type.—No. 4798, U.S.N.M. From spiral intestine of the tiger shark (*Galeocerdo tigrinus* Ranz); Woods Holl, Massachusetts, August 14, 1889; very numerous.

Bothria four, variable in shape from long to short-oval, each with two pits (acetabula), an anterior small and shallow, a posterior larger and profound, with a strong contractile border; anterior acetabulum confluent with posterior (Fig. 8), which is from a sketch of a hardened specimen; the thick border of the bothria is not so evident in fresh specimens.

These specimens were referred at the time of collecting, upon a somewhat hasty examination of the living worms, to *O. angustum*, but on account of the smaller size, shorter neck, and different character of the bothria revealed in the preserved specimens, I have found it necessary to make a different disposition of them.

Dimensions of typical example: Length, 9 mm.; diameter of head, 0.43; length of bothrium, 0.22; diameter of neck, 0.15; distance to first segments, 0.47; breadth of first segment, 0.15; length of first segment, 0.03; length of fourth segment from last, 0.47; breadth of last segments, 0.28; length of last segment, 1.03.

Under a high magnifying power the neck and segments are seen to be crossed by fine transverse lines which give a finely serrate outline to the margins, the neck is shorter and the striae and marginal serrations not so evident as in *O. angustum*.

The disposition of the reproductive organs agrees with that of *O. angustum*. The vitelline glands lie along the lateral margins; germ gland two-lobed near posterior end; vagina curves in a crook around and in front of cirrus-bulb; cirrus retracted in every case, but was seen to be beset with minute spines; cirrus-bulb pyriform; reproductive aperture on about anterior third of lateral margin; testes longitudinally placed, central to vitelline glands.

When scolices of preserved specimens of *O. angustum* and *O. paulum* are compared the differences are seen to be considerable, and can not be accounted for by different action of the preserving fluid.

29. *ORYGMATOBOTHRIMUM CRENULATUM*, new species.

(Plates XXXIII, figs. 9-12; XXXIV, fig. 1.)

Type.—No. 5506, U.S.N.M. From spiral intestine of the sting ray (*Dasyatis centrura*); Woods Holl, Massachusetts, August 14, 1889; two examples.

Bothria four, cruciformly disposed, globular, each provided with an auxiliary acetabulum and an accessory disk of strong circular fibers; no myzorhynchus; neck crossed by fine transverse lines, which make a serrate or crenulate margin, which character persists throughout the

strobile, the posterior segments being crenulate on lateral margins; segments at first broader than long, becoming square, then longer than broad.

Dimensions of a specimen (alcoholic): Length, 8.5 mm.; diameter of head, 0.44; diameter of neck, 0.11; distance to first distinct segment, 1; length of first distinct segment, 0.08; breadth of same, 0.14; length of last segment, 0.56; breadth of last segment, 0.28.

The strobiles were young and the reproductive apparatus could not be made out satisfactorily. The vitellaria make a comparatively narrow border along the margins; ovary at posterior end, apparently single; testes centrally placed, mostly forward of the genital cloaca; the genital aperture is about the middle or a little in front of the middle of the length of the segment, not on a lateral margin, but near it. (Plate XXXIII, fig. 12.)

Plate XXXIV, fig. 1, is from a sketch of a longitudinal section through the head of one of the specimens, and represents the relation of the anterior acetabulum to the bothrium proper and of the auxiliary organ of circular fibers. The two former organs present the usual appearance made by the strong radiating fibers characteristic of such organs; the latter lies superficially to the larger acetabulum and consists almost entirely of strong circular fibers. In these two specimens these fibers were strongly contracted into a circular disk, with small aperture. The disk really represents the border of the bothria proper, and when relaxed no doubt gives to the bothrium a very different aspect from what it bears in these specimens.

Plate XXXIII, fig. 11, is a hypothetical sketch giving what I conceive to be the relation of the circular fibers to the acetabula when relaxed.

30. CROSSOBOTHRUM LACINIATUM Linton.

Crossobothrium laciniatum LINTON, U. S. Fish Com. Rept., 1886, pp. 469-474, pl. III, figs. 4-18; 1887, pp. 799-802, pl. VII, fig. 4.

Nos. 4718, 4723, 4734, 4738, 4780, 4781, U.S.N.M. Several lots of this parasite occur in the United States National Museum collection. All were collected at Woods Holl, Massachusetts, the host in each case being the sand shark (*Carcharias littoralis* Mitchell). The parasites were usually in considerable numbers and were found in the the spiral intestine.

These specimens were collected in the months of August, November, and December. Collectors, Vinal N. Edwards and Ralph S. Tarr.

Both young and adult specimens were found together in the November collections, appearing much as I have seen them in July.

One specimen was found which had an elongated first joint, or neck, like that noticed and figured in my report on Cestodes of Marine Fishes.¹ This is the second individual of the kind that I have noticed among many hundreds of individuals from many different hosts.

¹ U. S. Fish Com. Rept., 1887, p. 800, pl. VII, fig. 4.

In this lot were some with attenuated anterior ends and distorted heads which would be very puzzling to one who has not seen the living worm.

Since reporting on this worm I have encountered it at Woods Holl, Massachusetts, July 8, 1889, where in about one hundred and seventy-five specimens, young and adult, it was found in spiral intestine of sand shark. The young worms were found in the anterior part of the intestine near the pyloric division of the stomach. Again on July 12, 1889, numerous specimens found in spiral intestine of each of two sand sharks, and on July 13, 1889, a few specimens were found in a mutilated intestine of sand shark which had been brought into the laboratory.

In July, 1889, I received from Doctor E. A. Andrews a vial containing a single example of *C. laciniatum*, which was found by him, in a pail containing specimens of *Molgula*. August 16, 1889, one specimen of *C. laciniatum* in intestine of sand shark.

31. ONCHOBOTHRIMUM UNCINATUM Diesing.

(Plate XXXIV, figs. 2-5.)

Onchobothrium uncinatum DIESING, Revis. d. Cephal., Param., pp. 269-270.—OLSSON, Lund's Univers. Årsskrift, III, p. 45, pl. II, figs. 30-34.

No. 4795, U.S.N.M., is from intestine of sting ray (*Dasyatis centrura*); two specimens, in poor state of preservation. Heads much distorted and details of structure difficult to make out; bothria, four, in marginal pairs, apparently trilocular; the largest loculus near apex, and surrounded by a pair of dark-brown, nearly black hooks; neck long; broadest segment some distance from posterior end, toward which they become narrower; genital apertures marginal, irregularly alternate.

Dimensions: Length of largest, 61 mm.; breadth of broadest segments, 2; length of same, 0.3; length of posterior segments, 0.8; breadth of posterior segments, 1; thickness of head, 0.6; breadth of head, 0.8; breadth of neck, 0.6; length of bothrium, 0.4; breadth of bothrium, 0.35.

One of the specimens was quite attenuate, and 34 mm. in length without any indication of segments. The details of structure of hooks were not made out with entire satisfaction. One hook of each pair bears a small tubercular hook at its base. The hooks are in pairs, whether united at base not certain; in one case the hooks of a pair were united by a slender chitinous bar, a blending of their broad bases. In another case the bases, while contiguous, were not united. The hooks were more or less broken, so that lengths could not be obtained exactly.

Dimensions of hooks: Length, measured from top to opposite of base, about 0.17 mm.; breadth of base, 0.1; length of hook proper, 0.08.

While the hooks do not agree in detail with descriptions of this species, none of them maintaining the tubercular hook which is born by one hook in each pair, I do not feel justified in making a new specific name, particularly when the small amount of material and its poor state of preservation are taken into consideration.

32. CALLIOBOTHRIUM ESCHRICHTII Beneden.

Calliobothrium eschrichtii BENEDEN, LINTON, U. S. Fish Com. Rept., 1887, pp. 812-816, pl. VII, figs. 5-12.

Nos. 4777, 4779, U.S.N.M. Three lots of this worm have been collected since the report for 1887 was made, all in the summer of 1889; Woods Holl, Massachusetts, from the dogfish (*Mustelus canis*). July 12, a small number of specimens from each of two dogfish; July 18, few specimens from each of four dogfish; August 1, few specimens from three of four dogfish.

In nearly every case they were associated with *C. verticillatum*, *Rhynchobothrium bulbosum*, and *R. tumidulum*.

33. CALLIOBOTHRIUM VERTICILLATUM Rudolphi.

(Plate XXXIV, figs. 6, 7.)

Calliobothrium verticillatum RUDOLPHI, LINTON, U. S. Fish Com. Rept., 1886, pp. 476-479, pl. IV, figs. 1-8; 1887, pp. 810-812.

No. 4778, U.S.N.M. The following discoveries of this species were made in the summer of 1889 at Woods Holl, Massachusetts; all from intestine of the dogfish (*Mustelus canis*). July 12, a small number of specimens in each of two dogfish; July 18, a few specimens in each of four dogfish; July 22, a few specimens in each of two dogfish; July 25, a good many, large, in one dogfish; August 1, many specimens in three of four dogfish.

Usually associated with *C. eschrichtii*, *Rhynchobothrium bulbosum*, and *R. tumidulum*, but, as a rule, I have found it more abundant than its associates, and more likely to occur in this, its apparently peculiar host.

Some proglottides belonging to those collected August 1 were left in sea water over night. On the following morning masses of ova were found in the water, inclosed in what appeared to be portions of the uterus (Fig. 6). Many of these ova had begun to undergo segmentation. In some the embryonic spines had made their appearance, although the exact number could not be made out with certainty in any case.

34. PHOREIOBOTHRIUM LASIUM Linton.

Phoreiobothrium lasium LINTON, U. S. Fish Com. Rept., 1886, pp. 474-476, pl. IV, figs. 24-29; 1887, pp. 819-820.

No. 4800, U.S.N.M. One specimen was found associated with numerous examples of the species *Orygmabothrium angustum*, from the intestine of the blue shark (*Prionace glauca*); Woods Holl, Massachusetts, August 5, 1889.

This species was originally described from specimens found in *Carcharinus obscurus*.

35. THYSANOCEPHALUM CRISPUM Linton.

Phyllobothrium thysanocephalum LINTON, U. S. Fish Com. Rept., 1886, pp. 464-468, pl. II, figs. 1-12.

Thysanocephalum crispum LINTON, U. S. Fish Com. Rept., 1887, pp. 823-824; 1888, pp. 543-556, pls. LXI-LXVII, figs. 1-43.

No. 4732, U.S.N.M. This species has been reported upon in a special paper, cited above. It was found on two occasions in the summer of 1889, at Woods Holl, Massachusetts, in the intestine of the tiger shark (*Galeocerdo tigrinus*). I have examined only three specimens of this shark, but in each have found enormous numbers of this curious cestod.

36. RHYNCHOBOTHRIMUM BULBIFER Linton.

Rhynchobothrium tenuicolle RUDOLPHI, LINTON, U. S. Fish Com. Rept., 1886, pp. 486-488, pl. V, figs. 17, 18.

R. bulbifer LINTON, U. S. Fish Com. Rept., 1887, pp. 825-829, pl. X, figs. 8, 9; pl. XI, figs. 1, 2.

Nos. 4752, 4746, U.S.N.M. I found this species on three occasions in the summer of 1889, Woods Holl, Massachusetts, in the intestine of dogfish (*Mustelus canis*). July 12, a few specimens in each of two dogfish; July 18, few in each of three dogfish; July 25, few in one dogfish.

This species is usually associated with the smaller *R. tumidulum* and the two species of *Calliobothrium*, *C. verticillatum* and *C. eschrichtii*.

37. RHYNCHOBOTHRIMUM TUMIDULUM Linton.

Rhynchobothrium tumidulum LINTON, U. S. Fish Com. Rept., 1887, pp. 829-832, pl. XI, figs. 3-11.

No. 4748, U.S.N.M. This species was discovered on three occasions in the summer of 1889 in intestine of the dogfish (*Mustelus canis*); Woods Holl, Massachusetts; July 12, a few from each of two dogfish; July 18, few in each of four dogfish; August 1, a few in three of four dogfish.

This species is usually associated in the dogfish with the larger *R. bulbosum* and two species of *Calliobothrium*, *C. verticillatum* and *C. eschrichtii*.

A *Rhynchobothrium* which I found in the intestine of the sting ray (*Dasyatis centrura*) at Woods Holl, Massachusetts, August 16, 1889, agrees with this species.

38. RHYNCHOBOTHRIMUM TENUISPINE Linton.

(Plate XXXIV, fig. 8.)

Rhynchobothrium tenuispine LINTON, U. S. Fish Com. Rept., 1887, pp. 837-838, pl. XII, figs. 1, 2.

Nos. 4749, 4751, U.S.N.M. I discovered this species on one occasion in the sting ray (*Dasyatis centrura*), intestine, since 1887, in the summer of 1889; July 18, one specimen.

I have also found a *Rhynchobothrium* in the spiral valve of the blue

shark (*Prionace glauca*) which appears to be identical with this species, at least in the character and disposition of the hooks on the proboscides, which I find to be one of the safest criteria in determining identities in the Tetrarhynchida. Two specimens were found in the blue shark August 5, 1889, at Woods Holl, Massachusetts. They were associated with *Orygmatobothrium angustum* and *Anthobothrium laciniatum*.

Dimensions of alcoholic specimens: Length of head and neck, 0.85 mm. in one, 1 in the other; length of bothrium, 0.24; breadth of head, 0.36; diameter of neck, 0.27; length of last (eighth) segment, 0.54; whole length of each specimen, 2.5. Color faint reddish brown or flesh color. The posterior segments are loosely attached and evidently became detached before maturity. A number of free proglottides which had been placed in a vial with specimens of *O. angustum* are evidently *Rhynchobothrium* segments and presumably belong to this species. One of them is represented in Fig. 8. If they are in truth specimens of this species they have increased in length enormously as compared with those which are still attached to the strobile.

Dimensions of one of these free proglottides (alcoholic): Length, 2.8 mm.; breadth near anterior end, 0.56; breadth at reproductive aperture, 0.56; breadth near posterior end, 0.3.

Proglottis slipper-shaped, round at anterior end, slightly constricted in front of reproductive aperture about middle, bluntly rounded and slightly narrowed posteriorly; reproductive aperture on lateral margin near posterior third, in broad shallow cloaca; vitellaria narrow along each lateral margin through nearly whole length; testicular masses in anterior half; ovaries two, united by narrow part about halfway between reproductive aperture and posterior end; vagina short, curved, opening beside and behind cirrus; cirrus bulb oval, inclined inward and forward.

The crenulate margins agree with what was observed on segments attached to strobile. Analogy with *R. bulbifer*, whose proglottides grow after separation from strobile, favor the theory that these segments belong to *R. tenuispine*. Length of longest fragment, 22 mm. (the length of a strobile must be very considerably greater than this); length of bothrium, 0.55; breadth of bothrium, 0.4; length of head and neck, 1.4; diameter of neck, 0.4; length of contractile bulbs, 0.35; length of last segments, 2.4; breadth of last segments, 0.6.

Dimensions of another specimen, alcoholic: Length of bothrium, 0.45 mm.; length of proboscis, 0.9; diameter of proboscis at base, including hooks, 0.045; diameter of proboscis at apex, including hooks, 0.035; length of largest hooks, 0.012.

In one specimen two of the proboscides had been extended along with 0.3 mm. of the sheath.

The scolex and strobile bear some resemblance to those of *R. agile*, but the character of the hooks on the proboscides is quite different in the two species.

39. RHYNCHOBOTHRIMUM IMPARISPINE Linton.

Rhynchobothrium imparispine LINTON, U. S. Fish Com. Rept., 1887, pp. 840-843, pl. XII, figs. 6-9.¹

No. 4745, U.S.N.M. From the intestine of the skate; October 17, 1887, Woods Holl, Massachusetts; V. N. Edwards, collector, seven specimens.

Dimensions of alcoholic specimen: Length, 26 mm.; length of bothrium, 0.9; length of head and neck, 6; length of posterior segments, 2.2; breadth of posterior segments, 1.

The hooks of this species bear a close resemblance to those of *R. erinaceus* Beneden.

The species of skate is probably *Raja erinacea*.

40. RHYNCHOBOTHRIMUM LONGICORNE Linton.

Rhynchobothrium longicorne LINTON, U. S. Fish Com. Rept., 1887, pp. 847-849, pl. XIII, figs. 4-8.

No. 4839, U.S.N.M. was collected at Woods Holl, Massachusetts, date not given; from intestine of sand shark (*Carcharias littoralis*).

Dimensions of alcoholic specimen: Length, 35 mm.; length of head and neck, 5; length of proboscis, approximately, 4; length of last segment, 3.5; breadth of last segment, 1.75.

Genital aperture near anterior end with prominent lips showing crenulate outline. The bothria project in front of the head, are distinctly emarginate posteriorly, and bilobulate, with a prominent median ridge between the loculi. Hooks of very diverse shapes.

41. RHYNCHOBOTHRIMUM BREVISPIKE, new species.

(Plate XXXIV, figs. 9-11.)

Type.—No. 4750, U.S.N.M. Label reads: "Intestine of small ray; Penikese, July 13, 1874."

It is highly probable that the ray was *Rhinoptera bonasus*, since a parasite recognized as *Rhinebothrium longicolle* was along with this parasite in the same vial.

Bothria elliptical, divergent at base; neck subcylindrical; first segments very short and crowded, becoming squarish, then much longer than broad, last segments four or more times as long as broad; reproductive aperture near middle of lateral margin, or a trifle nearer the posterior than the anterior edge of the segments; proboscides long and slender, twice as long as the bothria, very slightly tumid at base, tapering a little toward the apex; hooks small, about four longitudinal rows of stout hooks with broad bases and recurved points, these flanked by two longitudinal rows on each side of smaller hooks not quite so

¹Errata, p. 839, line 2, read figs. 3-5 instead of figs. 3-6; p. 840, line 13, read figs. 6-9 instead of figs. 7-9; p. 880, for *Anthobothrium*, read *Anthocephalum*; p. 890, fig. 6, with explanation, should follow *Rhynchobothrium imparispine*.

broad. The remaining rows are composed of hooks which are more slender and not so sharply recurved. There is not a very great diversity of shape and size in the hooks in this species.

Dimensions obtained by measurement of alcoholic specimens.

42. RHYNCHOBOTHRIMUM AGILE, new species.

(Plate XXXIV, figs. 12-15.)

Type.—No. 4747, U.S.N.M. Bothria elliptical, divergent at base, with longitudinal median raised septum; neck cylindrical, short when compared with strobile, which is very long and slender; proboscides armed with exceedingly small hooks, those on one side being stouter and more recurved and blunter than those on the other side, more slender, shorter, straightish, and sharper pointed; segments begin near base of contractile bulbs as fine, transverse lines; first segments consequently very short, soon becoming squarish, then oblong, ultimately twice as long as broad and subcylindrical, posterior margins slightly flaring; reproductive aperture near middle of lateral margin.

From intestine of cow-nosed ray (*Rhinoptera bonasus*); Woods Holl, Massachusetts, 1889, August 14, two specimens; August 16, one specimen.

Dimensions of living specimen: Length, 63 mm.; breadth of head, 0.7; length of bothrium, 0.46; breadth of bothrium, 0.44; diameter of neck, 0.4; length of free proglottides with ova, 4; breadth of free proglottides, 1.5.

The free segments were almost cylindrical. When placed in sea water one of them was seen to discharge ova from one end in a dense white stream. After a short time they formed a mass at the bottom of the watch glass. The color of the mass of ova changed rapidly from white to very bark-brown, almost black. Some of the ova appear nearly globular, others measured 0.028 and 0.022 mm. in the two principal diameters.

The specimen obtained on August 16 was long and slender, white, very active, even after lying twelve hours in sea water, contracting irregularly and throwing itself into knots and coils so that it was impossible to get satisfactory measurements. In contracting, tumid places are succeeded by filiform places, which in their turn may quickly become tumid again. This worm was still active nearly twenty-four hours after its capture, when it was placed in picrosulphuric acid. It was broken in several pieces while it was still alive in endeavoring to dislodge the proboscides from a segment into which the worm had thrust them. It held on very tenaciously and was dislodged with the greatest difficulty.

Some dimensions of alcoholic specimen: Breadth of head, 0.65 mm.; length of bothrium, 0.45; breadth of bothrium, 0.36; diameter of neck, 0.36; length of contractile bulbs, 0.34; length of head and neck, 1.23; diameter of proboscis exclusive of hooks, 0.03; length of largest hooks, 0.006; length of last segment, 1.5; diameter of last segment, 0.65.

43. TETRARHYNCHUS ROBUSTUM Linton.

Tetrarhynchus robustum LINTON, U. S. Fish Com. Rept., 1887, pp. 855-857, pl. XIV, figs. 7-9.

No. 4821, U.S.N.M.; Woods Holl, Massachusetts, August 14, 1889, intestine of cow-nosed ray (*Rhinoptera bonasus*), two specimens.

The dimensions of the bothria and all the soft parts somewhat less than those given of *T. robustum* in original description and more than those given of *T. tenue*; the shape, arrangement, and dimensions of the hooks agree with those of *T. robustum*. Reproductive apertures are near the anterior margin of the proglottis.

This species was originally described from specimens found in the sting ray (*Dasyatis centrura*).

44. TETRARHYNCHUS BISULCATUM Linton.

Rhynchobothrium bisulcatum LINTON, U. S. Fish Com. Rept., 1886, pp. 479-486, pl. IV, figs. 9-23.

Tetrarhynchus bisulcatum LINTON, U. S. Fish Com. Rept., 1887, pp. 857-861, pls. XIV, figs. 10-12; XV, fig. 1.

No. 4713, U.S.N.M. Label reads: "Spotted shark, No. 69."

Numerous specimens of this species are felted together into a mass from which it is difficult to get a complete specimen. One fragment was measured and found to be over 150 mm. in length.

I have found this species in the adult condition, thus far, only in the dusky shark (*Carcharinus obscurus*). The name "spotted shark" is not distinctive. The host in this case was without much doubt *Carcharinus obscurus*.

45. TETRARHYNCHUS TENUE Linton.

Tetrarhynchus tenue LINTON, U. S. Fish Com. Rept., 1887, pp. 853-855, pl. XIV, figs. 5-6.

No. 4827, U.S.N.M. The following additional find of this species is here noticed: August 16, 1889, Woods Holl, Massachusetts, one specimen from the sting ray (*Dasyatis centrura*) stomach.

EXPLANATION OF PLATES.

The following letters have the same significance in all figures:

a. auxiliary bothrium.	lm. longitudinal muscles.
b. bothrium.	o. ovary.
c. cirrus.	t. testes.
cb. calcareous bodies.	u. uterus.
cm. circular muscles.	v. vagina.
cp. cirrus pouch.	vd. vas deferens.
cu. cuticle.	v g. vitelline gland.
	vsp. vaginal sphincter.

Where the degree of enlargement is not noted on the figure, the symbols used in these explanations refer to the eyepieces and objectives of Zeiss. stand No. VII.

The degree of enlargement with the eyepieces and objectives which were used in

the construction of these sketches, draw-tube open, is approximately that given in the following table:

Objective.	Eyepiece.	
	2	4
A.....	50	90
B.....	240	420

It should be remembered, in using this table, that the figures have been reduced one-fourth linear in the process of printing.

Most of the sketches were made with the aid of a camera lucida. Those in which the Zeiss eyepieces and objectives were used were made with an Abbe camera lucida. It is to be understood that the sketches are made from alcoholic specimens unless otherwise stated.

PLATE XXVII.

Tania salvelini, from *Cristivomer namaycush*.

- Fig. 1. Head and neck. Enlarged fourteen times.
 2. Head, neck, and first segments of another specimen. Enlarged fourteen times.
 3. Small strobile, entire. Enlarged fourteen times.
 4. Head and neck. Enlarged thirty times.
 5. Single proglottis of one of longer strobiles. Enlarged fourteen times.

Tania ocellata Rudolphi (?), from *Ambloplites rupestris*.

6. Front view of head. Enlarged fifteen times.
 7. Same enlarged. Enlarged thirty times.
 8. Posterior segments. Enlarged fourteen times.
 9. Postero-median segment, in oil of cloves. Enlarged fifteen times.
 10. Longitudinal vertical section through cirrus and vagina. Zeiss 2/A, draw-tube open.
 11. Longitudinal horizontal section through cirrus-pouch and vagina. Zeiss 2/A, draw-tube closed.

Monobothrium hexacotyle, new species, from *Catostomus* sp.

12. Ventral view of specimen. Enlarged three times.
 13. Head of same, side view. Enlarged fifteen times.
 14. Head of another specimen, side view. Enlarged fifteen times.
 15. Marginal view of head. Enlarged fifteen times.
 16. Transverse section near anterior end of head. Zeiss 2/A, draw-tube open.
 17. Transverse section of head farther back than fig. 16. Zeiss 2/A, draw-tube open.
 18. Cell from parenchyma (see Plate XXVIII, Fig. 2). Zeiss 4/D, draw-tube open.
 19. Another cell from same. Zeiss 2/D, draw-tube open.

PLATE XXVIII.

(*Monobothrium hexacotyle*, new species (continued)).

- Fig. 1. Transverse section toward base of head. Zeiss 2/A, draw-tube open.
 2. Transverse section through middle of body, *gc.* cell in parenchyma, see Plate XXVII, Figs. 18 and 19. Zeiss 2/A, draw-tube open.
 3. Diagrammatic sketch, ventral view.

Schistocephalus dimorphus Creplin (?), from *Cottus bairdii*.

- Fig. 4. Head and interior segments. Enlarged fifteen times.
5. Part of transverse section of body, *n.* nerve, *lm.* small longitudinal muscle bundles, *lm.* large longitudinal. Zeiss 2/A, draw-tube open.

Cyathocephalus truncatus Pallas, from *Coregonus clupeiformis*.

6. Ventral view of specimen. Enlarged six times.
7. Head of same. Enlarged thirty times.
8. Head of another specimen. Enlarged thirty times.

Dibothrium rugosum Rudolphi, from *Gadus callarias*.

9. Posterior segment, abnormal. Enlarged about fourteen times.
10. Longitudinal horizontal section, *lv.* excretory vessel. Zeiss 2/A, draw-tube closed.

PLATE XXIX.

Dibothrium rugosum Rudolphi (continued).

- Fig. 1. Longitudinal vertical section. Zeiss 2/A, draw-tube closed.
2. Same, more highly magnified, showing cross section of cirrus-pouch and vagina. Zeiss 2/D, draw-tube open.
3. Part of transverse section of body through the laterally placed cirrus-pouch. Zeiss 2/A, draw-tube closed.
4. Part of longitudinal vertical section of body through the external orifices of uteri. Zeiss 2/A, draw-tube closed.

Dibothrium hastatum, new species, from *Polyodon spathula*.

5. Lateral view of head, sketch from life. Enlarged fifteen times.
6. Marginal view of same, from life. Enlarged fifteen times.
7. Antero-median segments, from life, enlarged about three times.
8. Median segments, from life. Enlarged about three times.
9. Posterior segments. Enlarged four times.
10. Same of another strobile. Enlarged four times.
11. Optical section of lateral genital aperture, in oil of cloves. Enlarged one hundred and eighty times.

PLATE XXX.

Dibothrium hastatum, new species (continued).

- Fig. 1. Lateral view of head of living specimen. Enlarged thirty times.
2. Marginal view of head of living specimen. Enlarged twenty-five times.

Dibothrium infundibuliforme Rudolphi, from *Lota maculosa* and *Salvelinus namaycush*.

3. Head of specimen from *L. maculosa*. Zeiss 2/A, draw-tube closed.
4. Head of another specimen from same host. Zeiss 2/A, draw-tube closed.
5. Head of specimen of *S. namaycush*. Enlarged fifteen times.
6. Another type of head from same host. Enlarged fifteen times.

Dibothrium laciniatum, new species, from *Tarpon atlanticus*.

7. Head and anterior segments. Enlarged twelve times.
8. Same specimen, lateral view. Enlarged twelve times.
9. Another specimen, marginal view, corresponding to lateral margin of body. Enlarged twelve times.
10. Lateral view of same specimen. Enlarged twelve times.
11. Front view of head. Enlarged twelve times.
12. Antero-median segments. Enlarged twelve times.

- Fig. 13. Postero-median segments. Enlarged twelve times.
 14. Posterior segments. Enlarged twelve times.
 15. Longitudinal vertical section. Zeiss 2/A, draw-tube open, *vg'*., inner vitelline gland.
 16. Ovum. Zeiss 4/D, draw-tube open.

PLATE XXXI.

Dibrothrium laciniatum, new species (continued).

- Fig. 1. Genital cloaca with external end of cirrus-pouch and vaginal sphincter, from longitudinal, vertical section. Zeiss 2/D, draw-tube closed.
 2. Part of transverse section of body through cirrus-pouch and external, dorsal, opening of uterus. Zeiss 2/A, draw-tube closed.
 3. Section of cirrus and cirrus-pouch and vaginal sphincter, near ventral surface, from longitudinal, horizontal section of body. Zeiss 2/D, draw-tube open.
 4. Same, section made a little deeper in body than *lm*. longitudinal muscles of cirrus-bulb, Fig. 3. Zeiss 2/D, draw-tube open.
 5. Section of cirrus and cirrus-pouch and vagina, from longitudinal, horizontal section of body, not so much magnified as 3 and 4. Zeiss 2/D, draw-tube closed.
 6. Portion of transverse section. Zeiss 2/D, draw-tube closed.
 7. Longitudinal muscles and calcareous bodies. Zeiss 4/D, draw-tube open.

PLATE XXXII.

Dibrothrium occidentale, new species, from *Sebastes* sp.

- Fig. 1. View of head, bothrial side. Enlarged twenty-seven times.
 2. Marginal view of head. Enlarged forty times.
 3. Part of transverse section of body. Zeiss 2/A, draw-tube closed.
 4. Longitudinal section of cirrus-pouch, from transverse section of body. Zeiss 2/D, draw-tube open.
 5. Longitudinal section of external end of vaginal tube, vagina surrounded by nucleated cells, from transverse section of body. Zeiss 2/D, draw-tube open.
 6. Portion of ovary showing large, nucleated germ cells (*gc.*) and sphincter of oviduct (*spo*), from transverse section of body. Zeiss 2/D, draw-tube open.
 7. Transverse section of genital aperture, near surface, from longitudinal, horizontal section of body. Zeiss 2/D, draw-tube open.
 8. Same, a little deeper in body than Fig. 7, showing end of cirrus and opening of vagina, from longitudinal, horizontal section of body. Zeiss 2/D, draw-tube open.
 9. Transverse section of cirrus-pouch and vagina, deeper in body than fig. 8, from longitudinal, horizontal section of body. Zeiss 2/D, draw-tube open.
 10. Ovum. Zeiss 4/D, draw-tube open.
 11. End of ovum with apercle. Zeiss 4/D, draw-tube open.

PLATE XXXIII.

Anthobothrium pulvinatum Linton, from *Dasyatis centrura*.

- Fig. 1. Free-hand sketch of head from life. Enlarged about twice.

Rhinebothrium longicolle Linton, from *Rhinoptera bonasus*.

2. Cirrus, sketch from life. Enlarged about two hundred times.
 3. Ova as seen through transparent walls of proglottis, compressed, from life. Enlarged about two hundred times.
 4. Single ovum, from life, in sea water, filament not shown. Enlarged about four hundred times.

Rhinebothrium minimum Beneden, from *Raja laevis*.

Fig. 5. Head, bothria somewhat distorted. Enlarged about fourteen times.

Phyllobothrium foliatum Linton, from *Dasyatis centrura*.

6. Free proglottis. Enlarged about forty times.

Orygmatobothrium paulum, new species, from *Galeocerdo tigrinus*.

7. Front view of head. Zeiss 2/A, draw-tube open.

8. Single bothrium, front view. Zeiss 2/D, draw-tube closed.

Orygmatobothrium crenulatum, new species, from *Dasyatis centrura*.

9. Front view of head. Zeiss 2/A, draw-tube open.

10. Single lobe of same; *as*, anterior sucker; *ps*, posterior sucker; *cm*, circular muscles. Zeiss 2/A, draw-tube open.

11. Single lobe, diagrammatic, letters same as in fig. 10.

12. Posterior segments. Zeiss 2/A, draw-tube closed.

PLATE XXXIV.

Orygmatobothrium crenulatum, new species (continued).

Fig. 1. Part of longitudinal section of head; letters same as in Plate XXXIII, fig. 10, highly magnified.

Onchobothrium uncinatum Diesing, from *Dasyatis centrura*.

2. Side view of head. Enlarged twenty-four times.

3. Hooks as seen in front view of head; *tb*, tubercle. Enlarged about one hundred and eighty times.

4. Broken hooks; *h*, base of hooks; *th*, base of tubercle. Enlarged about one hundred and eighty times.

5. Side view of hook; *th*, tubercle. Enlarged about one hundred and eighty times.

Calliobothrium verticillatum Rudolphi, from *Mustelus canis*.

6. Masses of ova in oviduct, from life. Enlarged about sixty times.

7. Single mass of ova, from life. Enlarged about two hundred and twenty-five times.

Rhynchobothrium tenuispine Linton, from *Dasyatis centrura*.

8. Free, mature segment; *cl*, genital cloaca; *sr*, seminal receptacle. Enlarged about twenty times.

Rhynchobothrium brevispine, new species, from small ray (*Rhinoptera bonasus*)?

9. Head and neck, proboscides extended. Enlarged about twenty-two times.

10. Proboscis near base. Enlarged about four hundred and seventy-five times.

11. Another view of proboscis, near base. Enlarged about four hundred and seventy-five times.

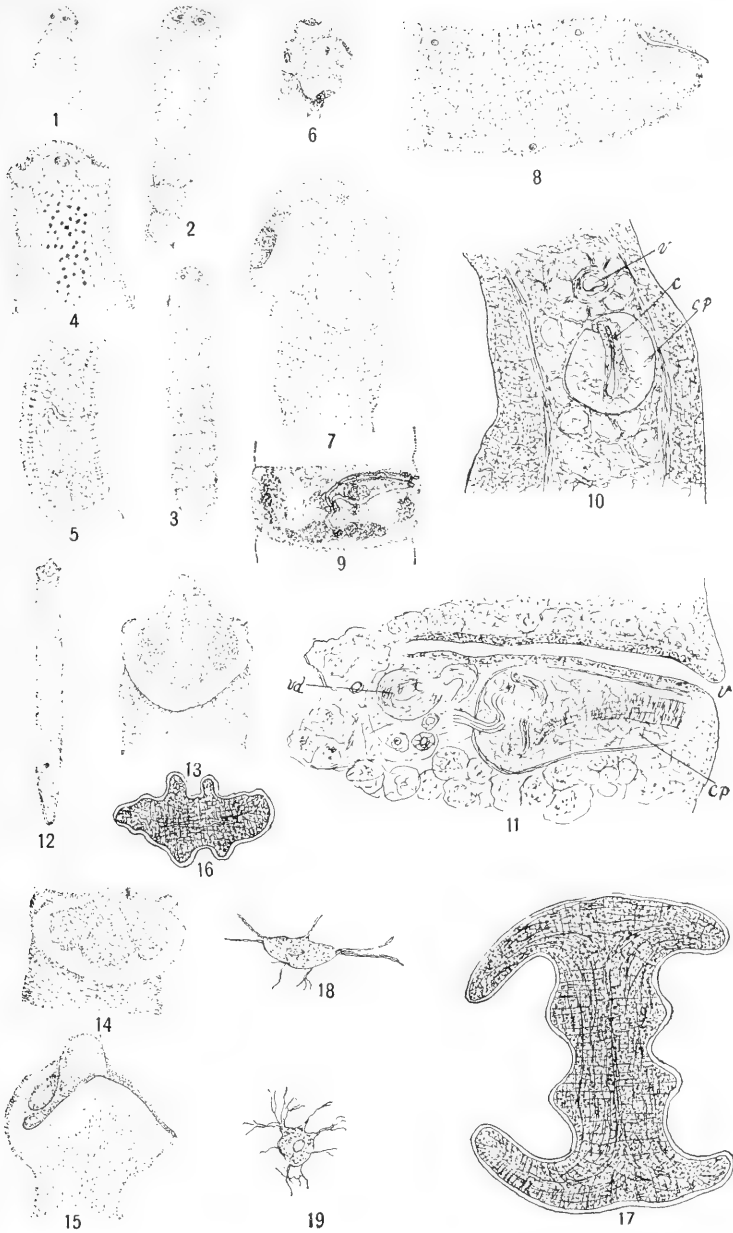
Rhynchobothrium ague, new species, from *Rhinoptera bonasus*.

12. Head and neck, showing proboscides, sheaths, and bulbs. Zeiss 2/A, draw-tube closed.

13. Portion of strobile. Enlarged about fifteen times.

14. Proboscis, near apex. Zeiss 2/D, draw-tube open. The hooks are larger on the opposite side of the proboscis.

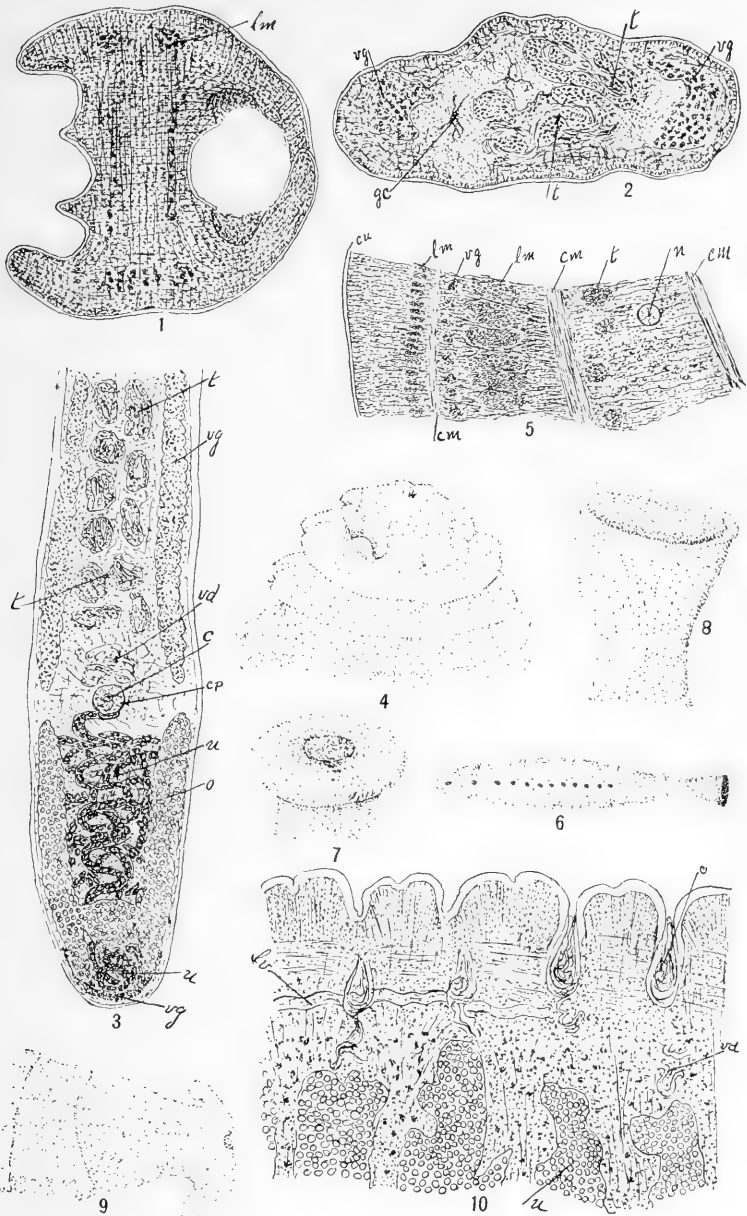
15. Proboscis, near base. Zeiss 2/D, draw-tube open. The hooks are smaller on the opposite side of the proboscis.



PARASITIC WORMS (*Taenia*) FROM GREAT LAKE TROUT AND ROCK BASS, AND (*Monchothrium*) FROM SUCKER.

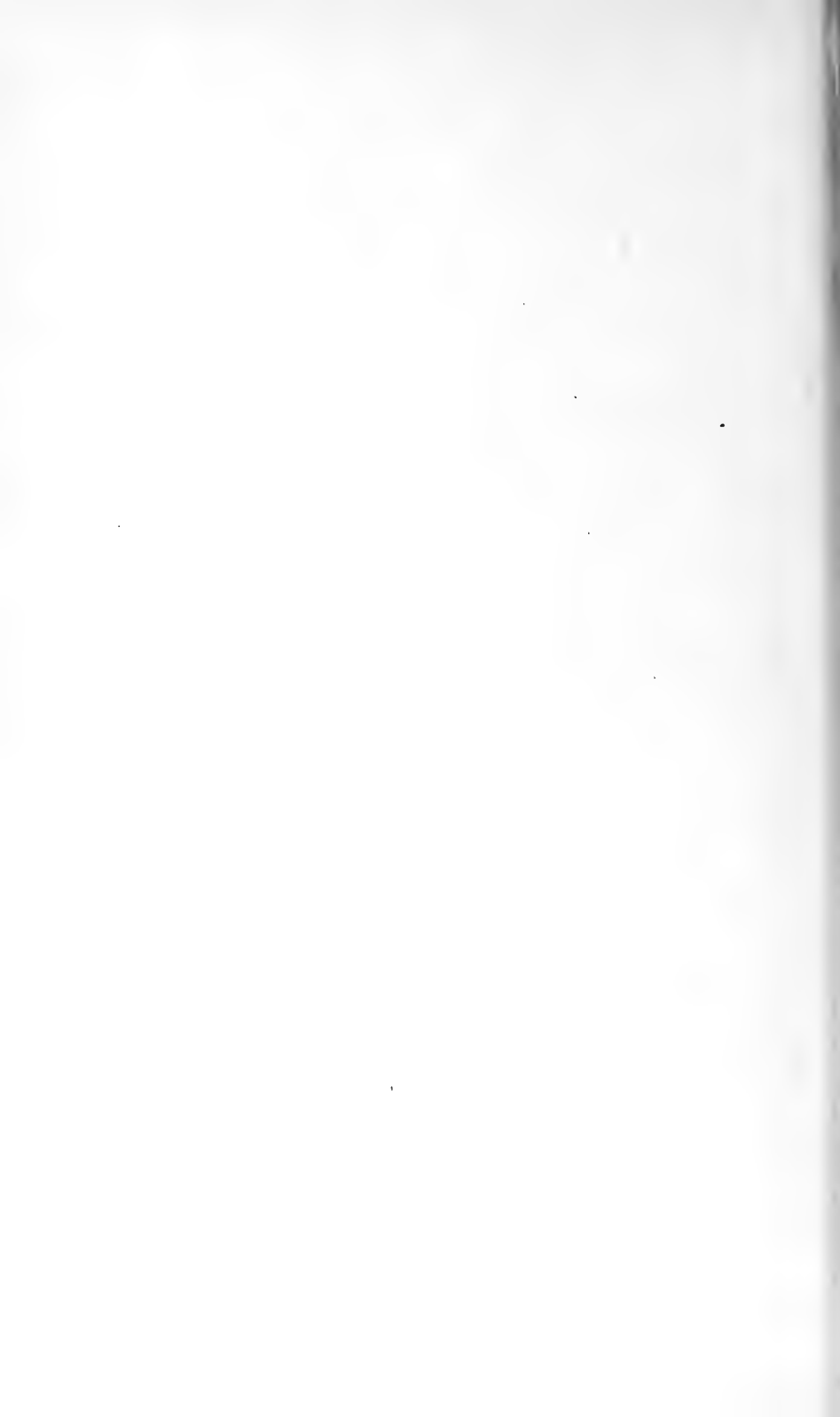
FOR EXPLANATION OF PLATE SEE PAGE 453.

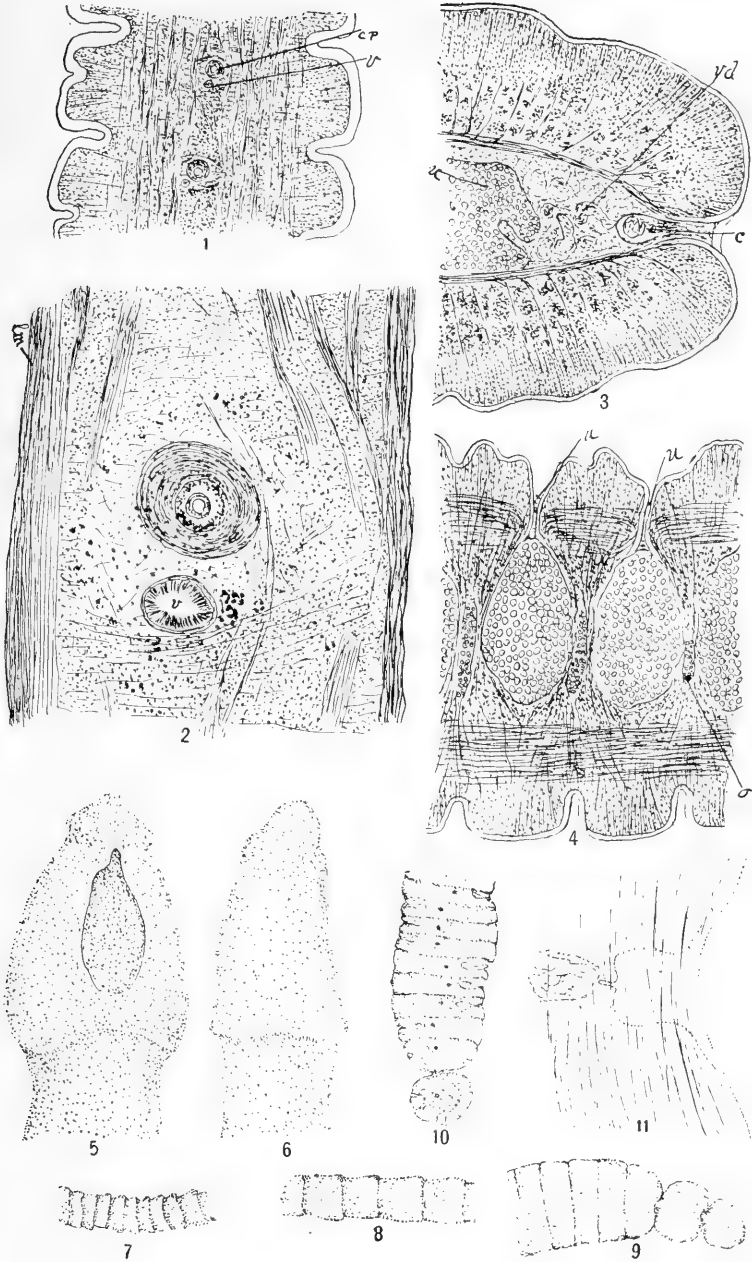




PARASITIC WORMS (*Monobothrium*) FROM SUCKER, (*Schistocephalus*) FROM BLOB, (*Cyathocephalus*) FROM WHITEFISH, AND (*Dibothrium*) FROM COD.

FOR EXPLANATION OF PLATE SEE PAGES 453 454.

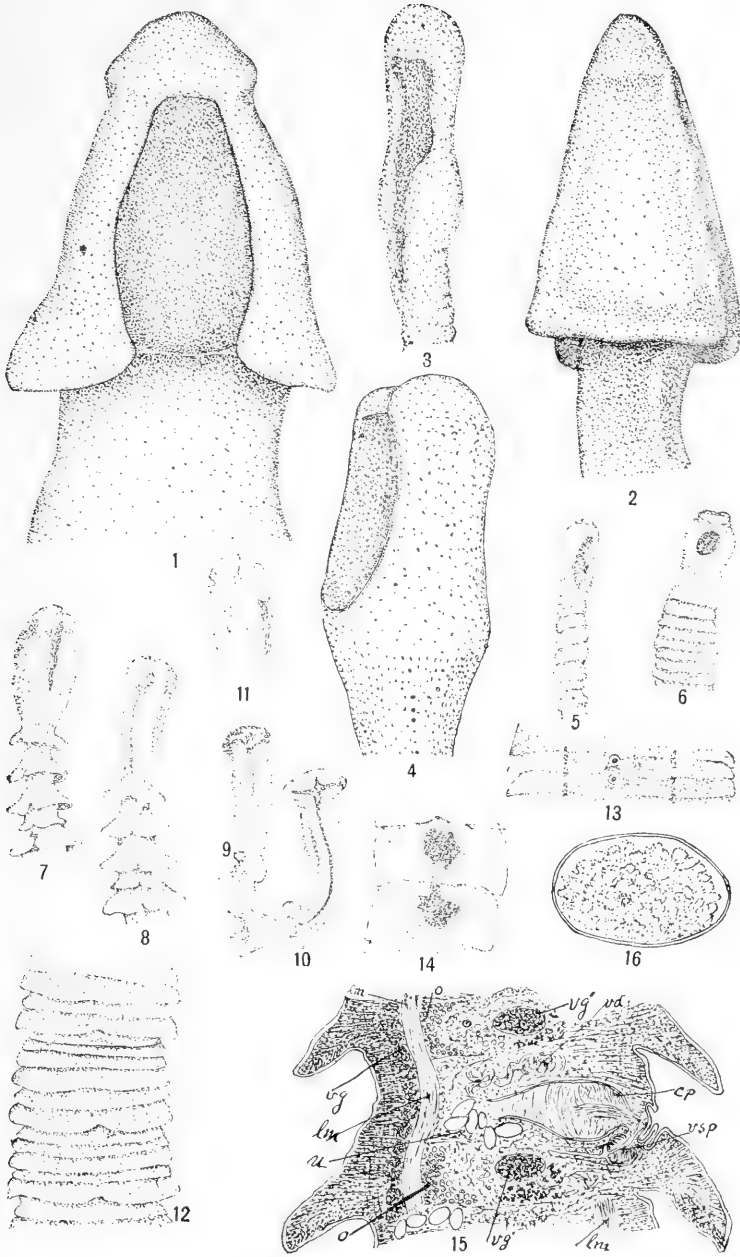




PARASITIC WORMS (*Dibothrium*) FROM COD AND PADDLEFISH.

FOR EXPLANATION OF PLATE SEE PAGE 454.

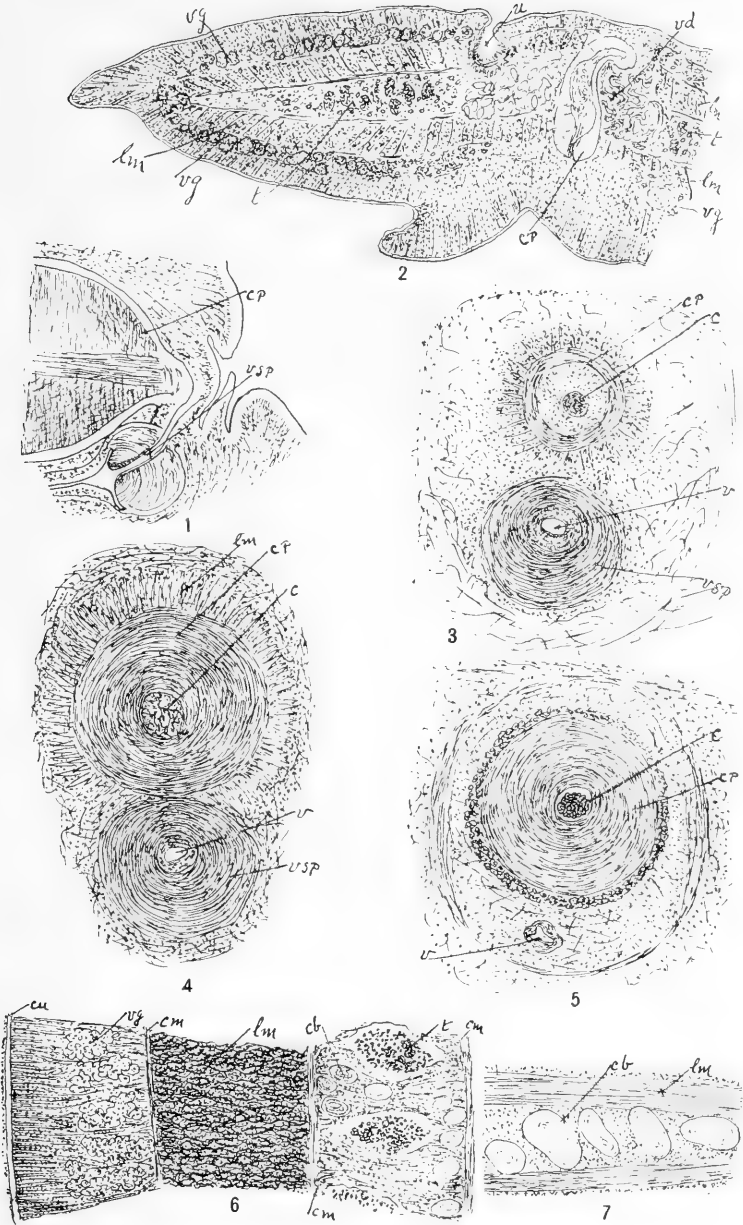




PARASITIC WORMS (*Dibothrium*) FROM PADDLEFISH, COD, LING, GREAT LAKE TROUT, AND TARPUM.

FOR EXPLANATION OF PLATE SEE PAGE 454.

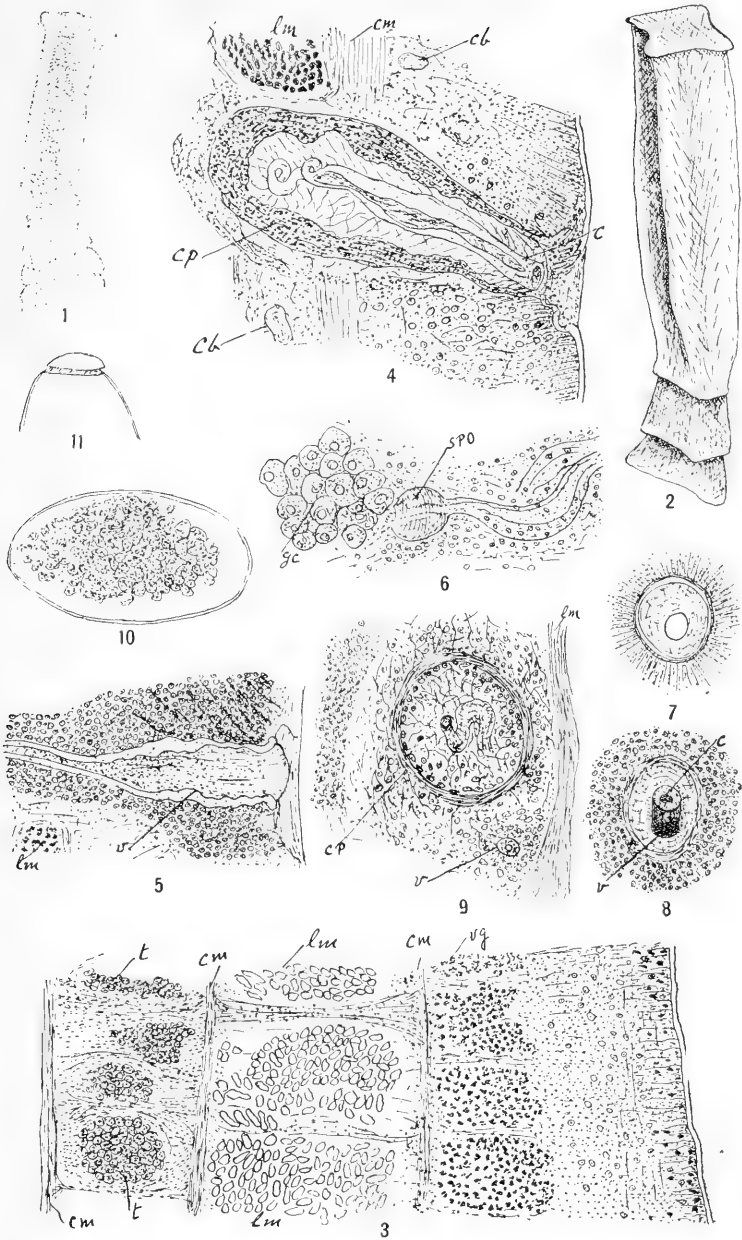




PARASITIC WORM (*Dibothrium*) FROM TARPUM.

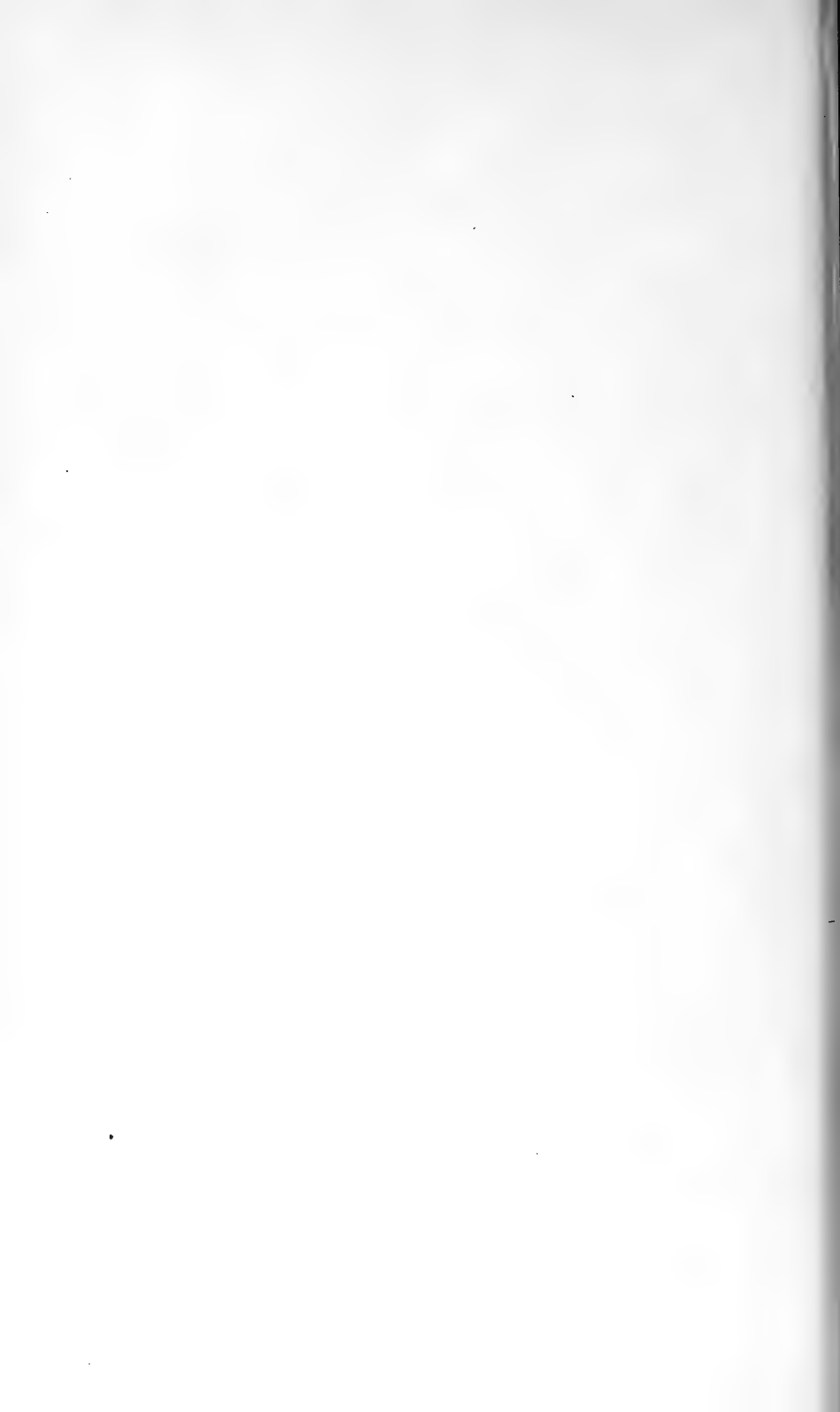
FOR EXPLANATION OF PLATE SEE PAGE 455.

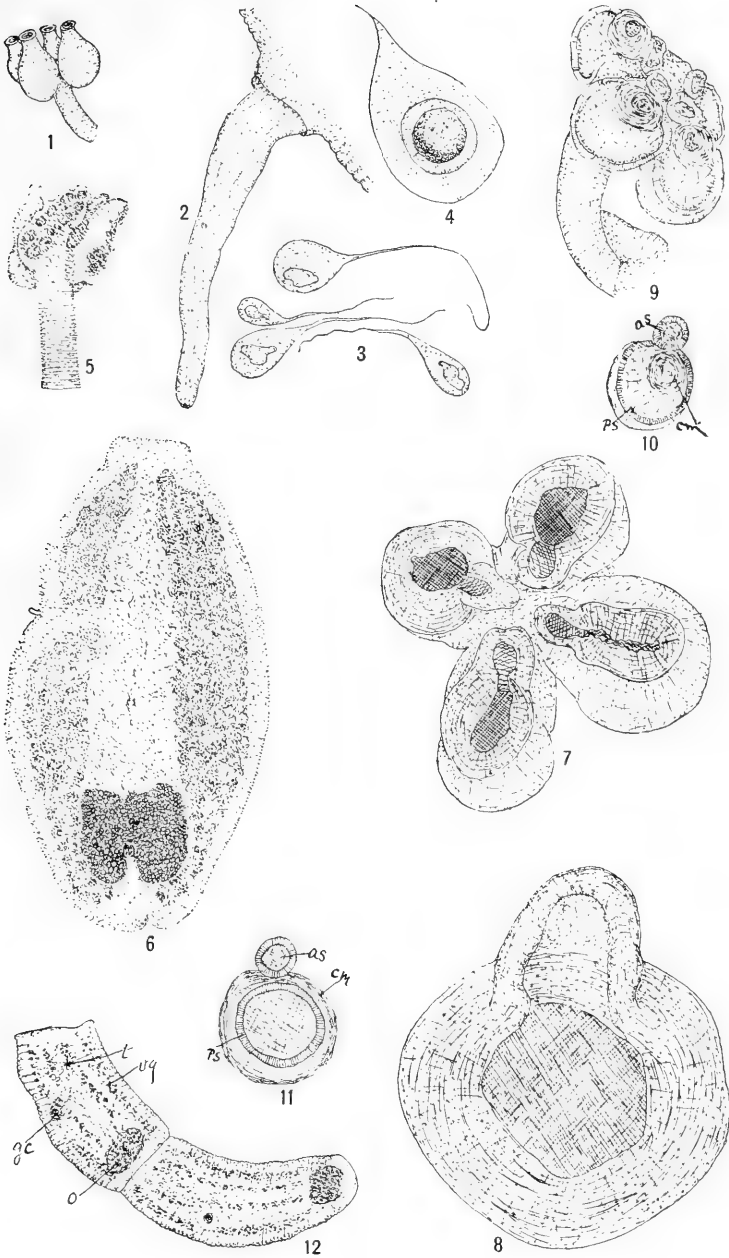




PARASITIC WORM (*Dibothrium*) FROM ROCK COD.

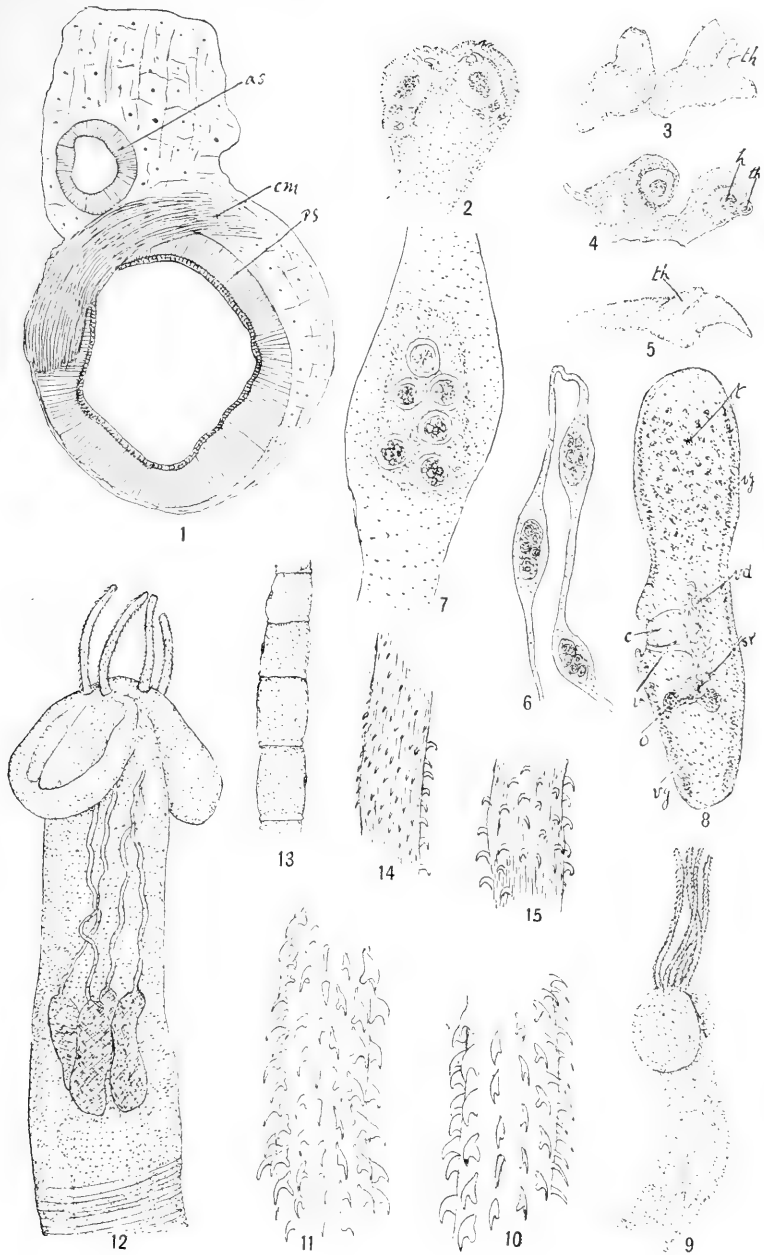
FOR EXPLANATION OF PLATE SEE PAGE 455.



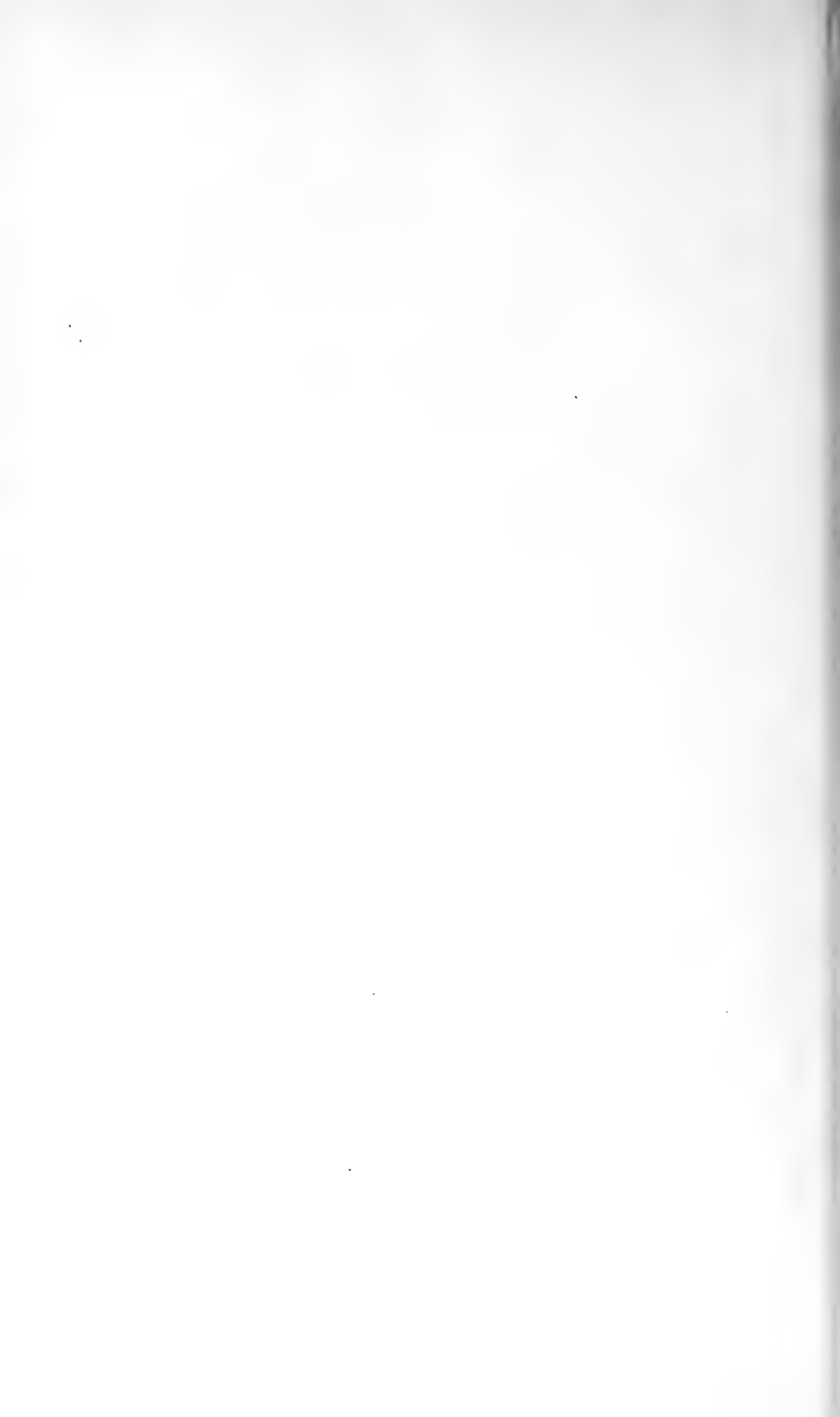


PARASITIC WORMS (*Anthobothrium* and *Phyllobothrium*) FROM STING RAY, (*Rhinebothrium*) FROM COW-NOSED RAY AND SMOOTH RAY, AND (*Orygmatobothrium*) FROM TIGER SHARK AND STING RAY.





PARASITIC WORMS (*Orygmatobothrium* and *Onchobothrium*) FROM STING RAY, (*Calliobothrium*) FROM DOGFISH, AND (*Rhynchobothrium*) FROM STING RAY AND COW-NOSED RAY.



PRELIMINARY DIAGNOSES OF NEW MAMMALS OF THE
GENERA LYNX, UROCYON, SPILOGALE, AND MEPHITIS,
FROM THE MEXICAN BOUNDARY LINE.

By EDGAR A. MEARNS, M. D.,
Assistant Surgeon, United States Army.

THIS is the fifth of a series of papers giving preliminary descriptions of the new mammals collected on the recent survey of the boundary between Mexico and the United States.¹ Detailed descriptions, with illustrations of the new forms, and comparisons with their allies will appear later in the report on the collections made by the International Boundary Commission.

LYNX RUFUS EREMICUS, new subspecies.

DESERT LYNX.

Type.—No. 60676, U.S.N.M. (Collection International Boundary Commission.) Skin and skull. Adult male, from New River, 6 miles northwest of Laguna Station, on the Colorado Desert, in San Diego County, California. Collected by Dr. Mearns, May 5, 1894. Original number, 3506.

Description of type.—In winter pelage. Above pale yellowish brown, mixed with gray and black, obscurely spotted and striped with brown and blackish from the nape to the root of the tail. Legs ochraceous-buff, mixed with grayish. Under side of body and of tail, white. Chest, belly, and inner side of limbs, spotted or banded with black. The sides and outside of limbs are spotted with yellowish brown. Tail, reddish brown above, white below, with a subterminal spot of black. Ears, pale gray, with a blackish spot at base, and black on apex and terminal pencil; the usual gray spot, in this form, extends as a band clear across the convexity of the ear; inner surface of ear, white. Under side of hind foot with a narrow longitudinal line of black, bordered by sooty. Crown and cheeks with obsolete rusty stripes. Sides of

¹ Proc. U. S. Nat. Mus., XVII, 1894, pp. 129-130; XVIII, 1895, pp. 443-447, 551-565; XIX, 1896, pp. 137-140.

[Advance sheets of this paper were published January 12, 1897.]

upper lip with four lines of small black spots; edge of lip, black posteriorly. Tail, with about seven transverse dorsal bars of black, which become obsolete toward the base. Length, 925 mm.; tail vertebrae, 170 (to end of hairs, 195); ear from crown, 75; ear from anterior base, 82; length of ear pencil, 23; distance between eyes, 33; longest whisker, 90; from tip of nose to angle of mouth, 50; to eye, 48; to center of pupil, 59; to ear, 117; to tip of ear, 202; to occiput, 140; to end of outstretched hind limb, 1,190; fore limb, measured from olecranon process to end of longest claw, 287; length of fore foot, 133; longest claw of manus (chord), 18; hind limb from knee-joint to end of claws, 325; length of hind foot, 185; longest claw of pes, 18.

Geographical range.—This subspecies inhabits the eastern and western desert tracts, on the Mexican line. In the "Eastern Desert Tract" its ears are shorter, and its color appears to be redder in summer.

LYNX RUFUS CALIFORNICUS, new subspecies.

CALIFORNIAN LYNX.

Type.—No. $\frac{15888}{37163}$, U.S.N.M. Skin and skull. Adult female, from San Diego, California; collected February 2, 1856, by Doctor J. F. Hammond, who recorded the following measurements: Length of head, $5\frac{3}{4}$ inches; body, 28; tail, 7.

Description of type.—In winter coat. Similar to *Lynx rufus texensis* (Allen), but browner, less spotted, and with larger ears. Coloration dark. Above reddish brown, considerably mixed with gray and black; decidedly dusky in the median line, with two parallel, interrupted, black lines extending from the shoulders to the root of the tail. Outer surface of limbs, and sides, ochraceous-buff, mixed with gray and spotted with yellowish brown. Inner surface of limbs, under surface of head and body, and under side and tip of tail, white. Chest with a broad, rusty-grayish collar which is conspicuously spotted with black. Under side of body and inner surface of limbs banded or spotted with black. Under side of hind foot with the usual median black stripe. Ears much larger than those of *Lynx rufus*, but marked much the same; white inside, edged with grayish white, and black on the convex surface, the black contributing a liberal terminal pencil, and inclosing a small triangular patch of gray. The upper lip has a large, black marginal spot on each side.

Geographical range.—This form of lynx occupies the "Pacific Coast Tract"¹ of California and Lower California.

¹ See Proc. U. S. Nat. Mus., XIX, 1896, p. 137, for definition of geographic differentiation areas on the Mexican boundary line.

UROCYON CINEREOARGENTEUS TEXENSIS, new subspecies.

TEXAN GRAY FOX.

Type.—No. $\frac{130}{1116}$, U.S.N.M. Skin and skull. From San Pedro, near Eagle Pass, Texas; collected in 1851 by Arthur Schott, a naturalist of the old Mexican boundary survey, under Lieut. Col. W. H. Emory.

Description of type.—Similar to *U. cinereoargenteus*, but paler, with larger ears, and a longer tail. The markings of the limbs, sides of neck, and base of ears, which are chestnut or cinnamon-rufous in the typical form, are ochraceous. Height of ear above crown, 80 mm.; length of hind foot, 128; length of caudal vertebræ, 350.

Another specimen taken by the same collector on the lower Rio Grande (No. $\frac{201}{1175}$, U.S.N.M.), agrees with the above, except in having a few gray-and-black hairs on the limbs, and a little darker coloration. It is probable that these two specimens represent different seasonal pelages, as that of the last-mentioned example is coarser and harsher. Other specimens from northern Mexico and extreme southwestern Texas approach *Urocyon cinereoargenteus scottii*.

This subspecies inhabits the Texan region, and finds its nearest analogue in the form inhabiting the Pacific coast of southern and Lower California, described below, the two being separated on the Mexican border by the range of *U. c. scottii* of the interior region.

UROCYON CINEREOARGENTEUS CALIFORNICUS, new subspecies.

CALIFORNIAN GRAY FOX.

Type.—No. 62873, U.S.N.M. Skin and skull. Adult male, from the San Jacinto Mountains, altitude 8,000 feet, Riverside County, California; collected by Mr. A. W. Anthony, July 6, 1895. Original number, 41.

Description of type.—Similar to *Urocyon cinereoargenteus*, but smaller and paler, with larger ears and relatively longer tail. Length, 890 mm.; caudal vertebræ, 330; ear from crown, 85; length of hind foot, 120. Compared with the gray fox of New York, the skull is smaller, relatively broader, with a higher brain case, and with the temporal crests much more widely separated. The coronoid process of the mandible is more nearly vertical.

Remarks.—This is a dark coast form, differing widely from that of the interior region, which I have named¹ *U. c. scottii*. It is about as darkly colored as the Texas gray fox, described above, but differs from it considerably in the shades of coloring, and also somewhat in proportions. It differs from *U. c. texensis* chiefly in having larger ears, and grayer, less fulvous coloring.

The gray foxes of northern California are almost like those from New

¹ Bull. Amer. Mus. Nat. Hist., III, 1891, p. 336.

York and Illinois. The color of the back is about the same, but the coloration as a whole is paler; and the California animal lacks the black down the fore legs. The species ranges north to Washington.

SPILOGALE AMBIGUA, new species.

CHIHUAHUAN LITTLE STRIPED SKUNK.

Type.—No. $\frac{203002}{356006}$, U.S.N.M. (Collection International Boundary Commission.) Adult male from Eagle Mountain, Chihuahua, Mexico (about four miles south of Monument No. 15, Mexican boundary line), taken March 23, 1892, by Doctor Mearns and F. X. Holzner. Original number, 1574.

Description of type.—Color pattern as usual in this genus. In markings scarcely differing from *S. gracilis*, except that the white spots on the thighs and at the base of the tail are smaller. The lowest stripes on the sides are as broad as they are in *S. gracilis*, and, consequently, much broader than those of *S. leucoparia*. There is more black on the under side of the tail at base than in *S. gracilis*.

Measurements of type.—Length, from nose to end of vertebræ of tail, 411 mm.; tail vertebræ, 147 (to end of hairs, 287); ear from crown, 11 (from notch 26); distance between eyes, 18; diameter of eye, 6.5; length of longest whisker, 50; from tip of nose to eye, 24; to center of pupil, 28; to ear, 45; to tip of ear, 72; to occiput, 65; to end of outstretched hind limb, 361; fore limb from olecranon, 68; length of fore foot, 34; longest claw of fore foot, 9; hind limb from knee-joint, 82; length of hind foot, 43; longest claw of hind foot, 6.5.

Cranial and dental characters.—The skull is almost as high as that of *S. ringens*, with the frontoparietal region almost as much elevated. The zygomatic arches are more spreading, the nasal orifice much smaller, the postorbital processes more peg-like, and the anterior teeth of the lateral row more crowded. Altogether the skull and teeth are almost exactly intermediate between those of *S. gracilis* of southern Arizona and the eastern group of species having high-and-narrow skulls.

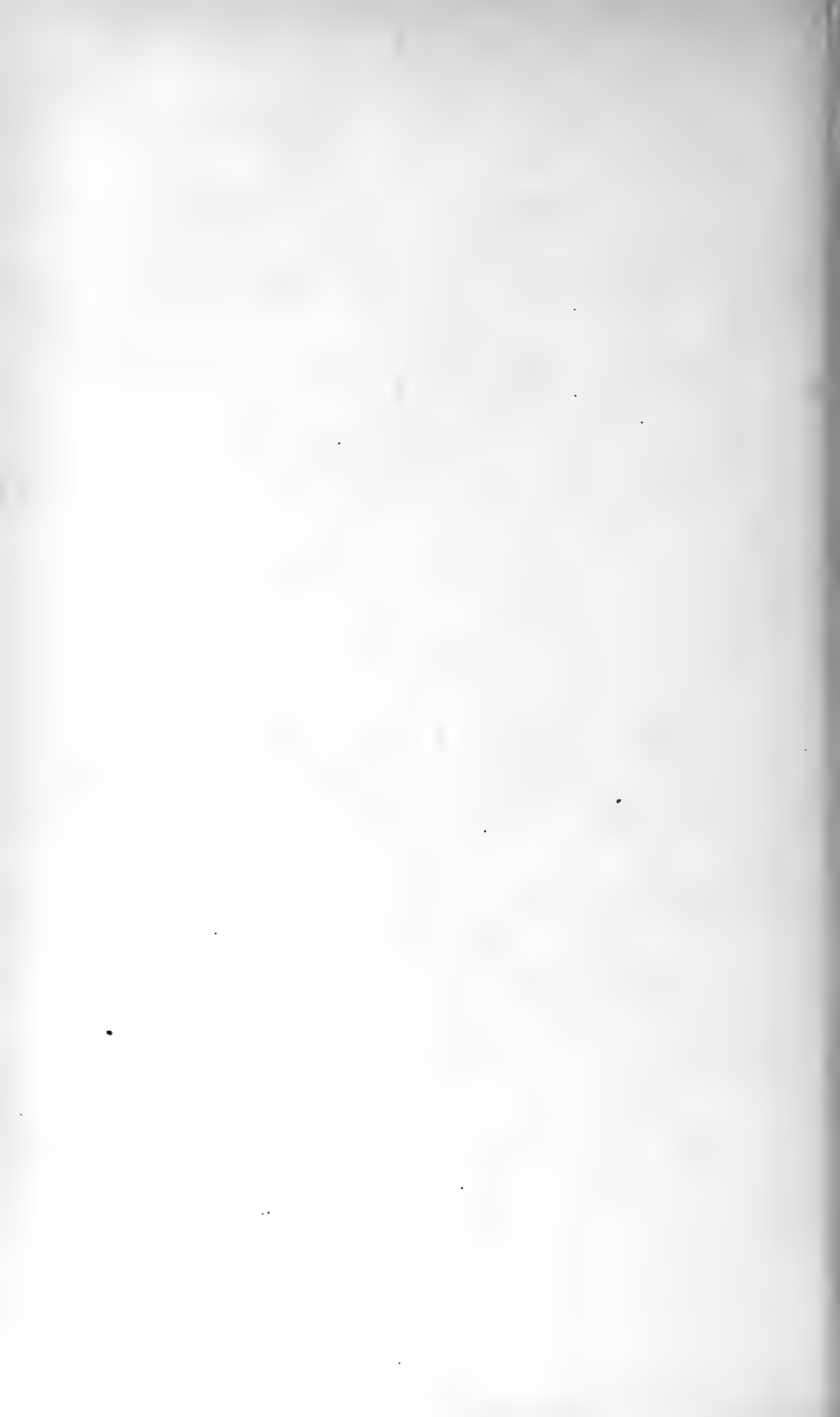
General remarks.—This is a small, slender species, with much shorter ears than *S. gracilis*. The pelage is soft and long, with the parts which are ordinarily jet black faded to grayish black. With cranial characters intermediate between those of the eastern and western sections of the genus, this species is the connectant. Its closest relationship is with the *Spilogale* of central Mexico, and not with *S. indianola* of the Gulf coast of Texas, from which it is separated by the range of *S. leucoparia*, a species belonging to the low-skulled western group inhabiting the middle Rio Grande region. This species is at present known only from the rocky hills east of the Mimbres Valley and Lake Palomas, on the Mexican line.

MEPHITIS OCCIDENTALIS HOLZNERI, new subspecies.

SAN DIEGO SKUNK.

Type.—No. $\frac{8065}{6422}$, American Museum of Natural History, New York; collected July 3, 1894, at San Isidro Ranch, Lower California, by Frank X. Holzner. Original number, 1554.

Description of type.—Similar to *Mephitis occidentalis* Baird, but smaller. Skull, with mastoids much less prominent, and intermastoid breadth, consequently, relatively much less. The length of the palatal floor and rostral portion of skull are relatively greater, this being correlated with the greater distance of the palate from the foramen magnum. Mastoid bulla much smaller, but more prominent. The length of the lateral tooth-row and breadth across molars are relatively greater, the dentition being heavier. The foramen magnum is smaller and more nearly spherical. Color black, with the usual longitudinal white stripe on the upper surface of the head. The white dorsal area begins broadly just back of the ears, forms a triangular patch on the nape, bifurcates well forward, and extends backward as two narrow white stripes which are continued on to the sides of the tail and meet about the middle of its upper surface. The rest of the caudal hair is white at base and black at tip. Under surface of body wholly black. Length, 665 mm.; tail to end of vertebræ, 273; tail to end of hairs, 360; ear from crown, 13.5; length of hind foot, 72.



DESCRIPTION OF A NEW BLENNY-LIKE FISH OF THE
GENUS OPISTHOCENTRUS, COLLECTED IN VULCANO
BAY, PORT MORORAN, JAPAN, BY NICOLAI A. GREB-
NITSKI.

By TARLETON H. BEAN,
Honorary Curator of the Department of Fishes,
and
BARTON A. BEAN,
Assistant Curator of the Department of Fishes.

IN OUR NOTES on Fishes collected in Kamchatka and Japan by Leonhard Stejneger and Nicolai A. Grebnitski¹ we doubtfully placed *Opisthocentrus* (No. 47565, U.S.N.M.) with Kner's species *O. quinque-maculatus*. We now consider it quite distinct and describe it as new, under the name

OPISTHOCENTRUS TENUIS, new species.

Type.—No. 47565, U.S.N.M.; collected in July, 1894, in Vulcano Bay, Port Mororan, Japan, by N. A. Grebnitski.

D. 39, XV; A. 38.

Length of fish to caudal base, $5\frac{1}{8}$ inches; length of head, 1; depth of body, $\frac{7}{8}$. The greatest width of the body is contained two and one-half times in the length of the head. The diameter of the eye is nearly equal to the length of the snout and is contained four and one-half times in the length of the head. The width of the interorbital space is almost equal to the long diameter of eye. The maxilla reaches to the vertical past front of eye. Teeth bluntly rounded, imbedded in flesh; vomerine teeth present; palatines none.

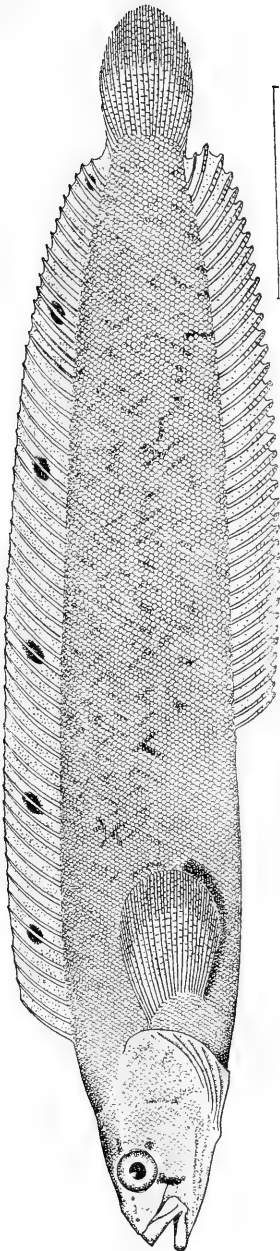
The origin of the dorsal fin is over the end of the gill cover. Its first thirty-nine rays are simple and flexible, the last fifteen are strong spines and end slightly above the membrane in stiff points. The longest spine is almost one-third as long as the head. The anal originates under the twentieth ray of the dorsal. Its rays are divided and articulated. The longest ray is one-third as long as the head.

¹ Proc. U. S. Nat. Mus., XIX, 1896, pp. 381-392.

[Advance sheet of this paper was published January 28, 1897.]

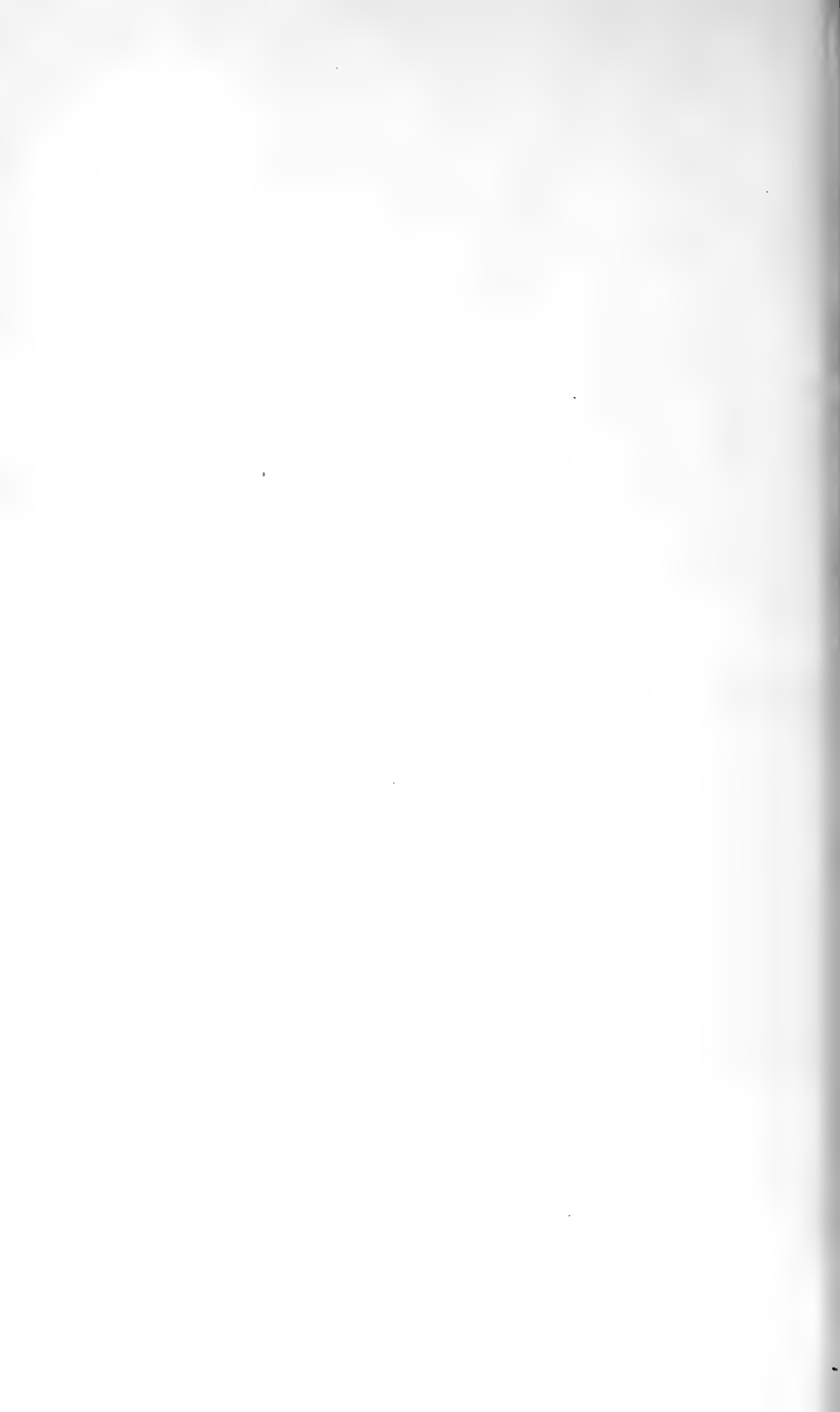
The general color is brown, with cross reticulations of black. Sides of head and body along base of anal, orange; anal, caudal, and pectorals light, with dusky shadings; dorsal finely mottled with black and bearing six black spots on areas of white, the first of these spots being on the sixth ray and the last on the next to last spine; a black bar from front of eye downward, and another from posterior margin obliquely down and backward.

This species differs from the typical form in its greater compression of the body and its increased number of dorsal spines. It seems to represent the form described by Boulenger as *Blenniophidium*, which genus we can not separate from *Opisthocentrus*.



A NEW BLENNY-LIKE FISH (*Opisthocentrus tenuis*).

PL. XXXV



DESCRIPTION OF A NEW CRUSTACEAN OF THE GENUS
SPHÆROMA FROM A WARM SPRING IN NEW MEXICO.

By HARRIET RICHARDSON.

A NUMBER OF specimens of the following species were collected by Mr. Theodore D. A. Cockerell, a few miles west of Socorro, New Mexico, where they were found living in a warm spring. The only other instance of a fresh-water *Spheroma* is that of *S. dugesi*, a Mexican species, described by Adrien Dollfus.¹ The differences between his species and the present one will appear in the description.

SPHÆROMA THERMOPHILUM, new species.

Head nearly three times as broad as long, with its anterior margin widely rounded. Eyes round and post-laterally situated. The first pair of antennæ, with a flagellum of eight articles, extends to the middle of the first thoracic segment. The second pair of antennæ reach the posterior margin of the first thoracic segment; the flagellum contains eleven articles.

The thoracic segments are all similar with the exception of the first, which extends laterally around the head, almost touching the peduncle of the first pair of antennæ with its anterior angle. The epimeral parts are continuous with the segments with no indication of a separation from them.

The abdomen is formed of two distinct segments, the first of which is partly covered by the last thoracic segment, the second is sub-triangular, rounded posteriorly. The internal lamella of the uropods is moderately broad, well rounded, and extends to the posterior edge of the last abdominal segment. The external lamella is half as long and half as broad as the internal one, and is more pointed at its extremity.

The body is oblong-ovate with almost parallel sides. Its surface is entirely smooth.

The grayish-brown color of the body is everywhere marked with small black spots and lines, which run together, forming a broad, black band

¹ Bull. Soc. Zool. France, 1893, XVIII, p. 115, figs. 1, 2.

[Advance sheet of this paper was published February 6, 1897.]

in the center of each one of the thoracic segments. All the exposed edges of the body are tinged with a bright orange.

This species can readily be distinguished from *S. dugesi*, to which it is closely related, by the absence of hairs on the body, by the relative length of the uropods, the outer one being only half as long as the inner one, while in *S. dugesi* they are of equal length, and by the difference in color.

Type.—No. 19609, U.S.N.M.

PRELIMINARY DIAGNOSES OF NEW MAMMALS OF THE
GENERA MEPHITIS, DORCELAPHUS, AND DICOTYLES,
FROM THE MEXICAN BORDER OF THE UNITED STATES.

By EDGAR A. MEARNs, M. D.,
Assistant Surgeon, United States Army.

THIS IS the sixth of a series of papers giving preliminary descriptions of the new mammals collected on the recent survey of the boundary between Mexico and the United States.¹ Detailed descriptions, with illustrations of the new forms, and comparisons with their allies will appear later, in the report on the collections made by the International Boundary Commission.

MEPHITIS MILLERI, new species.

MILLER'S HOODED SKUNK.

Type.—No. 58851, U.S.N.M. (Collection International Boundary Commission). Skin and skull. Adult male, from Fort Lowell (near Tucson), Arizona. Collected by Mr. F. X. Holzner, November 13, 1893. Original number, 1109.

Description of type.—In winter pelage. Body slender. Caudal vertebrae longer than head and body. Nape with a hood of spreading elongated hair. Coat long and glossy, with copious fine underfur. Head with a narrow, longitudinal, white stripe above. Color glossy black, with a white area low down on the sides, extending from the ear to the tail, and tending to form a double stripe toward either extremity. Tail all white at base of hair; externally black above and all round subterminally; under side all white, except the subterminal black ring. End of tail with a copious tuft of white hair nearly 300 mm. in length. Feet and under parts, except tail, all black. Length to end caudal vertebrae, 790 mm.; tail to end of vertebrae, 435; ear from crown, 18; length of hind foot, 73.

¹ Proc. U. S. Nat. Mus., XVII, 1894, pp. 129-130; XVIII, 1895, pp. 443-447, 551-565; XIX, 1896, pp. 137-140; XX, pp. 457-461.

[Advance sheets of this paper were published February 11, 1897.]

Another specimen, No. $\frac{20772}{35973}$, U.S.N.M., male, from the eastern base of the Patagonia Mountains, in the Santa Cruz Valley, near monument No. 112, Mexican boundary line, taken November 18, 1892, by Mr. F. X. Holzner. Original number, 822, represents a very different but common phase of coloration in this skunk, and in *M. macroura* Lichtenstein. The upper surface is white, from the occiput to the middle of the back, and the rest of the dorsum, including the whole upper side of the tail, grayish black, beautifully veiled by long white hairs. In this specimen the white stripe on the upper side of the head is reduced to a trace, and in a few others it is wholly absent. The under surface, including the middle of the tail to near its extremity, is all black, except a white patch running backward from the neck to near the middle of the abdomen. There is no white striping low down on the sides. Some specimens have the light back, also the white side-stripes; others have the white dorsal area ending at the lumbar region, with or without white on the sides; and still other individuals are almost wholly black, even as to the tail except at the base of the hair. The two individuals particularly described above are of the common patterns. The species is variable.

The skull, although much larger and relatively narrow zygomatically, is closely similar to that of *Mephitis macroura* Lichtenstein, of which this may prove to be a subspecies. Named in honor of Mr. Gerrit S. Miller, jr.

DORCELAPHUS CROOKI, new species.

CROOK'S BLACK-TAILED DEER.

Type.—No. $\frac{20572}{35973}$, U.S.N.M. (Collection International Boundary Commission). Adult female; shot by the author on the summit of the Dog Mountains, Grant County, New Mexico, June 9, 1892. Original number, 1873.

Description of type.—In the summer pelage. Color reddish fawn, darker from black annulations on the back, lightening to grayish cinnamon on the sides, and grayish drab on the neck. The legs are cream-buff, except where new clay colored hair is coming in on the anterior border, the limbs being almost the last part to receive the summer coating. The coloring of the head is very similar to that of the mule deer in corresponding pelage. It has the horseshoe or arrow mark on the forehead, and other dark markings of the head to correspond; and the ears are relatively almost or quite as large, and as scantily coated with hair. The bushy hair around the metatarsal gland, which agrees in size and location with that of *Dorcelaphus columbianus*, is sooty at base, and white apically. The tail is colored much as in *D. columbianus*, but has a longer terminal switch; upper side and extremity of tail all black, lower side white mesially, and naked towards the base. The pelage of this deer is short and coarse in comparison with that of the white-tailed or Virginia deer, or the black-tailed deer of the Columbia River region;

and, as would naturally be expected, is not so red as that of the latter. This specimen contained a fetus the size of a cottontail rabbit. The measurements of the type, taken from the fresh specimen, are as follows: Total length, measured in a straight line, 1,440 mm.; tail vertebrae, 195 (to end of hairs, 304); ear above crown, 220; ear above notch, 190; width following curve, 125; distance between eyes, 100; girth of chest, 790; distance from head of humerus to head of femur, 620; from tip of nose to eye, 155; to center of pupil, 175; to base of ear, 290; to tip of ear, 470; to occiput, 295; height of animal at shoulder, 650; fore limb from coracoid, 630; from olecranon, 540; length of manus, 300; hind limb from knee-joint, 620; length of pes, 400. Weight, eviscerated and dry, 72 pounds avoirdupois.

Cranial characters.—The skull has very nearly the same conformation as that of *D. columbianus*, the lachrymal fossa being deeper than in the Virginia deer, but shallower than in the mule deer. The same intermediate condition obtains with respect to the vomer, in the relationships of the nasal and premaxillary bones, in the form and size of the teeth; and, in short, the whole animal appears to be a compromise between the characteristics of the white-tailed and mule deer. Named in honor of Major-General George Crook, United States Army.

DICOTYLES ANGULATUS SONORIENSIS, new subspecies.

YAQUI PECCARY.

Type.—No. ²¹⁰⁵⁷/₂₅₋₁₄₇, U.S.N.M. (Collection International Boundary Commission). Adult male, from San Bernardino River, Sonora, Mexico, near monument No. 77, Mexican boundary line. Collected by Doctor Edgar A. Mearns and Mr. F. X. Holzner, September 8, 1892. Original number, 2099.

Description of type.—Above, there is a mane of long, black-tipped bristles, extending from the crown to the naked gland on the rump, the longest bristle measuring 135 mm. in length. The rest of the upper surface is a pepper-and-salt mixture of commingled grayish-white, yellowish-white, and brownish-black colors, the bristles being whitish, ringed and pointed with black. The flanks are whitest and the shoulders blackest. An incomplete and rather indistinct whitish collar extends across the side, behind the neck, and in front of the shoulder. The muzzle, cheeks, and space in front of the eye are brownish gray, annulated with darker. There is a brownish-white orbital area, and a brownish glandular stain below the front of the eye. The under jaw is yellowish, with a triangular blackish patch near the end of the chin. The ears have their outer surface and tip of inner surface coated with black bristles; concavity rugose, with five bands of long, buffy-white hairs occupying the ridges. Legs mixed brownish white and brownish black, becoming solidly black about the hoofs, and with a light band encircling the fore leg above the accessory hoofs. Under surface of

body with a blackish median area, the color fading to grayish on the axillary and inguinal regions. Snout livid plumbeous, flesh color around the nostrils. Hoofs plumbeous-black. Length, 920 mm.; tail vertebrae, 65; tail to end of hairs, 128; ear from crown, 115; ear from notch, 95; width of ear, 88; distance between eyes, 80; diameter of eye, 16; length of longest whisker, 80; from tip of snout to angle of mouth, 105; to eye, 160; to center of pupil, 175; to ear, 235; to tip of ear, 368; to occiput, 300; to end of outstretched hinder extremity, 1,250; height of animal at shoulder, 610; from head of humerus to end of hoof, 390; from olecranon process to end of hoof, 287; length of manus (measured in front), 132; height of animal at hips, 520; from great trochanter to end of hoof, 460; from knee-joint to end of hoofs, 308; length of hind foot, 200; distance from point of shoulder to great trochanter, 495; girth of chest, 580. Weight, 46 pounds avoirdupois.

The young are pale reddish brown, with a black vertebral stripe. The upper surface is sprinkled with black bristles, the lower surface plain and paler. The limbs are reddish brown, becoming blackish next to the hoofs.

This animal differs from the peccary of eastern Texas and north-eastern Mexico in being larger, with relatively larger ears and feet, and paler colors. The peccary of the Lower Rio Grande is blackish, while that of Sonora and Arizona is grayish, with a sharply contrasting, black dorsal stripe. The posterior molars are smaller and more simple in form than those of true *D. angulatus*.

DORCELAPHUS HEMIONUS EREMICUS, new subspecies.

BURRO DEER; DESERT MULE DEER.

The mule deer of the Western Desert Tract, like all mammals of that region, is remarkable for the extreme pallor of its coloration. An adult male (No. 63403, U.S.N.M), taken by Mr. W J McGee, in December, 1895, in the Sierra Seri, near the Gulf of California, in the most arid portion of Sonora, Mexico, is in full winter pelage. The coat is short and glossy. Coloration above very pale drab-gray, with a dark vertebral area, which begins as a narrow median stripe on the upper side of the neck, broadens and becomes fainter on the back, forms a blackish spot at the root of the tail, down which it descends for a short distance. The buttocks, inguinal and abdominal regions, and the middle of the tail all around are white. The axillae and hollows of the thighs are entirely naked. The edges of the buttocks, posterior surface of limbs, and the feet are washed with pale, muddy cinnamon. The chest is light sooty drab. Tail with a heavy brush or short switch of black hair at the end, the middle portion being white all around, the dusky color running down a short distance, on the upper side, from the blackish spot at its base. While the general effect is to produce a pale drab-gray coloring of the upper surface, there is the usual pepper-and-salt commingling of colors, produced by light and dark annulation of

the hairs, those in the vertebral area being pointed with brownish black. It appears to be a larger animal than the mule deer of the Eastern Desert Tract, and, unless the specimens brought home by our party are abnormal, its horns are heavier and more divergent, being remarkable for the great length of the beam before forking. In a youngish specimen from the Sonoyta Valley (No. 59910, U.S.N.M.), the distance from the burr to the first fork, following the curve of the beam, is 320 mm. The total expanse of this pair of horns is 620. They are doubly dichotomous throughout, having four points, besides a basal snag, on each horn. Another pair (No. 60855, U.S.N.M.) belonged to a fully adult animal, killed at Black Butte, on the Colorado Desert near the "volcanoes" or mud geysers, Lower California. This was one of six that were killed by Mr. Samuel Cameron, one of our guides, during the winter of 1893-94. The beam is unusually stout, and has an extent of 310 mm. before forking, and the horns have a total expanse of 775. The horns are also doubly dichotomous.



NEW SPECIES OF COLEOPTERA OF THE FAMILY
CHRYSOMELIDÆ, WITH A SHORT REVIEW OF THE
TRIBE CHLAMYDINI.

By MARTIN L. LINELL,

Aid, Department of Insects.

THE collections made by the entomologists of the United States Department of Agriculture in the course of their investigations of the cotton-boll weevil and other insects in southwestern Texas contain several species of Chrysomelidæ that are not hitherto described, and others that had previously only been recorded from Mexico. While rearranging the material of this family in the collection of the United States National Museum, it was found advisable to place on record such species as are new to our faunal list. This paper includes also a few forms obtained by the Museum from other sources.

The tribe Chlamydini has been much neglected by students in recent years, and a study of available material has enabled the writer to attempt a brief review of this group.

Genus MEGASCELIS Latreille.

Megascelis LATREILLE, Cuvier, Règn. anim., 2d ed., V, 1829, p. 138.

This neotropical genus belongs in the tribe *Sagrini*, and differs from *Lema* by the mouth being short and rounded instead of being prolonged into a distinct muzzle. The claws are connate at base, and the sides of the thorax are obtusely angulate, not crenulate or spinose. One species has been found in Texas that appears to be undescribed.

MEGASCELIS TEXANA, new species.

Elongate, parallel, rufotestaceous; bright green above. Antennæ much shorter than the body, infusate, with the four basal joints testaceous. Front coarsely rugosely punctate. Eyes distinctly emarginate. Thorax as long as broad, distinctly impressed across the disk, constricted at base, deeply and densely punctate, sparsely pubescent. Elytra with margin and sutural stripe testaceous, the latter narrow at base and apex, often dilated at middle; disk rather densely pubescent, with short, erect

griseous hairs, deeply punctatostriate; intervals transversely cribrate; apices rounded without sutural spine. Ventral surface either uniformly testaceous or more or less greenish on the sides of metasternum, covered with a fine, sparse, silvery gray pubescence. Legs entirely testaceous, femora simple. Length, 3 to 4 mm.

Type.—No. 1289, U.S.N.M. Nineteen examples collected in May and June at Brownsville, Texas, by Professor C. H. Tyler Townsend and Mr. E. A. Schwarz.

This species is nearly allied to the Mexican *M. delecta* Clark, and *M. suturalis* Lacordaire, but differs from the former by lacking sutural spines and from the latter by the sutural stripe and elytral margin being testaceous.

LEMA LONGIPENNIS, new species.

Body elongate, as in *L. texana* Crotch, but larger and with color and sculpture of *L. collaris* Say, from which it differs as follows: Much larger, collum red, median frontal groove terminating in a round fovea on vertex, thorax a little longer proportionately, distinctly and broadly constricted near the base and with the sides more gibbous in front; scutellum elongate, subtriangular, with apex rounded (in *L. collaris* semioval, subtruncate at apex); elytra two and one-half times longer than broad (in *L. collaris* only twice). Length, 6.5 mm.

Type.—No. 1290, U.S.N.M. Five examples, Canon City, Colorado (Wickham).

LEMA JACOBINA, new species.

Elongate, shining, reddish-yellow, with a spot at apical fourth of each elytron, suture, the seven outer joints of the antennae and apices of tarsal joints black. Thorax as long as broad, moderately constricted behind the middle, impunctate. Elytra broadest at base, regularly convex, deeply punctate in regular striae, the ninth broadly interrupted; the marginal stria impressed from the base, the others only at apex. Ventral surface and legs sparsely and finely punctate, finely pubescent. Length, 5 mm.

Type.—No. 1292, U.S.N.M. One example, collected at San Diego, Texas (May 26), by Mr. E. A. Schwarz, who recognized it as undescribed and labeled it with the manuscript name used above.

This species is allied to *L. 6-guttata* Olivier, but is smaller, more elongate, has no impressions on the disc of the elytra, and has also a different coloration.

LEMA LEBIOIDES, new species.

Moderately broad, rufotestaceous, shining; mouth, sides of head, coxae and side pieces of meso- and metathorax black. Antennae slender, ferruginous. Head sparsely punctate, vertex nearly smooth, with a small round fovea. Thorax broadest at base, deeply constricted behind the middle, impunctate. Elytra parallel, slightly depressed on the disc one-third from the base, ferruginous, with a large square scu-

tellar spot and a longitudinal vitta black, the latter starting from the humerus, widened behind to the suture and interrupted before the apex; striae regular, of rather strong punctures, the ninth not interrupted. Ventral surface and legs sparsely and finely punctulate, finely pubescent. Length, 5.5 mm.

Type.—No. 1291, U.S.N.M. One example collected at Brownsville, Texas, by Professor C. H. T. Townsend.

This species has the form of *L. conjuncta* Lacordaire, but is very much smaller, has the elytra more strongly punctate, and is different in coloration.

LEMA COLORADENSIS, new species.

Shortly oblong, parallel, shining. Head red, sparsely and finely punctulate, labrum and apices of palpi infuscate; front strongly bituberculate; eyes emarginate. Antennae stout, shorter than half the body, slightly incrassate toward the apex, black; basal joint entirely and second to fourth on the lower surface red. Thorax red, subparallel, slightly longer than broad, obsoletely punctulate on the disc, moderately constricted at the sides behind the middle; the transverse basal constriction obsolete, with a small impressed fovea on the median line. Scutellum red, quadrate, emarginate at apex. Elytra bluish-green, convex, obsoletely impressed on fourth from the base; ten regular rows of moderately close punctures, the intervals somewhat rugose by finely impressed, irregular scratches. Thorax beneath red, sparsely pubescent. Abdomen shining black, nearly impunctate; last ventral rufous at apex. Legs red, the posterior femora slightly more incrassate than the others, reaching the base of the third ventral segment. Length, 4 mm.

One example from Greeley, Colorado, in collection of Messrs. Hubbard & Schwarz.

This species is closely allied to *L. brunnicollis* Lacordaire, but has the thorax and elytra slightly more elongate and a different coloration of the head and legs.

LEMA CONFUSA Chevrolat.

Lema confusa CHEVROLAT, Col. Mex. Cent., II, 1835, No. 116.—LACORDAIRE, Mon., p. 409.—JACQUELIN, Duv., Hist. Cub. Ins., p. 282, pl. XI, fig. 3.

Recorded from Mexico and Cuba, this species has also been collected at Enterprise and Crescent City, Florida, by Messrs. Hubbard & Schwarz. It is allied to *L. conjuncta*, but is smaller and less robust. The color is shining black; elytra yellow, with a sutural stripe, expanded at apex, and an abbreviated discal stripe, black. It varies with the elytral stripes confluent and the abdomen black or yellow.

Genus CHLAMYS Knoch.

Chlamys KNOCH, Neu. Beytr. Ins., I, 1801, p. 122.

ANALYTICAL KEY TO THE SPECIES OF CHLAMYS.

Antennæ with third and fourth joints subequal, slender.

Legs maculate, body subquadrate, pubescent... *C. maculipes* Chevrolat. (p. 476).

Legs black, body subquadrate, metallic.

Metascutellum visible, elytra with velvety-black foveæ on disc.

C. memnonia Lacordaire. (p. 476).

Metascutellum not visible, intervals of elytra uniform.

Elytral intervals sparsely punctate.

Sides of thorax densely strigose..... *C. plicata* Fabricius. (p. 478).

Sides of thorax obsoletely strigose... *C. tuberculata* Klug. (p. 479).

Elytral intervals densely, deeply punctate.

C. cribripennis Le Conte. (p. 479).

Legs red, body oblong, black, opaque..... *C. foreolata* Knoch. (p. 479).

Antennæ with fourth joint broadly dilated, body oblong, ferruginous.

C. arizonensis, new species. (p. 479).

CHLAMYS MACULIPES Chevrolat.

Chlamys maculipes CHEVROLAT, Col. Mex. Cent., II, 1835, No. 120.—LACORDAIRE, Mon., p. 660.

This species, which is not uncommon in Mexico and Nicaragua, has lately been collected at Brownsville, Texas, by Mr. E. A. Schwarz and Professor C. H. T. Townsend. It is oblong quadrate, greenish black above, pubescent and densely rugosely punctate. The gibbosity of the thorax is rounded, without crest, and has two polished black spaces on the anterior surfaces. The elytra have small obtuse isolated tubercles, one on the basal lobe, four in an oblique line from the humerus to the middle of the suture, one near the lateral sinus, and three or four posteriorly. The ventral surface, pygidium and legs are ferruginous, varied with black. The head is entirely ferruginous in the Texan specimens. The antennæ are longer and more slender than in the *plicata* group.

CHLAMYS MEMNONIA Lacordaire.

Chlamys memnonia LACORDAIRE, Mon., p. 785.

From southern Arizona and southwestern Texas there have long been represented in American collections certain roughly sculptured forms of *Chlamys*, supposed generally to be merely varieties of *C. plicata*. A closer examination shows that these forms differ materially, not alone in sculpture, but in the remarkable character of having a visible second scutellum. In *C. plicata* the metanotum, on removing the elytra, shows a fine carina, which in *C. memnonia* becomes very strongly developed, and in most individuals becomes visible, between the applied elytra, behind the ordinary scutellum as a long, narrow second scutellum. This

appearance is further facilitated by a depression and slight emargination of the edges at this place, the serration of the elytral suture being interrupted some distance behind the mesoscutellum in all the *Chlamys* of the *plicata* group. There is, however, a marked individual variation, and specimens occur that by their sculpture evidently belong to *C. memnonia*, but still show no second scutellum. On the other hand, one example of the ordinary *C. plicata* has been observed with metascutellum visible. Mr. Jacoby¹ has noted this variation, but nevertheless transfers *C. memnonia* to Lacordaire's genus *Diaspis*, founded upon a Mexican species, *D. paradoxa*, which was the only coleopteron recorded with two scutella previous to Mr. Jacoby's observation.

Another structure in these beetles still more remarkable for its variability is the form of the mesoscutellum. In *C. plicata* this is ordinarily subquadrate, slightly broader behind, with acute hind angles and three subequal acute teeth, plainly visible in front. Occasional specimens, however, occur with the scutellum as much as one-half broader than long. In *C. memnonia* the width is sometimes more than twice the length. The lateral teeth are deflexed in front and concealed by the thoracic lobes. The posterior angles are rounded, imparting an entirely different appearance when viewed from above. Some specimens have the scutellum narrower, with the teeth more visible, in which case, if the metascutellum also happens to be concealed, they are distinguishable from *C. plicata* only by the sculpture of thorax and elytra. After diligent search for specific characters to separate the specimens with two scutella obtained at Brownsville and San Diego, Texas, from those taken in southern Arizona, I have reached the conclusion that all belong to one variable species, namely, *Chlamys memnonia* Lacordaire. All specimens collected by Belfrage at Waco, Texas, that I have seen, are *C. plicata*. The characters for *C. memnonia* may be summarized as follows:

Thorax with distinct lateral tubercle and scattered coarse punctures; the gibbosity on all sides rugosely scabrous and deeply bifid at summit. Scutellum generally about twice broader than long and with one visible lobe in front. Metascutellum exposed. Elytra with acutely elevated tubercles, the four in the humero-median line forming a sinuous ridge, connected by longitudinal ridges with the tubercle on the basal lobe and with the juxta-scutellar tubercle, including a deep, round velvety black fovea on the disk just in front of the strong transverse median tubercle, that terminates the humero-median ridge; generally there is another similar black fovea between this ridge and the lateral carina; the latter is strongly developed and arcuate; on the posterior half of each elytron are five other more isolated tubercles. The intervals are finely rugose and coarsely, sparsely punctured. Pygidium coarsely reticulately rugose. Average size somewhat larger than *C. plicata*.

¹ Biol. Cent.-Amer., Ins. Col., VI, Pt. 1, p. 74 and Suppl., p. 155.

CHLAMYS PLICATA Fabricius.

Chlamys plicata FABRICIUS, Ent. Sys. Supp., p. 111.—OLIVIER, Ent., VI, p. 876, pl. 1, fig. 3 a-b.—LACORDAIRE, Mon., p. 701.—CROTCH, Proc. Phil. Acad. Sci., XXV, p. 30.

After separating the preceding forms specifically there still remains *C. plicata*, a species very variable in sculpture. The thorax is strigose over the whole surface and the tubercles on the sides of the disk are obsolete and without coarse punctures; the central gibbosity has never any punctures on its posterior surface, but the anterior face and the crest are variable, being impunctate or having smaller shallow foveæ. These latter, however, are never coarse and confluent; the summit is more or less bifid and the longitudinal channel is obsolete or impressed. The elytral sculpture is still more variable, but the tubercles are never as large and as acutely ridged as in *C. memnonia*. The tubercle on the basal lobe is always distinct and isolated, but varies in size; the juxta-scutellar and post-scutellar tubercles are often entirely absent and when present are isolated, and never connected with the median ridge. The small spiny ridge along the sutural edge at the base, nearly always present in *C. memnonia*, is here totally wanting, and the surface is flat. The tubercles of the humero-median range are either isolated or connected in an undulating ridge, but are never connected with the basal or scutellar tubercles; the lateral carina is seldom entire, generally broken up, and the anterior part is often developed transversely; the posterior tubercles are more or less developed; the intervals between the tubercles are uniform, never showing any velvety foveæ, always sparsely punctate, either flat or covered with numerous smaller tubercles. The pygidium has a median carina and a fovea each side at apex; the balance of the surface varies from flat to coarsely reticulate.

By a careful study of the characters used for separating *C. assimilis* Klug, and *C. polycoeca* Lacordaire, I have been unable to find even local races where they are at all constant. Both are said to differ from *C. plicata* in having impunctate, obsoletely canaliculate gibbosity of the thorax and the lateral carina of the elytra are divided; *C. polycoeca* should differ from *C. assimilis* in the more isolated elytral tubercles.

Specimens from the Middle and Northern States agree best with the descriptions of these two forms, and the more roughly sculptured individuals from Florida and Texas should be the true *C. plicata*, but I have seen occasional female specimens from New York or the District of Columbia as rough as any from the farthest South and *vice versa*, smoother specimens from Texas and Florida. Moreover, the characters used for their separation are very rarely combined in any one individual. Consequently I am forced to consider *C. polycoeca* and *C. assimilis* as merely synonyms of *plicata* and not even entitled to rank as races.

CHLAMYS TUBERCULATA Klug.

Chlamys tuberculata KLUG, Ent. Mon., pp. 117, 122, pl. VIII, fig. 1.—LACORDAIRE, Mon., p. 808.

A small form collected by Mr. E. A. Schwarz, at Enterprise, Florida, agrees exactly with the description of Klug's species. It has the form of *C. plicata*, is bright cupreous; the thorax is obsoletely strigose at the sides with some small punctures; the tuberosity is densely strigose, and on the anterior surface sparsely punctate. The scutellum is slightly transverse. The elytra are very feebly sculptured, the humero-median series consisting of two fine arcuate ridges, obsoletely connected with the basal tubercles; the lateral carina and the posterior tubercles are isolated and small; the intervals nearly flat, sparsely, rather finely punctate. The length is 2.5 mm.

Lacordaire mentions a black variety and gives the locality of the species as "Carolina."

CHLAMYS CRIBRIPENNIS Le Conte.

Chlamys cribripennis LE CONTE, Proc. Am. Phil. Soc., XVII, p. 614.

I have seen in the collection of Messrs. Schwarz and Hubbard two specimens collected at Detroit, Michigan, the same locality which supplied Doctor Le Conte with the type of the species. The size is small, not quite 3 mm.; the thorax is nearly impunctate, strigose, and the crest of the tuberosity is feebly bifid. The elytra have feeble tubercles, but the intervals are deeply and more densely punctate. The labrum is pale in the one and black in the other specimen.

The rather dense and strong punctation of the elytra seems to indicate this to be a valid species, as small specimens of *C. plicata* have very obsoletely punctate elytra.

CHLAMYS FOVEOLATA Knoch.

Chlamys foveolata KNOCH, Neu. Beytr., I, p. 130, pl. IV, fig. 9.—LACORDAIRE, Mon., p. 835.—CROTCH, Proc. Phil. Acad., XXV, p. 30.

Of this species there is in the National Museum a specimen collected by Belfrage in Waco, Texas. It is elongate, subcylindrical, black, opaque; front, mouth parts, antennæ, and legs ferruginous. Thorax reticulately, longitudinally strigose, the elevation broad, without crest, broadly but not deeply canaliculate. Elytra reticulately carinate, deeply punctate. Pygidium with a fine median carina, punctate and not foveolate. Length, 2.7 mm.

CHLAMYS ARIZONENSIS, new species.

Oblong, subcylindrical, ferruginous; antennæ pale ferruginous, last four joints black; third joint as long as second, triangular; fourth joint transverse, nearly as broad as fifth. Head flat, alutaceous, obsoletely

punctate; clypeus more strongly punctate. Thorax rather long, very densely, deeply punctate; sides convex, median gibbosity rounded, obsolete broadly canaliculate; a blackish spot on the middle and some indefinite brownish spots on the sides. Scutellum slightly transverse, with prolonged hind angles and margined with black. Elytra parallel, margined with black at base and with a rectangular brown sutural spot behind the middle, deeply punctate in bigeminate striae, which are irregular at base and apex; the elevated tubercles are few and smooth; the basal and juxtascutellar ones are united on the basal margin, the median sutural and the lateral are transverse; an oblong one is on the disk posteriorly and another one is humeral, all being united by narrow longitudinal carinae. Pygidium flat, rather sparsely punctate. Ventral surface varied with paler and darker ferruginous; femoral grooves deep black. Legs immaculate, tarsi moderately broad. Length, 3 mm.

Collected by H. K. Morrison in southern Arizona.

Type.—No. 1298, U.S.N.M.

Genus EXEMA Lacordaire.

EXEMA GIBBER Olivier.

Chlamys gibbera OLIVIER, Ent., VI, p. 876, pl. I, fig. 14.—CROUCH, Proc. Phil. Acad. Sci., XXV, p. 30.

Oblong quadrate, dark cupreo-aeneous; antennae labrum and tarsi beneath pale. Thorax and elytra densely punctate and acutely tuberculate. Prosternum concave. Length, 2 to 3 mm.

All specimens that I have seen are from Florida and Louisiana.

EXEMA CONSPERSA Mannerheim.

Chlamys conspersa MANNERHEIM, Bull. Moscow, 1843, II, p. 311.

Chlamys rugulosa MANNERHEIM, Bull. Moscow, 1845, I, p. 109.

Oblong quadrate, black without metallic luster, more or less spotted with yellow. Thorax and elytra with obtuse tubercles. Prosternum flat. Length, 2 to 2.5 mm.

Occurs from Atlantic to Pacific States. *E. dispar* Lacordaire, is a synonym. Specimens from southern California and Arizona are generally more maculate and less coarsely sculptured.

CRYPTOCEPHALUS PUBICOLLIS, new species.

Cylindrical, deep black, shining, densely grayish pubescent; elytra glabrous with red humeral spot. Antennae slender, entirely black, the five basal joints subglabrous. Head sparsely punctate, smooth and glabrous on the median line. Thorax very convex, as broad as elytra, densely punctate at the sides, smoother and less pubescent at the middle. Elytra moderately strongly punctate in regular striae, the marginal stria impressed the whole length and the submarginal at

apex; red humeral spot extending along the base to the third or fourth stria and covering the whole of the epipleural lobe, inclosing a dark cloud on the umbone. Pygidium coarsely punctate, with a fine median carina toward apex. Length, 6 mm.

Male.—Antennæ nearly as long as the body. Prosternum, with a strong recurved cusp at apex, emarginate behind. Last ventral vaguely impressed and glabrous at middle. Posterior femora reaching the apex of elytra; posterior tibiæ straight, globosely expanded at apex.

Female.—Antennæ much shorter than the body. Prosternum flat in front. Last ventral with a very deep, smooth, circular fovea. Posterior femora reaching to the apex of the third segment; tibiæ simple.

One male and two females in the collection of Messrs. Hubbard and Schwarz, collected in southern Arizona by H. K. Morrison. One of these examples has been presented to the National Museum.

Type.—No. 1307, U.S.N.M.

The species should take its place after *C. basalis* Suffrian, from which it differs by the more globose thorax and the glabrous elytra.

COLASPIDEA SUBVITTATA Fall.¹

Elongate, cupreous green, less shining, sparsely clothed with long recumbent white pubescence; labrum, base of antennæ and legs rufous. Head slightly convex, with a shallow rounded impression between the eyes, finely and sparsely punctate. Thorax finely and sparsely punctate, side margins feebly rounded, anterior angles strongly deflexed. Elytra more densely and coarsely punctate than the thorax; each with three impunctate glabrous lines on the disk that become obsolete at apex. Ventral surface more cupreous, with shorter pubescence, moderately densely punctate. Femora with metallic luster on the upper side. Length, 3.8 mm.

Type.—No. 1293, U.S.N.M. Collected on Santa Catalina Island, California, by Mr. H. C. Fall. One example presented to the National Museum by Mr. E. A. Schwarz.

This species has the form and appearance of a *Graphops*, but has no trace of supraorbital groove and the postocular lobes are well developed. The prosternum is broad and flat, as in the three Californian species, placed by Doctor Horn in the genus *Colaspidea*. It comes nearest to *C. cuprascens*, but is readily separated by its much longer pubescence and the smooth discal lines of elytra.

METACHROMA VITICOLA, new species.

Oblong, shining, rufocastaneous, elytra and legs paler. Antennæ ferruginous, with last five joints infuscate. Head nearly smooth, with

¹ [Subsequent to the completion of the manuscript of this paper a description of this species was published by Mr. H. C. Fall (Canadian entomologist, vol. 29, No. 10, October, 1897, p. 243), and the name proposed by Mr. Linell has, therefore, been suppressed.—E. A. Schwarz.]

a distinct frontal impression; clypeo-frontal suture obliterated; clypeus sparsely and vaguely punctate. Thorax wider than long, narrowed at apex; sides strongly arcuate; angles slightly auriculate; disk very convex, obsoletely punctulate. Elytra striato-punctate, the punctures coarse but not close, somewhat finer toward apex, but not obliterated; the short striae regular. Propleura and metasternum smooth; prosternum between the coxae rugose; abdomen sparsely and finely punctate. Posterior femora simple. Length, 4.5 mm.

Type.—No. 1294, U.S.N.M. Five examples from Brighton, Texas, collected June 27 by Mr. J. Taylor, who reported the species to the Department of Agriculture as injurious to grape.

This species resembles *M. ustum* Le Conte, but is much smaller, has simple femora, antennae infuscate at apex, body darker beneath, and the elytral striae distinct to apex.

PLAGIODERA PURPUREA, new species.

Elongate, oval, feebly convex, violaceo-purpureous. Head coarsely punctate; clypeal suture arcuate, distinct. Thorax moderately densely punctate; sides feebly convergent from the base, broadly rounded toward apex; anterior angles prominent. Scutellum large, semioval, alutaceous. Elytra strongly striato-punctate; intervals obsoletely punctulate, finely alutaceous. Ventral surface sparsely punctate. Length, 4.8 mm.

Type.—No. 1295, U.S.N.M. Three examples from southwestern Utah (from Mr. Charles Palm, of New York).

This species approaches in form the largest varieties of *P. prasinella* Le Conte, but is distinct by its larger size, purplish color, parallel-sided thorax, and elytral punctation.

PLAGIODERA THYMALOIDES Stål.

Plagiödera thymaloides STÅL, Diagn., 1860, p. 468; Mon., p. 311.—CHEVROLAT, Dejean, Cat., 3d ed., p. 428.

The above-mentioned species, previously recorded from Mexico and Central America, was collected in June, 1896, in Brownsville, Texas, by Professor C. H. T. Townsend. It is nearly circular, with crescent-shaped thorax and convex elytra, resembling a *Coccinella*; color fulvous, with disk of thorax and elytra aeneous. Following our classification, it belongs in the genus *Lina* after *L. arizonæ* Crotch.

PHYLLOBROTICA NIGRITARSIS, new species.

Elongate, parallel. Head entirely yellow, smooth. Antennae black, the three basal joints yellow, the third nearly as long as fourth. Thorax broader than long, smooth, yellow, slightly narrowed behind. Elytra yellow, each with two piceous spots, one at base small and a larger oblong one behind the middle; surface sparsely finely punctate and

alutaceous. Ventral surface moderately finely punctate, sparsely pubescent, black; prothorax and metasternum yellow. Legs yellow, tarsi black.

Male.—Abdomen convex, uniformly pubescent; second to fourth segment equal, with straight margins; fifth slightly longer, with a deep cupuliform fovea, the margin with a truncate lobe at middle, limited by a deep notch each side; last dorsal deeply semicircularly emarginate. Posterior tibiæ slightly arcuate. Length, 6.5 mm.

Three males and one female from Kansas, Nebraska, and Texas (Coll. Belfrage).

Type.—No. 1309, U.S.N.M.

PHYLLOBROTICA SORORIA Horn.

Phyllobrotica sororia HORN, Proc. Cal. Acad. Sci., 2d ser., VI, p. 378.

Doctor Horn (loc. cit.) describes this species from a female specimen from Burnett County, Texas. In the National Museum are three specimens from Waco, Texas (Coll. Belfrage), one male and two females. The male is remarkable as being the only one in the genus with differentiated antennæ. The claws of this species are nearly bifid. The male characters are as follows:

Antennæ longer, the basal joint more inflated, entirely yellow; the three terminal joints distinctly incrassate, yellow. Ventral segments convex, with straight hind margins, uniformly pubescent; the fifth slightly longer, with triangular notch at apex; last dorsal feebly emarginate. Posterior tibiæ arcuate. First tarsal joint more incrassate.

Type.—No. 1310, U.S.N.M.

The male of *D. decolorata* Say, has the first to fourth ventral segments more or less deeply impressed along the middle and glabrous, and the hairs are longer and denser on each side of this channel; the second to fourth are broadly and deeply emarginate, leaving the fifth largely exposed.

DIAEROTICA NITIDA, new species.

Elongate oval, very shining. Antennæ three-fourths the length of the body, slender, piceous, the three basal joints paler; second joint small, the third as long as the fourth. Head polished, black, vertical fovea small. Thorax pale yellow, feebly convex, scarcely wider than long; sides feebly arcuate in front, parallel behind; posterior angles acute; disk smooth, bifoveate. Scutellum black. Elytra ivory-white; a sutural and humeral vitta, nearly reaching the apex, shining black; punctures fine, not close, irregularly disposed; two rather feeble, smooth costæ in the dorsal ivory stripe. Ventral surface yellowish-white, metasternum piceous. Legs piceous, basal half of femora pale. Tibiæ carinate toward the base only. Length, 4.5 to 5 mm.

Male.—Last ventral segment broadly emarginate.

Type.—No. 1296, U.S.N.M. Collected in New Mexico by Professor F. H. Snow and at San Diego, Texas, by Mr. E. A. Schwarz.

This species has been distributed in collections under the name of *D. lemniscata*, but is at once distinguished by the elongate third antennal joint. From *D. vineta* it differs by the fine elytral punctation and from *D. blandula* by the narrow thorax and the color of the legs. It should be placed after *D. blandula* in the arrangement of Doctor Horn.

GALERUCELLA MARMORATA Jacoby.

Galerucella marmorata JACOBY, Biol. Centr.-Amer., Ins. Col., VI, Pt. 1, p. 491.

Described from Mexico and Guatemala and since collected at Brownsville, Texas (February 27, 1895), by Professor C. H. T. Townsend. It is varied with fuscous and obscure reddish, the thorax red, with three large dark spots; the elytra are densely finely pubescent, with three elevated longitudinal lines, the one nearest suture interrupted before middle and connected transversely with the second line just behind the middle.

HALTICA NIGRITULA, new species.

Oblong oval, convex, shining black. Antennæ slender, somewhat longer than half the body, ferruginous, slightly infuscate at apex; joints two to four, equal in length. Head smooth, frontal carina obtuse, tubercles feeble. Thorax one-half wider than long, narrowed at apex; sides arcuate; disk convex, very finely sparsely punctulate; the transverse ante-basal impression deep, sharply defined, extending from side to side, with a short, deep longitudinal fovea each side. Elytra broader than thorax, rounded at the sides; humeri rounded, umbone not prominent, feebly impressed within; disk convex, coarsely punctate at base, gradually more finely toward the apex. Ventral surface piceous, less shining, sparsely and finely punctulate, finely pubescent. Legs finely pubescent, ferruginous; the posterior femora infuscate at middle. Length 2 mm.

Male.—Last ventral segment deeply sinuate each side, the middle forming a short subtruncate lobe with a small triangular fovea at apex.

Type.—No. 1297, U.S.N.M. Collected at San Diego, Brownsville, and Corpus Christi, Texas (April, May, and June), by Mr. E. A. Schwarz, who recognized it as a new species and labeled it with the name used above.

This small species is of the size of *H. nana* Crotch, but is more robust and rounded and the color is not metallic. The basal groove of the thorax extends distinctly to the side margin, although there is a very well defined longitudinal fovea each side.

CREPIDODERA CARINATA, new species.

Elongate oval, subparallel, greenish black, shining; antennæ, mouth parts, and legs bright ferruginous. Head smooth, frontal carina obtuse, tubercles distinctly limited, flattened; antennæ as long as half the body, very slightly incrassate to apex. Thorax nearly twice as wide

as long, slightly narrowed in front; sides arcuate, acutely toothed at the anterior angles, with a row of coarse punctures inside the strongly reflexed margin; disc convex, polished, with very sparse minute punctures; the antebasal transverse impression deep, coarsely punctate along its posterior margin, the longitudinal impressions deep, short, between the antebasal and the basal grooves. Elytra at base broader than thorax, slightly rounded at the sides; umbone prominent; disc feebly convex, with a long scutellar and nine discal striæ of moderately closely placed punctures, coarser at the base but gradually finer toward apex; intervals nearly smooth, the eighth with an obtuse carina from the umbone to near the apex. Prosternum sparsely punctuate in front, coarsely rugose between the coxæ. Abdomen with sparse setiferous punctures. Length, 3 mm.

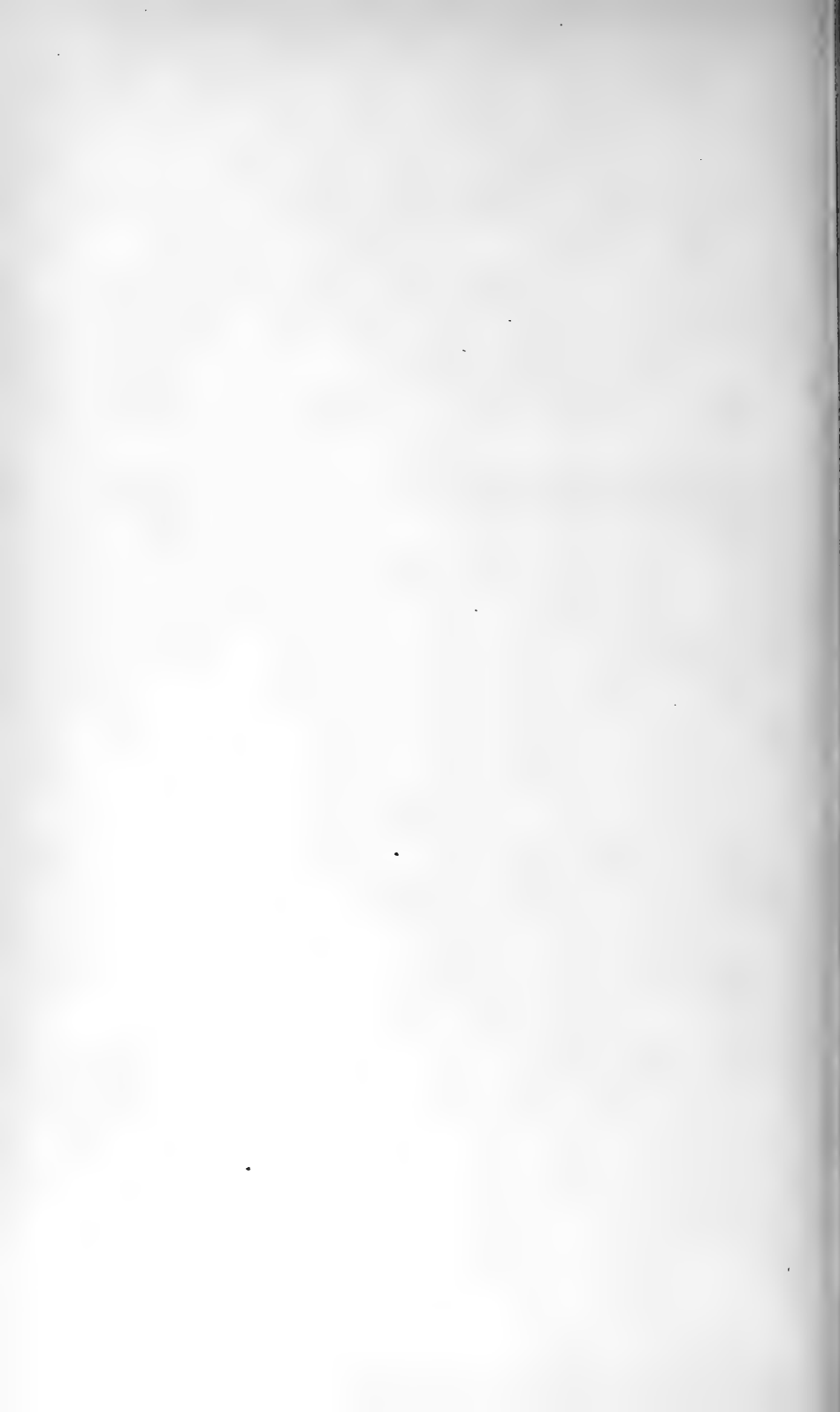
One example from Round Knob, North Carolina, in the collection of Messrs. Hubbard and Schwarz.

BRACHYCORYNA PUMILA Guérin.

Brachycoryna pumila GUÉRIN, Ic., Regn. Anim., Ins., p. 280.—DEJEAN, Cat., 3d ed., p. 390.

Octotoma pumila GEMMINGER ET HAROLD, Cat. 12, p. 3610.

In Biologia Centrali-Americana this species is recorded from Mexico, Central America, and Colombia, and Professor C. H. T. Townsend has collected it in Brownsville, Texas. It is smaller and more depressed than *Stenopodius flavidus*; the antennæ, head, and ventral surface are deep black, dorsal surface and legs pale yellow, sparsely maculate with black; elytra with four narrow elevated carinæ and ten rows of deep punctures. The antennæ are short, strongly clavate, the apex of the thorax not produced and the third tarsal joint bifid.



NOTES ON A COLLECTION OF FISHES FROM THE COLORADO BASIN IN ARIZONA.

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and

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DURING the latter half of April and the early part of May, 1890, the senior author and Mr. A. B. Alexander, of the United States Fish Commission, were temporarily detached from the "Albatross" and assigned to special duty in Arizona. The principal object of the expedition was to investigate the alleged occurrence of shad in the Lower Colorado, where it had been planted several years before by the United States Fish Commission. It was soon ascertained that the reports of the capture of shad had been erroneous, the fish in question being the German carp, then a stranger in the Colorado River. Repeated trials of the shad net and seine at Yuma, and later in the Horseshoe Bend of the Colorado below Lerdo, Mexico, failed to demonstrate the presence of shad. The river seems entirely unsuited to it.

Collections of the native fishes were made in the Colorado and in the mouth of the Gila River at Yuma; in the Salt River from Tempé to near the mouth of the Rio Verde, and in the upper course of the Rio Verde at Chino. The commoner species are well represented in the collection, and in addition such desiderata as *Plagopterus argentissimus*, *Meda fulgida*, a new species of *Pantosteus*, and, most important of all, *Tiaroga cobitis*, known heretofore only from the types, discovered in 1851. We secured all the species credited to the Lower Colorado and Gila rivers excepting of *Pantosteus clarki* and *Catostomus insignis*.

In their excellent historical account and check-list of the fishes of the Colorado River,¹ Evermann and Rutter call attention to the fact that a remarkably high percentage of its fishes are peculiar to the Colorado Basin. This becomes still more striking when we examine the short list (seven species in all) supposed by them to be found in other basins as well. For of these seven, two must be eliminated: *Lepidomedu vittata* and *Cyprinodon macularius*. *L. vittata* was, it is true, taken in southwestern Arizona by the Death Valley Expedition, but the river in

¹ Bull. U. S. Fish Commission, XIV, 1894, pp. 475-486.

which it was found is properly a tributary of the Rio Virgen, though now lost in the desert sands before reaching that stream. *C. macularius* is known from the Colorado River, and also from springs in the great Colorado Desert. So far as known to us, it occurs only where the natural drainage is toward the Colorado River. Of the remaining five species, three are of very wide distribution, seemingly able to set at defiance what are effective barriers to the dispersion of other fishes. By virtue of what special characteristics they accomplish this result we do not know. Their testimony must for the present be simply ignored in any discussion of faunal relations. The case is different with one of the remaining species, *Leuciscus lineatus*, which is common to mountain tributaries of the Colorado and to the Utah Basin. Its occurrence in the Colorado is an unexplained anomaly, and contradicts all the other facts, which bespeak a very long period of absolute isolation for the Colorado Basin and its fauna. The last of the list, *Agosia chryso-gaster*, was described from the Rio Santa Cruz, Sonora, Mexico, a tributary of the Gila. In a recent paper on the fresh-water fishes of Sonora by Rutter¹ it is listed, together with *Pacilia occidentalis*, from the Rio Sonora and the Yaqui, which flow independently into the Gulf of California. These Gulf streams are practically unexplored, and may or may not prove to have had a comparatively recent connection with the Lower Colorado.

For the sake of completeness we include in this paper two undescribed species of marine fishes taken at the mouth of the Colorado. *Gillichthys detrusus* enters the river, and lives in salt or brackish water. Like its California congener, *G. mirabilis*, it sustains immersion in fresh water without apparent inconvenience.

Family CATOSTOMIDÆ.

1. PANTOSTEUS ARIZONÆ Gilbert, new species.

(Plate XXXVI.)

Four specimens of this species were taken at Tempé, Arizona. It is readily distinguished from all other species of *Pantosteus* by the large size of its scales.

Head broad and flat, $4\frac{1}{2}$ in length. Interorbital space flattened or very slightly concave, $2\frac{6}{10}$ in head. Depth $4\frac{3}{4}$; D. 11 or 12; A. 7; scales 7 or 8—65 to 67—11 to 15. The scales are unusually large in front of dorsal and along back, much smaller along lateral line, and become minute on belly. Those along the lateral line grow gradually larger posteriorly. Eye moderate, very high up, posterior, $3\frac{1}{2}$ in snout, 6 in head, $2\frac{1}{2}$ in interorbital space; orbital ring somewhat raised. Preorbital less than half as wide as long. Snout considerably longer than rest of head. Isthmus very broad, $2\frac{1}{2}$ in head. Greatest depth

¹Proc. Cal. Acad. Sci., 1896, p. 260.

of head $1\frac{1}{2}$ in its length. Fontanelle obliterated, the bone covering it very thin. Mouth very broad, its width contained $3\frac{1}{5}$ times in length of head. Lips large, papillose. Lower lip broadly V-shaped behind, but slightly incised, a broad but shallow notch at junction of edge of upper and lower lips. Upper edge of dorsal straight; front of dorsal midway between tip of snout and base of caudal; pectorals $1\frac{1}{10}$ in head; ventrals $1\frac{3}{10}$; anal reaching base of caudal, $1\frac{1}{10}$ in head; caudal peduncle $1\frac{1}{4}$ in head, its least depth $2\frac{1}{5}$ in head or slightly more than 2 in its own length.

A preliminary account of this species has been given by Jordan & Evermann.¹

Table of measurements.

Length in inches.	Head.	Depth.	D.	A.	Eye in head.	Eye in snout.	Eye in inter-orbital.	Scales.	Depth of head in its length.	Length of L dorsal into head.	Depth of caudal peduncle into head.
9	$4\frac{1}{2}$	5	11	7	6	$3\frac{1}{3}$	$2\frac{1}{3}$	8-75-15	$1\frac{1}{4}$	11	$2\frac{1}{2}$
$8\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{3}{5}$	12	7	$5\frac{2}{3}$	$3\frac{1}{10}$	$2\frac{1}{2}$	7-71-11	1	$1\frac{1}{4}$	$2\frac{3}{10}$
4	$4\frac{1}{2}$	$4\frac{3}{4}$	11	7	$4\frac{1}{4}$	2	$2\frac{1}{2}$	7-67-12	1	$1\frac{3}{4}$	3
$3\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{3}{5}$	11	7	$4\frac{1}{10}$	2	$2\frac{1}{2}$	8-67-11	1	$1\frac{1}{2}$	$2\frac{1}{2}$

Type.—No. 48126, U.S.N.M.

2. *CATOSTOMUS LATIPINNIS* (Baird & Girard).²

Five specimens of this species were taken in the Salt River at Tempé, Arizona. It very closely resembles *C. discobolus* of Green River and Grand River (both tributaries of the Colorado), but differs in having larger scales, more dorsal rays, and a more slender caudal peduncle, as well as a more anterior insertion of the dorsal fin. These two fishes have been confused in Jordan & Evermann's "Fishes of North and Middle America." Their description of *C. latipinnis* is taken from specimens of *C. discobolus* from Green River and Grand River, and from notes on Baird & Girard's type of *C. latipinnis*. Following is a description and table of measurements based on our specimens.

Head $4\frac{1}{2}$ in length, depressed and flat above. Eye high up and small, 5 to 7 in head, 3 to $3\frac{1}{2}$ in snout, $2\frac{1}{3}$ to $2\frac{3}{4}$ in interorbital space. Interorbital width $2\frac{2}{3}$ in head. Depth about $5\frac{1}{2}$; least depth of caudal peduncle $4\frac{1}{2}$ in head, $3\frac{1}{2}$ in its own length; greatest depth of head $1\frac{1}{5}$ in its length; depth below lower edge of orbit 3 in head. Dorsal 14 or 15; anal 7. Scales 19 or 20—89 to 102—16 to 18, 46 to 50 transverse rows in front of dorsal fin. Fins very large, the dorsal with its upper margin concave; ventrals and pectoral rounded; dorsal as long as its longest ray, $1\frac{1}{10}$ in head, its last ray a little less than half the length

¹ *Fishes of North and Middle America*, 1896, p. 170.

² Not *Catostomus latipinnis* Jordan, Bull. United States Fish Commission, 1889, p. 26, which = *C. discobolus* Cope.

of the first ray; first dorsal nearer tip of snout than base of caudal; ventrals not reaching quite to vent, $1\frac{2}{5}$ in head. Muzzle not projecting; about six rows of short thick papillæ on upper lip, the smallest above; lower lip large, incised to its base, with about twelve rows of short thick papillæ, which are quite small posteriorly; distance from front of upper lip to back of lower $1\frac{1}{2}$ in snout; jaws with a slight cartilaginous sheath. Width of preorbital a little less than half its length. Reaching a length of 2 feet. Gila Basin.

This species has been recorded from the following places: Rio San Pedro, Gila Basin (type locality), by Baird & Girard; Fort Thomas, Gila River, by Kirsch.

Table of measurements.

Length in inches.	D.	A.	Scales.	Scales in front of dorsal.	Depth.	Head.	Eye.	Inter-orbital.
24	14	7	20-90-16	48	$5\frac{1}{2}$	$4\frac{1}{2}$	7	$2\frac{2}{5}$
10	15	7	20-102-17	50	$5\frac{3}{4}$	$4\frac{1}{4}$	6	$2\frac{3}{5}$
8	15	7	19-89-16	46	$4\frac{3}{4}$	$4\frac{1}{4}$	6	$2\frac{3}{5}$
$5\frac{1}{2}$	14	7	19-95-18	48	$5\frac{1}{2}$	$4\frac{1}{4}$	5	$2\frac{2}{5}$

3. CATOSTOMUS DISCOBOLUS Cope.

Catostomus discobolus COPE, Hayden's Geol. Surv. Wyom., p. 435, 1870.

The following description is based on specimens taken at Green River, Wyoming, by Doctor B. W. Evermann, of the United States Fish Commission. The species was not found by Doctor Gilbert in the Lower Colorado, where it is probably replaced by *C. latipinnis*. The description is included here in an attempt to clear up the confusion existing between the two species. Our specimens, although from the type locality, do not agree exactly with the original description, the differences being probably due to the very small size of the type.

Head $3\frac{1}{5}$ to $4\frac{1}{2}$. Depth about $5\frac{1}{4}$. Eye small, high up, $5\frac{1}{2}$ to 6 in head, $2\frac{2}{5}$ in snout, $2\frac{2}{5}$ in interorbital space. Interorbital space $8\frac{1}{2}$ in head. Width of preorbital less than half its length. Least depth of caudal peduncle $2\frac{1}{2}$ in its length, 2 in length of head; greatest depth of head $1\frac{3}{5}$ in its length, depth from lower edge of orbit $3\frac{1}{4}$ in head. Muzzle projecting slightly beyond upper lip. Upper margin of dorsal very slightly concave, the length of its base $1\frac{1}{5}$ in the longest ray, $1\frac{1}{2}$ in length of head; last ray half length of first; front of dorsal midway between tip of snout and base of caudal; ventral $1\frac{4}{10}$ in head, rounded, not reaching quite to vent. Mouth as in *C. latipinnis*, except that the posterior tubercles on lower lip are long and not nearly so closely set, there being nine or ten rows; jaws with a slight cartilaginous pellicle.

Specimens from Delta, Colorado, collected by Jordan & Evermann, differ slightly from Green River specimens in size of scales, as will appear from the following tables of measurements:

Measurements of Catostomus discobolus, Green River, Wyoming.

Length in inches.	D.	A.	Scales.	Scales in front of dorsal.	Depth.	Head.	Eye.	Inter-orbital.
8	12	7	20-101-18	56	4 $\frac{1}{2}$	3 $\frac{1}{2}$	6 $\frac{1}{2}$	2 $\frac{1}{2}$
8	12	7	19-108-20	58	5 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	2 $\frac{1}{2}$
5 $\frac{1}{2}$	12	7	21-111-21	60	4 $\frac{1}{2}$	4	5 $\frac{1}{2}$	2 $\frac{1}{2}$
5 $\frac{1}{2}$	13	7	20-106-18	62	5 $\frac{1}{2}$	4 $\frac{1}{4}$	5 $\frac{1}{2}$	2 $\frac{1}{2}$
5 $\frac{1}{2}$	13	7	19-101-17	52		4	5	2 $\frac{1}{2}$
5	13	7	-109-	63		4	3 $\frac{1}{2}$	2 $\frac{1}{2}$
6 $\frac{1}{2}$	13	7	21-106-18	58				
5 $\frac{1}{2}$	12	7	18-113-20	63				
6	13	7	19-107-18	59				
5	12	7	21-108-18	59				
5 $\frac{1}{2}$	13	7	20-104-17	57				

Measurements of Catostomus discobolus, Delta, Colorado.

Length in inches.	D.	A.	Scales.	Scales in front of dorsal.	Depth.	Head.	Eye.	Inter-orbital.
8	12	7	25-128-22	65	4 $\frac{3}{4}$	4	5 $\frac{1}{2}$	2 $\frac{3}{4}$
7	12	7	24-118-23	65	4 $\frac{1}{2}$	4	5 $\frac{1}{2}$	2 $\frac{1}{2}$
6 $\frac{1}{2}$	12	7	23-116-22	63	4 $\frac{1}{2}$	4	5 $\frac{1}{2}$	3
6	12	7	21-113-22	62	5	3 $\frac{1}{2}$	5 $\frac{1}{2}$	2 $\frac{1}{2}$
5 $\frac{1}{2}$	13	7	22-112-22	60	5	4	5 $\frac{1}{2}$	2 $\frac{1}{2}$
5 $\frac{1}{4}$	12	7	22-116-20	65	5 $\frac{1}{4}$	4	5	2 $\frac{1}{2}$

4. CATOSTOMUS GILA Kirsch.

Eleven specimens were taken at Tempé and agree with the original description in everything except the number of papillæ on the lips. Our specimens have six irregular rows on the upper lip and eight or nine on the lower lip.

Table of measurements.

Length in inches.	D.	A.	Scales.	Scales in front of dorsal.	Depth.	Head.	Eye.
6	12	7	11-58-9	29	4 $\frac{1}{2}$	3 $\frac{1}{2}$	5
5 $\frac{3}{4}$	12	7	10-59-10	30	4 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$
6	12	7	10-58-10	31	4 $\frac{1}{2}$	4	5
5	12	7	11-59-11	30	4	3 $\frac{3}{4}$	4 $\frac{1}{2}$
8	12	7	11-59-11	31	4 $\frac{1}{2}$	4 $\frac{1}{2}$	5
4 $\frac{1}{2}$	12	7	9-59-12	31	4 $\frac{1}{2}$	4	5
5 $\frac{3}{4}$	12	7	11-59-11	31	4 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$
5	13	7	11-59-11	32	4 $\frac{1}{4}$	4	4 $\frac{1}{2}$
5	12	7	12-60-14	31	4	4	4
4 $\frac{1}{2}$	12	7	12-58-12	32	4	3 $\frac{3}{4}$	4
4	12	7	12-60-12	32	3 $\frac{3}{4}$	3 $\frac{3}{4}$	4 $\frac{1}{2}$

5. XYRAUCHEN CYPHO Lockington.

Eight specimens of this species were preserved. It was found extremely abundant at Yuma and at all points below as far as the Horse-shoe Bend, and in Hardee's Colorado. A table containing measure-

ments and other data is given below. The scales average smaller than those in the type specimen, and the majority have one more dorsal ray. The anal fin is not so deep. In the small specimens the nuchal hump forms a sharp keel from dorsal to nape, the keel being but little elevated. *Xyrauchen uncompahgre*, described by Jordan & Evermann from a single small specimen, agrees with the young of *X. cypho* except in the number of dorsal rays, there being but twelve rays in the dorsal of *X. uncompahgre*. These two will probably be found to be the same species.

Measurements of Xyrauchen cypho.

Length in inches.	D.	A.	Scales.	Depth.	Head.	Eye.	Least depth of C. ped. in length.	Locality.
11 $\frac{3}{4}$	14	7	16-78-17	4 $\frac{1}{2}$	4	6 $\frac{1}{2}$	11 $\frac{1}{2}$	Yuma, Ariz.
12 $\frac{3}{8}$	15	7	17-87-17	4	4	6 $\frac{3}{10}$	11 $\frac{1}{8}$	Do.
9 $\frac{3}{8}$	15	7	23-87-16	4 $\frac{1}{2}$	4	6	11 $\frac{1}{2}$	Do.
8 $\frac{3}{8}$	15	7	19-87-17	4 $\frac{1}{2}$	4	5 $\frac{7}{10}$	11 $\frac{1}{2}$	Do.
6 $\frac{3}{8}$	15	7	18-83-15	3 $\frac{1}{2}$	3 $\frac{3}{8}$	5 $\frac{1}{2}$	11	Do.
11	14	7	15-78-18	3 $\frac{7}{10}$	3 $\frac{3}{8}$	5 $\frac{1}{2}$	11 $\frac{1}{2}$	Tempe, Ariz.
15 $\frac{1}{2}$	15	7	19-80-16	3 $\frac{1}{2}$	3 $\frac{1}{2}$	6 $\frac{1}{2}$	12 $\frac{1}{2}$	Do.
18 $\frac{1}{2}$	14	7	16-79-17	4 $\frac{1}{10}$	3 $\frac{3}{8}$	6 $\frac{1}{2}$	13 $\frac{1}{2}$	Horseshoe Bend.

Family CYPRINIDÆ.

6. PTYCHOCHEILUS LUCIUS Girard.

Several small specimens from the Colorado River at Yuma, and at the Horseshoe Bend near its mouth. They do not differ from the original description. The species is abundant in the Gila and Lower Colorado, and is the most highly prized of all the native fishes. It is frequently taken reaching a length of from 4 to 5 feet, and is universally known as the "Colorado Salmon." It is reported as abundant also in the headwaters of the Colorado in Utah, Colorado, and Wyoming.

7. GILA ELEGANS Baird & Girard.

Specimens of this species were taken in the Colorado and Gila rivers at Yuma, in Salt River at Tempé, and in the Lower Colorado at the Horseshoe Bend. It is most abundant in the larger river channels. Our specimens are from 4 to 15 inches long. The head is 4 $\frac{1}{2}$ in the length, the depth 4 $\frac{1}{2}$ to 5 $\frac{1}{2}$. Diameter of eye 4 to 7 $\frac{1}{2}$ in head. Scales 21 to 24—77 to 88—10 to 12. Dorsal 10 (9 to 11); anal 10 (9 to 11). Teeth 2-5-4-2.

In the larger specimens the pectorals reach a little past origin of ventrals, while in the smaller ones the ventrals are not reached by the pectorals. The caudal peduncle is longer in the adults and the upper profile of the head is very concave, while in the young it is nearly straight.

8. GILA ROBUSTA Baird & Girard.

Gila robusta BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, p. 368.—GIRARD, Pac. R. R. Surv., 1858, X, p. 285.—JORDAN & GILBERT, Synopsis, 1883, p. 228.—JORDAN, Bull. U. S. Fish Commission, IX, 1889, p. 27.—JORDAN & EVERMANN, Fishes of N. and M. A., 1896, p. 227.

Leuciscus robustus GÜNTHER, Cat., 1868, VII, p. 241.

Gila pulchella BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, p. 29.

Gila grahami BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, p. 389.—GIRARD, U. S. and Mex. Bound. Surv., Zool., 1859, p. 61.—JORDAN & GILBERT, Synopsis, 1883, p. 228.

Leuciscus grahami GÜNTHER, Cat., 1868, VII, p. 242.

Gila gracilis JORDAN & GILBERT, Synopsis, 1883, p. 229.

Very abundant in Salt River at Tempé, where it exceeds in numbers all other species. It was not taken in the Colorado, and is probably more abundant in smaller streams than in the main river channels. Our specimens show a great range of variation in the size of the scales, as can be seen from the following table. The two specimens having eighty-three and one hundred and ten scales in the lateral line are probably abnormal. The larger specimens bear a striking resemblance to *Gila elegans*, and the younger ones are difficult to distinguish from *Leuciscus intermedius*. Compared with the latter, *Gila robusta* has slightly smaller scales and a slenderer caudal peduncle. The body is not so deep and its head is more slender. The scales below the lateral line are not specked with black.

This species is abundant throughout the entire Colorado River Basin. Owing to the close resemblance which this species bears to *Leuciscus intermedius*, the synonymy of the two has been greatly confused.

Measurements of Gila robusta, Tempé, Arizona.

D. A.	Scales.	Rud. C. rays.	Least depth of C. ped. in length.	Length of C. ped. in length.	Head in length.	Eye in head.	Depth.	Length in inches.
9 9	24-93-11	10-11	16	4	4 $\frac{1}{2}$	5 $\frac{1}{2}$	5	14
9 9	24-105-10	10-11	13	4 $\frac{2}{3}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	4 $\frac{2}{3}$	4 $\frac{1}{2}$
9 9	24-93-12	10-10	13	4 $\frac{1}{2}$	3 $\frac{3}{4}$	4	4 $\frac{1}{2}$	4 $\frac{1}{2}$
9 9	22-100-10	10-10	11 $\frac{1}{2}$	5	3 $\frac{1}{2}$	3 $\frac{3}{4}$	4 $\frac{1}{2}$	3
9 9	23-98-10	10-12	12	4 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	5	3
9 9	24-83-11	10-10	12	4 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	4 $\frac{1}{2}$	3
9 9	24-110-12	10-10	12	4 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	4 $\frac{1}{2}$	3
9 9	25-102-13	10-10	12	4 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	4 $\frac{1}{2}$	3
9 9	25-94-12	10-10	12	4 $\frac{1}{2}$	3 $\frac{3}{4}$	3 $\frac{3}{4}$	4 $\frac{1}{2}$	3
9 9	24-100-12	9-9	13	4 $\frac{1}{2}$	3 $\frac{3}{4}$	3	4 $\frac{1}{2}$	3
9 9	24-99-11	11-10	12 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$	3

9. LEUCISCUS INTERMEDIUS Girard.

Gila gracilis BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1853, p. 369 (preoccupied in *Leuciscus*).—GIRARD, Pac. R. R. Surv., X, 1858, p. 287.—JORDAN & GILBERT, Synopsis, 1883, p. 229.

Gila gibbosa BAIRD & GIRARD, Proc. Ac. Nat. Sci. Phila., 1854, p. 28, RIO SANTA CRUZ (preoccupied in *Leuciscus*).

Tigoma gibbosa GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, p. 207.—GIRARD, U. S. Mex. Bound. Surv., Zool., 1859, p. 64.

Tigoma intermedia GIRARD, Proc. Ac. Nat. Sci. Phila., 1856, p. 206.

Squalius intermedius JORDAN & GILBERT, Synopsis, 1883, p. 238.

Leuciscus intermedius JORDAN & EVERMANN, Fishes of N. and M. A., 1896, p. 235.

Gila nigra COPE, Zool. Wheeler's Expl. W. 100th Mer., V, 1875 (1876), p. 663.

Squalius nigra JORDAN & GILBERT, Synopsis, 1883, p. 239.

Leuciscus niger JORDAN & EVERMANN, Fishes of N. and M. A., 1896, p. 235.

Squalius lemmonii ROSA SMITH, Proc. Cal. Ac. Sci., 1884, p. 3.

Leuciscus zunnensis GÜNTHER, Cat., VII, 1868, p. 241. Substitute for *L. gracilis*, preoccupied.

Numerous specimens about 3 inches in length were obtained at Tempé, and at Chino, Arizona. It is more robust than the young of *Gila robusta*, and has the scales a little larger, those below the lateral line specked with black. The specimens taken at Chino differ from the Tempé specimens in the slightly deeper caudal peduncle. This species varies greatly in its scale formula, as can be seen from the accompanying table. Like *G. elegans* and *G. robusta* it is found throughout the Colorado River Basin. It has been commonly known as *L. niger*, but there is no reason to consider the two nominal species distinct. *Squalius lemmonii* is described as having the scales 68, but in one of the types we find them 21-75-10. It may therefore well belong here.

Table of measurements.

D.	A.	Scales.	Rud. C. rays.	Least depth of C. ped. in length.	Length of C. ped. in length.	Head in length.	Eye in head.	Depth.
8	8	24-84-10	10-10	12 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$
9	9	18-91-10	9-10	12	4 $\frac{1}{2}$	4	3 $\frac{1}{2}$	4 $\frac{1}{2}$
8	8	18-83-10	10	12 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	3 $\frac{1}{2}$	4
8	8	18-92-10	10-10	12 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$
9	8	18-94-10	10-10	12	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$
9	8	18-92-10	10-10	11 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$
8	8	19-82-10	10-10	11 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4
8	8	20-95-10	10-10	10	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$
8	8	18-87-9	10-10	10 $\frac{1}{2}$	4 $\frac{1}{2}$	5 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$
8	9	19-87-10	10-10	12	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$
9	8	20-79	10-9	11	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$
8	8	20-87-11	10-10	11	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$
8	8	18-80-10	10-10	11 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4
9	8	19-87-10	9-9	11	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4
9	9	19-87-10	10-10	11	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4
8	8	18-83-10	10-10	11	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$
8	8	20-82-10	10-10	10 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4
8	8	21-76-10	10-10	10 $\frac{1}{2}$	4 $\frac{1}{2}$	3 $\frac{1}{2}$	3 $\frac{1}{2}$	4 $\frac{1}{2}$

10. TIAROGA COBITIS Girard.

(Plate XXXVII.)

Several specimens of this interesting species were obtained at Chino, Arizona, from a tributary of the Rio Verde, which belongs to the Gila Basin. It is of unusual interest, not having been taken since the discovery of the types in 1851. Girard's specimens were from the Rio San Pedro, a tributary of the Gila.

Head 4 to 4 $\frac{1}{2}$; depth 5 $\frac{1}{3}$; eye small, 4 to 4 $\frac{1}{2}$ times in the head, 1 $\frac{1}{2}$ in the snout, $\frac{3}{4}$ interorbital space. The snout is contained 3 to 3 $\frac{1}{2}$ times in the length of the head. D. 8; A. 7. Isthmus very wide, 2 in head.

In five specimens examined, four have the teeth 1, 4-4, 1, and one 2, 4-4, 1, without grinding surface. The lateral line is median and about straight, with seventy pores to base of caudal fin. The belly and the back in front of the dorsal are destitute of scales. Least depth of caudal peduncle $2\frac{1}{3}$ in head. Mouth very small, terminal, oblique: the lips fleshy. The maxillary is without barbels and is contained $1\frac{1}{3}$ in snout. The mandible is contained a little less than three times in head; premaxillary not protractile. The pectoral fins reach two-thirds distance to ventrals. The ventrals reach the front of the anal. The third ray of the anal is the longest, $2\frac{2}{5}$ in head. The front of the dorsal is slightly behind the origin of the ventrals, and considerably nearer the base of the caudal than the tip of the snout. The edge of the dorsal fin is straight, its second ray longest, $1\frac{2}{5}$ in head, its rudimentary rays not enlarged.

Color (in alcohol), pale gray or yellowish, mottled with reddish-brown on sides and back: a dark elongate black spot on base of middle caudal rays broadening posteriorly into a vertical bar, which follows the posterior outline of the caudal fin; this followed by a second and in some by a third fainter bar with lighter interspaces; a conspicuous white patch above and below caudal spot; there is a small but conspicuous white spot under the first rays of the dorsal and one under posterior end of dorsal, the two encroaching slightly on the fin; dorsal with two broad but faint dark bars parallel to its free edge. Length averages $2\frac{1}{2}$ inches.

11. AGOSIA OSCULA Girard.

About thirty specimens were obtained at Chino. This species is at once distinguished from the other species of *Agosia* in the Colorado Basin by its very small scales and its definite lateral band. We give here a description based on our specimens, as there is no good current description.

Head 4 in length; depth 4 to $4\frac{3}{4}$; eye 4; snout $3\frac{1}{4}$; scales 17 to 19-80 to 86-15 to 17; D. 8; A. 7; least depth of caudal peduncle $2\frac{1}{4}$ in head; teeth 1, 4-4, 1, hooked and with grinding surface. Body terete and rather elongate, the caudal peduncle not much compressed. The head tapers to an elongate but obtuse snout. The mouth is slightly oblique; the lips not fleshy; maxillary with a small barbel at its tip. Free margin of dorsal and anal straight. The front of the dorsal is slightly behind the origin of the ventrals and midway between the center of the orbit and the base of the middle caudal rays. Length of dorsal 2 in head; its longest ray $1\frac{1}{3}$ in head. The pectorals are short, reaching two-thirds distance to ventrals. The ventrals do not quite reach the front of the anal. Dusky olive above, silvery below; a definite dark lateral band about width of eye, expanding at the base of the caudal and narrowing abruptly to a faint caudal spot. In some specimens the sides are slightly mottled with darker. Our specimens are about 2 inches in length.

AGOSIA COUESII Yarrow.

Nine specimens were taken at Tempé, and do not agree perfectly with current descriptions. The following description is based on our specimens: Head $3\frac{3}{4}$ to 4; depth 4 to 5; eye 4 to $4\frac{1}{2}$ in head, 3 in snout; D. 8; A. 7; scales 14 to 17-70 to 77-10 or 11; teeth 1 or 2, 4-4, 2 or 1. Body stout, the head long and conical, the snout pointed. Mouth broad, inferior, horizontal, the lips fleshy. Width of isthmus 10 to 13 times in length of fish. Eye small and high up. Caudal peduncle deep and compressed, its least depth contained $2\frac{1}{2}$ in the head. Fins all large; the pectorals reaching front origin of ventrals; the ventrals reaching past front of anal; free edge of dorsal and anal slightly concave; front of the dorsal in advance of origin of ventrals and half way between base of middle caudal rays and nostril. The length of the dorsal is contained $1\frac{9}{10}$ in head; its longest ray $1\frac{1}{10}$ in head. The longest ray of the anal is contained $1\frac{1}{5}$ in the head. Color dark above and on sides, mottled slightly with black; pale below; fins all plain; no lateral band or caudal spot. Our largest specimen, $2\frac{1}{2}$ inches long.

Measurements of *Agosia couesii*.

Head.	Depth.	Eye.	Snout.	Inter-orbital.	D.	A.	Scales.	Teeth.
$3\frac{3}{4}$	$4\frac{1}{2}$	$4\frac{1}{2}$	3	$4\frac{1}{2}$	8	7	15-72-11	1, 4
$3\frac{3}{4}$	4	$4\frac{1}{10}$	3	4	8	7	16-77-11	2, 4-4, 2
$3\frac{1}{2}$	5	4	3	4	8	7	17-77-10	1, 4-4, 2
$3\frac{1}{4}$	$4\frac{1}{4}$	4	3	4	8	6	15-72-11	4-4, 1
$3\frac{3}{4}$	$4\frac{1}{4}$	4	3	$4\frac{1}{2}$	8	7	15-73-10	3, 3-4, 1
$3\frac{9}{10}$	$3\frac{3}{4}$	4	$2\frac{9}{10}$	$4\frac{1}{2}$	8	7	16-73-11	2, 4-4, 1
$3\frac{3}{5}$	$4\frac{1}{4}$	$4\frac{3}{5}$	$2\frac{3}{5}$	4	8	7	15-67-11	1, 4
4	4	4	3	4	8	7	14-73-10	4, 1
$3\frac{3}{4}$	5	4	3	4	8	7	14-73-10	4, 1
$3\frac{1}{4}$	4	4	3	4	8	7	14-69-10	1, 4-4, 1

13. AGOSIA CHRYSOGASTER Girard.

Only one specimen was obtained at Chino.

Head 4 in length; depth $4\frac{1}{2}$; eye $3\frac{1}{2}$; snout $3\frac{1}{2}$; interorbital 4; D. 8; A. 7; scales 16-80-14; teeth 4-4, without grinding surface.

14. PLAGOPTERUS ARGENTISSIMUS Cope.

A few specimens were procured in the mouth of the Rio Gila at Yuma, and others in the Salt River at Tempé. The species had been reported hitherto only from the San Luis Valley in western Colorado. Our specimens do not differ from the types, with one of which they have been compared.

Head 4 in length; depth 5; eye 4 in head, $1\frac{1}{3}$ in snout, $1\frac{1}{2}$ in interorbital space; D. II, 7; anal 10; teeth 2, 5-4, 2, without grinding surface. Length $2\frac{1}{2}$ inches. Least depth of caudal peduncle $2\frac{1}{2}$ in head, its length $1\frac{1}{2}$ in head. Preorbital not quite as long as eye.

Front of dorsal behind origin of ventrals, and very slightly nearer base of caudal than tip of snout; first dorsal spine not quite as long

as head, curved and slightly longer than the second spine, which is received into a longitudinal groove in the first; back of these the rays are thickened and ossified for a little over half their length, their tips articulated and issuing from the tips of the spines; length of anal $1\frac{1}{2}$ in head, with one rudimentary and ten developed rays; pectoral reaching ventrals, their rays slightly ossified at base; ventrals reaching vent, the first ray thickened and ossified for half its length, the remaining rays developed as six sharp flat spines which fold together like a fan when the fin is closed. From the posterior side of each spine and from just below its tip an articulated ray issues, the first extending beyond its spine for one-fourth length of latter, the others successively shorter; the last scarcely projecting; osseous portion of last ray joined for its whole length by a membrane to the abdomen; caudal forked for half its length.

Mouth moderate, horizontal, lower jaw included; maxillary extending to front of orbit, with a small barbel at its tip; length of mandible equal to distance from tip of snout to center of orbit, the space between them papillose and spongy. Nasals elevated, the muzzle slightly depressed. Lateral line deflected opposite the dorsal, not quite complete, about thirty-five pores to opposite front of anal; rudiments of scales can be seen above lateral line, more numerous in front of dorsal. Color pure silvery, yellowish beneath; dorsal region very finely punctulate; peritoneum and gill cavity light silvery.

15. MEDA FULGIDA Girard.

This species was found extremely abundant in the upper course of the Rio Verde, near Chino, Arizona, and was taken also in the Salt River at Tempé. It had previously been taken only in the Rio San Pedro. Following is a description of our specimens:

Head 4 in length; depth $5\frac{1}{2}$; eye $3\frac{1}{2}$ in head, equal to snout and to interorbital width. Least depth of caudal peduncle $3\frac{1}{2}$ in head, equaling diameter of eye. D. II, 6, counting last divided ray as one; A. 8, 9, or 10, usually 9. Front of dorsal behind origin of ventral considerably nearer base of caudal than tip of snout. The character of dorsal rays is the same as in *Plagopterus argentissimus*, the first spine curved nearer its tip than in the latter, the second spine shorter than the first; first spine $1\frac{3}{4}$ in head, longer than base of fin, which is contained twice in head; anal $1\frac{1}{2}$ in head; pectorals reach two-thirds distance to vent; the rays osseous at base; ventrals reaching almost to vent, and structurally the same as in *P. argentissimus*; caudal forked for a little less than half its length, the lobes rounded. Mouth moderate, terminal, slightly oblique, the lower jaw included; mandible reaching vertical from center of pupil; maxillary reaching front of pupil, without barbel. The teeth were examined in ten specimens, eight having them 1, 4-4, 1; one 2, 4-4, 1, and one 1, 4-5, 1. Lateral line gradually descending backward to beneath the dorsal, where it bends rather

abruptly upward to axis, and thence straight to caudal; no trace of rudimentary scales.

Color bright silvery, with reddish brown mottlings along back; a band of scattered black specks along lateral line, extending across opercle and around snout; body pale yellowish below; peritoneum and gill cavity silvery, with a few black specks. A few specimens have the second dorsal spine longer than the first, agreeing thus with the original description.

Family PÆCILIIDÆ.

16. CYPRINODON MACULARIUS Baird & Girard.

Numerous specimens were obtained in a spring-fed pond at Lerdo, Mexico.

17. PÆCILIA OCCIDENTALIS Baird & Girard.

Several specimens from Salt River at Tempé, Arizona. We agree with Garman in referring this species to the genus *Pæcilia*.

Head $4\frac{1}{4}$ in length; depth 4; eye $3\frac{1}{2}$; D. 7 or 8; A. 9 or 10; scales 29-7 or 29-8. Dorsal slightly behind front of anal; first dorsal ray undivided, two-thirds as long as second. Brownish above, the edges of the scales thickly dotted with brown, silvery beneath; a narrow black line on under side of caudal peduncle, another on side of body, commencing five or six scales back of opercle and running through center of middle row of scales to caudal; also a short black line a little longer than eye running forward and outward from vent. Teeth in two well-separated series; those of inner series small and slightly hooked; the outer compressed, curved, pointed, and tipped with red. Head in male $3\frac{3}{4}$ in length; depth $3\frac{3}{4}$. Anal and ventrals crowded forward in males, the anal prolonged into an intromittent organ. Length of females, $2\frac{1}{2}$ inches; males, $1\frac{1}{4}$ inches; agreeing in all respects with specimens from the type locality (Tucson, Arizona).

Family GOBIIDÆ.

18. GILLICHTHYS DETRUSUS Gilbert & Scofield, new species.

(Plate XXXVIII.)

Allied to *Gillichthys mirabilis* Cooper, differing in the broader and more depressed head, the larger anal fin, and the greater distance between the two dorsals.

Head $3\frac{1}{2}$; eye 7; snout 4; depth 5; interorbital $5\frac{1}{2}$; D. VI, 13; A. 11 developed rays (10 in *G. mirabilis*). Scales very fine anteriorly, becoming much larger posteriorly; about seventy-five oblique rows of scales from base of pectoral to caudal, and about twenty-five longitudinal rows between front of anal and front of second dorsal.

The head is depressed, the frontals broad, the least frontal width

being contained in the head eight times (eleven times in *G. mirabilis*). The post frontals are small and project but very little, differing from *G. mirabilis*, where the post frontals project into an elevated wing-like process. The width of the isthmus is contained three times in the head; length of maxillary $1\frac{1}{3}$ times in head; mandible $1\frac{2}{3}$. Least depth of caudal peduncle $2\frac{2}{3}$ in head. Distance between dorsals half length of base of first dorsal; base of first dorsal $2\frac{1}{4}$ in head; second dorsal $1\frac{1}{2}$; anal 2 in head; length of longest pectoral ray $1\frac{3}{4}$ in head. Color very pale olive, some of the specimens with dark punctulations about the head and fins. The pale coloration is probably due to their life in shallow water on bottom of pale sand.

Several specimens, the longest 5 inches long, were taken at Horse-shoe Bend, near the mouth of the Colorado River, in Mexico, where they are quite abundant. The species inhabits muddy creeks and channels communicating with the river, and is caught and eaten by the Indians.

Type.—No. 48127, U.S.N.M.

Family PLEURONECTIDÆ.

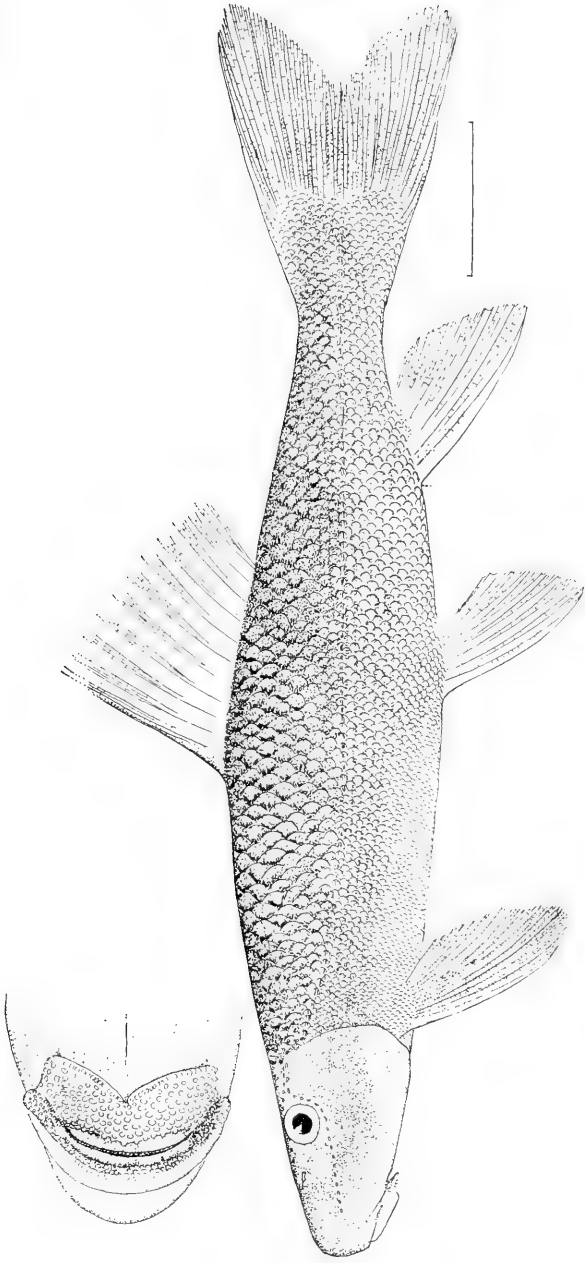
19. PARALICHTHYS ÆSTUARIUS Gilbert & Scofield, new species.

(Plate XXXIX.)

Head $3\frac{2}{3}$; depth $2\frac{1}{4}$; eye $5\frac{1}{2}$; interorbital space flat, 12 in head, half the diameter of the eye; maxillary 2 in head, equal to the pectoral fin; gill rakers 9+20, the longest two-thirds length of eye; dorsal 72 to 82; anal 58 to 64. (In the seven specimens the rays are: Dorsal 72, 79, 81, 81, 82, 83, 83; anal 58, 60, 60, 62, 63, 63, 64.) Vertebrae 10+28; scales weakly ciliated, with small accessory scales, 105 in the lateral line. Length of the arch contained four times in straight part of lateral line, 2 in head; height of arch $4\frac{1}{2}$ in head. Four of the seven specimens are sinistral. Color pale chocolate brown. Specimens small, 6 to 9 inches in length. Taken at Shoal Point, at mouth of the Colorado River, Mexico, by the United States Fish Commission steamer *Albatross*. This species is distinguished from the other members of the genus by its numerous fin rays and its many gill rakers. It is nearest related to *Paralichthys californicus*, which is abundant along the entire coast of California, extending as far south as Magdalena Bay, in Lower California. Two specimens in the museum of Stanford University from the latter locality are entirely typical of *P. californicus*.

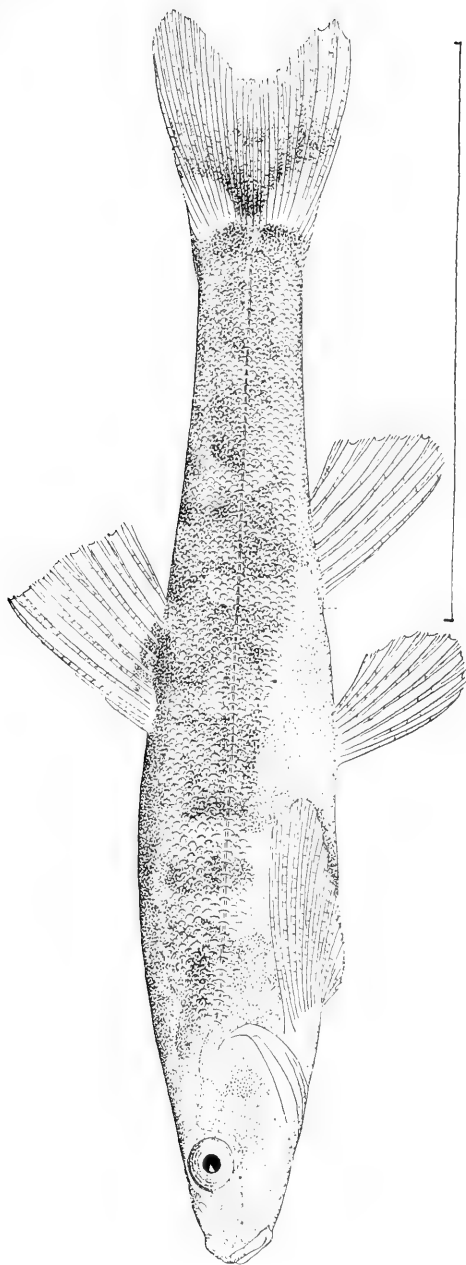
Type.—No. 48128, U.S.N.M.



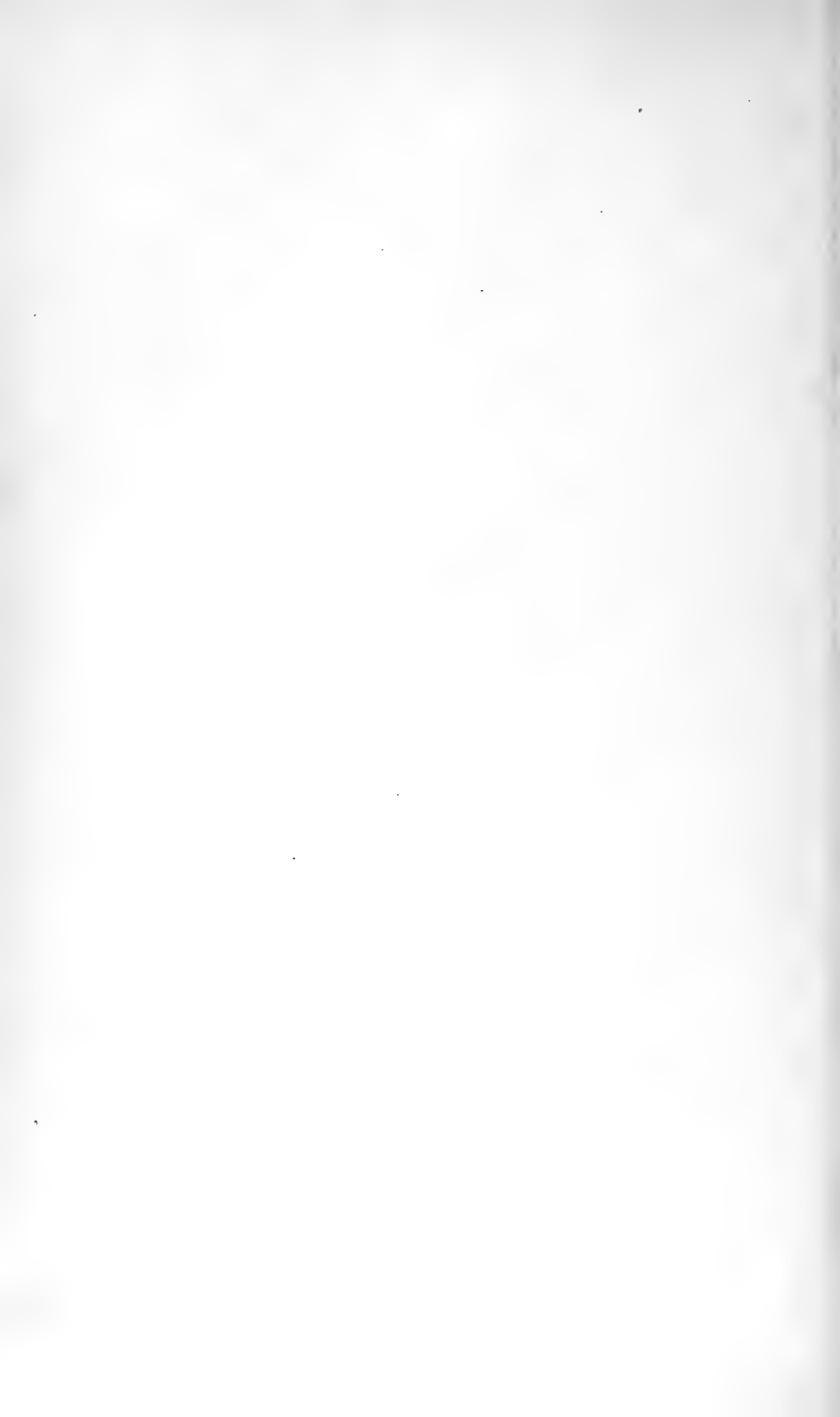


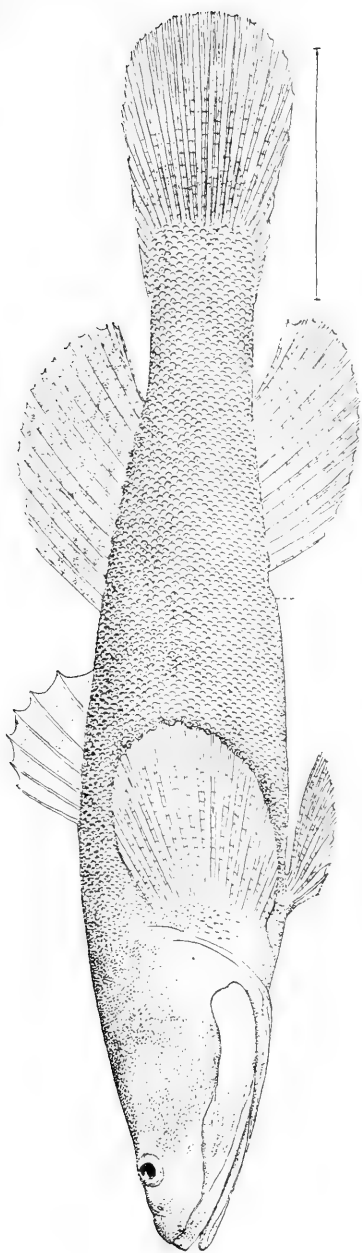
PANTOSTEUS ARIZONAE.





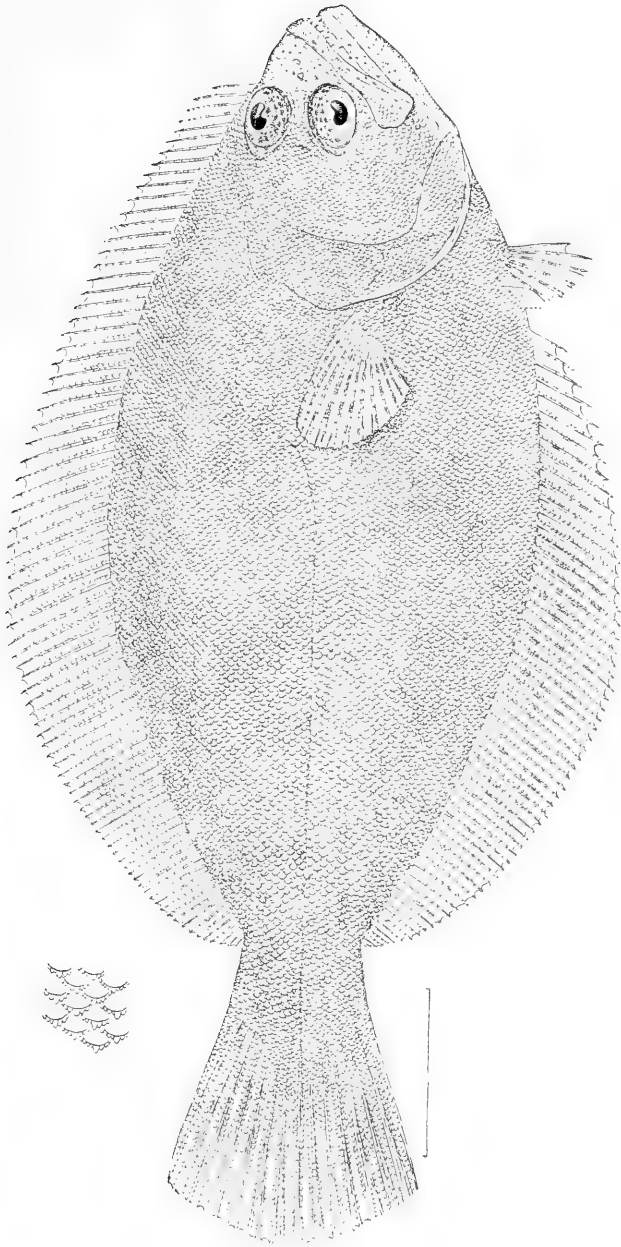
TIAROGA COBITIS.





GILLICHTHYS DETRUSUS.





PARALICHTHYS AESTUARIUS.



PRELIMINARY DIAGNOSES OF NEW MAMMALS OF THE
GENERA SCIURUS, CASTOR, NEOTOMA, AND SIGMODON,
FROM THE MEXICAN BORDER OF THE UNITED STATES.

By EDGAR A. MEARNS, M. D.,
Assistant Surgeon, United States Army.

THIS is the seventh of a series of papers giving preliminary descriptions of the new mammals collected on the recent survey of the boundary between Mexico and the United States.¹ Detailed descriptions, with illustrations of the new forms and comparisons with their allies, will appear later, in the report on the collections made by the International Boundary Commission.

SCIURUS FOSSOR ANTHONYI, new subspecies.

ANTHONY'S GRAY SQUIRREL.

Type.—No. 60928, U.S.N.M. (Collection International Boundary Commission). Skin and skull. Adult female, from Campbell's ranch, at Laguna, San Diego County, California. Collected by Doctor Edgar A. Mearns, June 10, 1894. Original number, 3642.

Description of type.—In winter pelage. Above gray, very faintly suffused with yellowish brown on the back. Tail gray above, the hairs very broadly annulated with black and tipped with white; tail below, tricolor, grayish mesially, then broadly banded with black, and edged with white. Feet mixed yellowish brown, gray, and black, the latter predominating on the toes. Ears scantily coated with grayish hair, the color changing to tawny ochraceous at base externally. Cheeks gray, mixed with white. Under parts, inner side of limbs, and orbital circle, white. Length, 540 mm; tail vertebrae, 270; ear from crown, 28 length of hind foot, 79.

Remarks.—The form of *Sciurus fossor* Peale, found in the interior region of southern and Lower California, is not, as has been supposed, the *Sciurus fossor nigripes* of Bryant. It lacks the strong yellowish-brown suffusion on the back, and the dusky of the crown; instead of

¹Proc. U. S. Nat. Mus., XVII, 1894, pp. 129-130; XVIII, 1895, pp. 444-447, 551-565; XIX, 1896, pp. 137-140; XX, pp. 457-461, 467-471.

[Advance sheets of this paper were published March 5, 1897.]

being darker than *Sciurus fossor* (typical), is much paler, as well as somewhat smaller. Mr. Bryant described¹ a very dark form of *S. fossor*—the subspecies *nigripes*—inhabiting the redwood belt of the coast region of California, south of San Francisco, from specimens taken in San Mateo County. Through the courtesy of Mr. F. W. True and Doctor J. A. Allen I have been able to compare topo-types of *Sciurus fossor nigripes* with the present form, and with true *Sciurus fossor* from the Sierra Nevada and other mountains of northern California and Oregon north as far as the Columbia River, with the result that three distinct geographic phases of *S. fossor* are recognized. The typical form is large, without reddish-brown on the back or blackish feet, and the caudal hairs are so thickly ringed with black that there is no distinctly tricolored pattern to the under surface of the tail. Its coloration is darker than that of the present form and paler than in *S. fossor nigripes*. Named in honor of Mr. A. W. Anthony, of San Diego, California.

CASTOR CANADENSIS FRONDATOR, new subspecies.

BROAD-TAILED BEAVER.

Type.—No. $\frac{20750}{35883}$, U.S.N.M. (Collection International Boundary Commission.) Adult male, from the San Pedro River, Sonora, Mexico, near monument No. 98 of the Mexican boundary line. Collected by Doctor Edgar A. Mearns and Mr. F. X. Holzner, October 24, 1892. Original number, 2151.

Description of Type.—Larger than the beaver of Canada, paler and different in coloration, with a much broader tail. Above russet, changing to chocolate on the caudal peduncle above, and to burnt sienna on the feet; toes reddish chocolate. Below grayish cinnamon, brightening to ferruginous on the under side of the caudal peduncle. Sides wood-brown, enlivened by the tawny-olive color of the overhair. Length 1,070 mm.; length of tail, measured from anus, 360; length of bare portion of tail, 290; width of bare portion of tail, 125; height of ear from crown, 31; height of ear from anterior base, 35; distance from tip of nose to eye, 68; from tip of nose to ear, 125; nose to occiput, 165; length of manus, with claw, 82; length of pes, with claw, 185. Weight, 62 pounds avoirdupois. Skull, 133 by 99.

Remarks.—The beaver of Canada and the northeastern United States is of a beautiful glossy bay on the upper surface, paling to chestnut on the head and rump. The under surface is seal brown. Sometimes the color is still darker, the back being blackish brown, the caudal peduncle burnt umber, and the under side of head vandyke brown. The feet are seal brown. I have examined thirty three skulls and a larger number of skins of this race of the beaver from Arizona and Sonora. In old males the total length reaches 1,130 mm.; and the bare and scaly por-

¹ Proc. Cal. Acad. Sci., 2d ser., II, 1889, p. 25.

tion of the tail measures 285 by 155. Adult males weigh 60 pounds and upward; females 40 to 50 pounds.

Cranial characters.—The skull of the European beaver (*Castor fiber*), which is readily distinguishable from that of the Canadian beaver (*C. canadensis*) by its slender build, lengthened nasal bones, and elongated rostral portion, presents still greater differences when compared with the beaver of Arizona and Sonora. There being at present no forest connection between the habitats of *Castor fiber* and *C. canadensis* in their respective geographic ranges, and consequently no continuity of habitat, there can be no question as to their specific distinctness. The skull of *C. canadensis frondator* differs from that of *C. canadensis* (typical) in being much larger, with more spreading zygomata.

Geographical range.—This form occupies the southern interior area of North America, ranging north from Mexico to Wyoming and Montana.

NEOTOMA CUMULATOR, new species.

COLORADO RIVER WOOD RAT.

Type.—No. 60348, U.S.N.M. (Collection International Boundary Commission.) Skin and skull. Adult male from old Fort Yuma, San Diego County, California. Collected by Doctor Edgar A. Mearns, April 2, 1894. Original number, 3473.

Description of type.—Upper parts grayish fulvous, thickly lined with black-tipped hairs, changing to gray on the limbs, and ochraceous-buff on the sides. Tail rather long-haired, almost black above, and white below. Feet, a small patch at base of ear, and whole under surface of body white. Ears scantily clothed with gray and black downy hairs on concave surface, and on posterior two-thirds of convex surface; anterior third of convex surface coated with longer black hairs. Whiskers long, reaching to shoulder; their color, mixed black and white. Orbital area dusky. Length, 403 mm.; tail vertebrae, 188 (to end of hairs, 197); ear above crown, 24.5; ear above notch, 30.5; distance between eyes, 18; diameter of eye, 8; length of longest whisker, 75; distance from tip of nose to eye, 25; to center of pupil, 31; to ear, 46; to tip of ear, 81; to occiput, 56; to end of outstretched hinder extremity, 292; fore limb, from olecranon process to end of claws, 54; length of fore foot, 22; longest claw of fore foot, 3.1; hind limb, from knee-joint to end of claws, 76; length of hind foot, 37; longest claw of hind foot, 4.7.

Remarks.—This is one of the largest of the round-tailed wood rats. The coloration is similar to that of *N. intermedia* Rhoads, but is paler than the typical form, and darker than the desert phase (*N. intermedia venusta*). The tail is more sharply bicolored, nearly black above, and quite heavily coated with rather long hair. It requires no comparison with any of the neighboring forms, but is closely related to *N. leucodon*, recently described by Doctor Merriam, from San Luis Potosi, Mexico, and extends the range of the *leucodon* group to within the United

States. The skull is large, measuring 47.5 by 23 mm. in extreme dimensions. The general shape is suggestive of that of *N. leucodon*. It has the same prominent premaxilla, ending posteriorly well behind the nasals. The skull is lower and more convex antero-posteriorly than that of *N. leucodon*, with the brain-case much more flat. It is more angular throughout, with zygomatic arches standing out more squarely anteriorly. The interparietal bone is less quadrate, being wider, and more pointed posteriorly; and the nasal bones differ markedly in having a prominent swelling anteriorly, which gives the pair a distinctly spatulate form, as in *Sigmodon hispidus eremicus* from the same region.

SIGMODON HISPIDUS PALLIDUS, new subspecies.

EASTERN DESERT COTTON RAT.

Type.—No. $\frac{2}{3} \frac{0103}{5464}$, U.S.N.M. (Collection International Boundary Commission). Adult male, from the left bank of the Rio Grande, about 6 miles above El Paso, Texas, and opposite the initial monument of the Mexican boundary. Collected by Doctor Edgar A. Mearns and Mr. F. X. Holzner, February 19, 1892. Original number, 1461.

Description of type.—Smaller than *Sigmodon hispidus texianus*, with the ears relatively and actually larger. Color much paler and grayer, the brown color being replaced by gray. Above buffy gray, finely mixed with black, producing a finely-blended grizzle. Feet grayish white. Under surfaces pure white. Tail dusky brownish above, grayish white on sides and below. Length, 242 mm.; tail to end of vertebrae, 103 (to end hairs, 108); height of ear from crown, 14 (from notch, 19.5); length of head, 37; length of hind foot, 30.

Geographical range.—This subspecies is known only from the chain of old lake basins along the course of the Upper Rio Grande, in the Eastern Desert Tract.

SIGMODON HISPIDUS EREMICUS, new subspecies.

WESTERN DESERT COTTON RAT.

Type.—No. 60319, U.S.N.M. (Collection International Boundary Commission). Skin and skull. Adult male, from Cienega Well, 30 miles south of monument No. 204, Mexican boundary line, on the left bank of the Colorado River, in Sonora. Collected by Doctor Edgar A. Mearns and Mr. F. X. Holzner, March 24, 1894. Original number, 3367.

Description of type.—General aspect yellowish gray. The usual black bands of the hair composing the outer coating are pale brown in this desert race, and the almost colorless tips of the longest hairs produce a peculiar haziness. Along the sides, but especially on the rump, there is a strong ochraceous tinge. Under surface white, but with pale gray underfur showing between the white-tipped over-hairs. Feet grayish white. Tail scantily haired, not distinctly blackish above. Length, 280 mm.; tail to end of vertebrae, 128 (to end of hairs, 133);

ear from crown, 15; length of hind foot, 34. Skull measuring 20.5 by 35 mm. in extreme dimensions. The nasals are expanded into a spatulate extremity, as in the *Neotoma* of the same region. This form, though as pale as that of the Eastern Desert, described above, may be instantly distinguished by its yellowish instead of grayish coloration, and by the spatulate terminal enlargement of the nasal bones.

Geographical range.—Found near the waters of the lower Colorado River, in the Western Desert Tract.



NOTES ON TREMATODE PARASITES OF FISHES.

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THE following notes are based on two distinct collections:

A collection made by myself while enjoying the privileges of the scientific station of the United States Fish Commission at Woods Holl, Massachusetts, and a collection belonging to the United States National Museum.

While the notes make no claim whatever to be exhaustive studies of the species considered, it is hoped that, in most cases, the descriptions are full enough to render the work of identification easy to future workers.

Following are the names of species discussed in this paper, together with a list of the hosts:

No.	Parasite.	Host.	Plate.	Figure.
1	<i>Nitzchia elegans</i> Baer	<i>Acipenser sturio</i>		
2	<i>papillosa</i> , new species	<i>Gadus callarias</i>	XL	1-6
3	<i>Tristomum laeve</i> Verrill?	<i>Gymnosarda petamys</i>	XL	7, 8
4	<i>coccineum</i> Cuvier	<i>Xiphias gladius</i>	XL	9
5	<i>rudolphianum</i> Diesing	<i>Mola mola</i>		
6	<i>Octoplectanum affine</i> , new species	<i>Paralichthys dentatus</i>	{ XL	10-13
		<i>Lepomis auritus</i>	{ XLI	1-5
		<i>Eipomotis pallidus</i>		
7	<i>Diplostomum cuticole</i> Diesing	<i>Chanosbryttus gulosus</i>	{ XLI	6-10
			{ XLII	1-5
8	<i>Distomum tornatum</i> Rudolphi	<i>Coryphaena hippurus</i>	XLII	6-12
9	<i>ocreatum</i> Molin	<i>Pomatomus saltatrix</i>	XLII	13
10	<i>rufoviride</i> Rudolphi	<i>Roccus lineatus</i>	{ XLII	14
			{ XLIII	1-4
			{ XLIII	5-8
11	<i>laeve</i> , new species	<i>Macrourus bairdii</i>	XLIV	1
12	<i>monticelli</i> , new species	<i>Remora remora</i>	XLIV	2-8
13	<i>grandiporum</i> Rudolphi	<i>Anguilla chryssypa</i>	XLV	9
14	<i>auriculatum</i> Wedl?	<i>Acipenser rubicundus</i>	XLV	1-7
15	<i>veliporum</i> Creplin?	<i>Raja laevis</i>		
16	<i>macrocotyle</i> Diesing	<i>Mola mola</i>	{ XLV	8-10
			{ XLVI	1-5
17	<i>gracile</i> Diesing	<i>Lepomis auritus</i>	XLVI	6-8
18	<i>lageniforme</i> , new species	<i>Eipomotis pallidus</i>		
19	<i>simplex</i> Rudolphi?	<i>Remora remora</i>	XLVII	1, 2
20	<i>pallens</i> Rudolphi	<i>Microgadus tomcod</i>	{ XLVII	3-7
		<i>Hemirhamphus americanus</i>		
21	<i>valdeinflatum</i> Stossich	<i>Alutera schoepfi</i>	XLVII	8, 9
22	<i>contortum</i> Rudolphi	<i>Alutera schoepfi</i>	{ XLVII	10-14
			{ XLVIII	1, 2
23	<i>nigrofavum</i> Rudolphi	<i>Mola mola</i>	XLVIII	3-7
			{ XLVIII	8-11
			{ XLIX	1, 2

No.	Parasite.	Host.	Plate.	Figure.
24	<i>Distomum foliatum</i> , new species.....	<i>Mola mola</i>	XLIX	3-5
			L	1-3
25	<i>nitens</i> , new species	<i>Tylosurus caribbeus</i>	LI	1-4
			LI	5, 6
26	<i>tenue</i> , new species	<i>Roccus lineatus</i>	LII	1
			LII	2-8
27	<i>tenue tenuissime</i> , new sub-species.....	<i>Morone americana</i>	LII	9-12
28	<i>species</i>	<i>Lagocephalus levigatus</i>	LIII	1, 2
29	<i>rachion</i> Cobbold?	<i>Gadus callarias</i>	LIII	3-7
30	<i>clavatum</i> Rudolphi	<i>Xiphias gladius</i>	LIII	8-11
31	<i>species</i> (larva).....	<i>Stizostedion canadense</i>	LIII	12, 13
			LIV	1
32	<i>Monostomum orbiculare</i> Rudolphi	<i>Lobotes surinamensis</i>	LIV	2-5

1. NITZSCHIA ELEGANS Baer.

Tristoma elongatum NITZSCH, Dujardin, Hist. Helm., p. 323.—OLSSON, Lund's Univ. Årsskrift, IV, p. 17.

Nitzschia elegans BAER, Diesing, Syst. Helm., I, p. 426.—VAN BENEDEN et HESSE, Rech., pp. 67, 68.

Body, reddish; length, 13 to 22.5 mm.; breadth, 4.5 to 7.8; oblong; contracted posteriorly, where there is present a large, almost globular sucker, with a crenulate border; anterior suckers marginal, linear, oblique; mouth triangular.

Found under the opercles and on the gills of the sturgeon.

Three specimens from gills of sturgeon (*Acipenser sturio*); Woods Holl, Massachusetts, August, 1884. Dimensions of alcoholic specimens: Length, 15 mm.; breadth, 3.5 to 5; diameter of posterior sucker, 4.5.

My specimens agree with the above synopsis of specific characters. The border of the posterior sucker is entire when expanded, crenulate when contracted.

2. NITZSCHIA PAPILLOSA, new species.

(Plate XL, figs. 1-6.)

Type.—No. 4874, U.S.N.M.; Woods Holl, Massachusetts, December 15, 1885, and fourteen specimens from cod (*Gadus callarias*) gills(?); Vinal N. Edwards, collector.

These specimens are all small.

These specimens differ from *N. elegans* in their very much smaller size, their papillose head, the absence of a crenulate border on the posterior sucker, and the proportionately more elongated body. They are mostly linear oblong, or narrowly linear lanceolate; body contracted posteriorly in front of a large sucker, which is a nearly circular disk when flattened out, with entire, thin border, radial and circular fibers evident; unarmed. There are no mature ova and the specimens are evidently young. A very long, filiform cirrus, everted, was made out in some instances (Fig. 4).

Dimensions of three alcoholic specimens of Nitzschia papillosa.

Measurements.	No. 1.	No. 2.	No. 3.
	<i>mm.</i>	<i>mm.</i>	<i>mm.</i>
Length	1.90	1.90	0.95
Diameter of posterior sucker.....	.45	.45	.23
Diameter in front of sucker.....	.32	.28	.16
Breadth of body, median.....	.55	.40	.22
Breadth of body, anterior.....	.30	.22	.16

3. TRISTOMUM LÆVE Verrill (?).

(Plate XL, figs. 7, 8.)

Tristomum læve VERRILL, Amer. Jour. Sci., X, p. 40; gills of *Tetrapterus albidus*; Ann. Report, U. S. Fish Com., 1883, fig. 194.

I refer provisionally to this species a single *Tristomum* from the gills of *Gymnosarda pelamys*, taken by the United States Fish Commission schooner *Grampus*, south of Marthas Vineyard, Massachusetts, August 18, 1886. No. 4878, U.S.N.M.

The specimen was associated with numerous oval cysts, 3.5 and 2 mm. in the two principal diameters, in which I was unable to find any parasite.

Dimensions of alcoholic specimens: Length, 4.5 mm.; breadth, 4.75; diameter of posterior sucker, 2.8; transverse diameter of anterior suckers, 1.04; longitudinal diameter of same, 0.65; distance between edges of anterior suckers, 0.28.

Orbicular margin entire or faintly undulating, with a deep, narrow posterior emargination, minutely punctate below; posterior sucker large, prominent, with crenulate border, the seven radii confluent in a rather large central body; anterior suckers squarish oblong, transverse; anterior border of body reflected ventrally between the two anterior suckers.

4. TRISTOMUM COCCINEUM Cuvier.

(Plate XL, fig. 9.)

Tristomum coccineum DIESING, Syst. Helm., I, p. 429.—TASCHENBERG, Abhandl. Naturf. Gesellsch., Halle, XIV, pp. 296-314, pls. I, II, figs. 3-9.—MONTICELLI, Bull. Soc. Nat. Naples, 1st ser., V, p. 123.

From gills of Swordfish (*Xiphias gladius*); off Marthas Vineyard, Massachusetts, July 25, 1887. Thirty-seven specimens. No. 4877, U.S.N.M.

When first removed from the gills of their host they were nearly all vermilion red in color, but the color disappeared when dead—i. e., after a number of hours in water.

Body flattened broadly, and somewhat irregularly ovate, posterior entire, lateral borders crenulate, ventral periphery with low nodular papillæ; each papilla with opaque granules; dorsal surface covered posteriorly with sharp-pointed papillæ, which become scattering toward

the middle of the back and disappear altogether anteriorly except near the margins. Head marked off by two deep notches; squarish or retuse in front, with suborbicular anterior suckers on under side. Mouth between posterior margins of anterior suckers, transversely elliptical, appearing like a transverse slit. Posterior sucker (acetabulum) circular, with crenulate or ruffled membranous border, pedicelled, with seven, symmetrical rays radiating from a central ring, thus making, with the central space, eight loculi.

The marginal papillæ in one specimen were thirty-four in number. The first papilla, anteriorly, had one granule; the next three papillæ had two granules each; the following two papillæ had three granules each; the following nine papillæ had four granules each; the next seventeen papillæ had three granules each; and the last two papillæ had two granules each.

Dimensions of two living specimens of Tristomum coccineum.

Measurements.	No. 1.	No. 2.
	mm.	mm.
Length	15.0	16.0
Greatest breadth	10.0	14.0
Breadth at anterior end	7.0	8.0
Breadth opposite posterior sucker	6.0	11.5
Diameter of an anterior sucker	1.5	2.0
Diameter of posterior sucker	2.5	3.5
Breadth of head, projecting between anterior suckers	1.5	2.5

5. TRISTOMUM RUDOLPHIANUM Diesing.

Tristomum coccineum RUDOLPHI, Dujardin, Hist. Helm., p. 322.

Tristomum rudolphianum DIESING, Syst. Helm., I, p. 429.

Body flattened, suborbicular posteriorly emarginate, minutely pitted beneath. Anterior bothria suborbicular. Acetabulum (posterior sucker) with a plicate membranaceous border; length, 18 to 22 mm.

On *Mola mola*; Woods Holl, Massachusetts, July 13, 1881. Nineteen specimens. No. 4879, U.S.N.M.

Dimensions of two alcoholic specimens of Tristomum rudolphianum.

Measurements.	No. 1.	No. 2.
	mm.	mm.
Length	18.0	14.0
Breadth	19.0	14.0
Diameter of acetabulum	10.0	6.5
Diameter of anterior sucker	1.7	1.2

One specimen was 12.5 mm. in length and 14 in breadth; another was 14.5 in length and 12.5 in breadth. They are mostly orbicular, but the ratio of length to breadth varies with the state of contraction.

The specimens agree with the descriptions of this species given by Diesing and Dujardin. The plicated ruffle-like margin of the acetabulum is about 1 mm. deep. The posterior emargination is as much as 4.5 mm. deep.

6. OCTOPLECTANUM AFFINE, new species.

(Plates XL, figs. 10-13; XLI, figs. 1-5.)

Body variable-spatulate in outline, consisting of three portions, an anterior broad appressed portion which may be round or long, oval, lanceolate, or even linear in outline, according to state of contraction; a median slender cylindrical portion of variable relative length, and a posterior palmate or rosette-like portion consisting of an elongated tubular enlargement of the posterior end of the slender middle portion, bearing eight digitate appendages, each consisting of a flexible pedicel surmounted by a flat, cup-shaped disk which is divided into four loculi and armed with a complicated set of chitinous bodies. The outer pair of loculi with fine parallel costæ; one of the others with an elevated, circular, muscular border. Anterior end broadly rounded, with two transversely elliptical suckers placed on either side of mouth and a little posterior to the mouth. The mouth is also transversely elliptical (in alcoholic specimens) and is, in life, subterminal and circular; reproductive aperture on median line a short distance back of mouth; cirrus armed with a circle of bifurcate hooks, fifteen in number. Ground color pale, very faintly tinged with yellowish-green, densely reticulated, with brown pigment spots; bothria transparent, bluish in reflected light, greenish-yellow in transmitted light; rosette and slender portion a dirty yellowish-green. Length of longest living specimen observed 28 mm. One alcoholic specimen with exceedingly long attenuated middle portion measured about 40 mm. in length.

Type.—No. 4876, U.S.N.M. Six specimens from mouth of common flounder (*Paralichthys dentatus*); Woods Holl, Massachusetts, September 2, 1887. Also two lots in United States National Museum collection (No. 4875), August 8, 1883; two perfect specimens and one fragment (No. 4875), one perfect specimen and one fragment; both lots from common flounder; Woods Holl, Massachusetts (Vineyard Sound), United States Fish Commission; R. S. Tarr, collector. This worm is very variable in life, but the alcoholic specimens are of rather uniform shape. Following are dimensions of a specimen preserved in glycerin: Length, 12 mm.; breadth (transverse diameter) of one of anterior suckers, 0.134; length of pharynx, 0.216; diameter of pharynx, 0.125; diameter of mouth, 0.086; diameter of circle of hooks of reproductive apparatus, 0.576; length of one of these hooks, 0.024.

Following is an abstract of notes made at time of collecting:

The pedicels are very changeable, becoming short, conical, and transversely wrinkled when contracted or, when elongated, slender and smooth, and capitate, the terminal organ (plectanum) not appearing to be susceptible of much diversity of form. My notes on the plectana of living specimens mention a character which does not appear in the one studied as an alcoholic specimen which is shown in Plate XLI, fig. 2. The difference is that instead of the two crescentic chitinous bodies,

which make the outer boundaries of the two outer sectors of the plectanum, there are four, each of the outer quarter circles being interrupted in the middle, so that the chitinous circumference is divided into six instead of four parts. Outside of the supporting ring there is a thin, transparent membrane which projects a little way in front and is entire in outline. The fine, parallel costæ which cover the surface of the two outer sectors (Plates XL, fig. 11; XLI, fig. 2) are of two kinds, long and short. The former cover the greater part of the surface and extend from the rib which separates the pair of outer sectors, while the short costæ extend from the ribs which separate the outer pair from the inner pair of sectors.

A large specimen had in life the following dimensions: Length, 28 mm. in repose, shortening to 20, lengthening proportionally; greatest breadth, 3.5; diameter of slender portion, 0.8; length of slender portion, 7; diameter of rosette, 3.5; length of pedicels, 1.4; diameter of pedicels, 0.6; diameter of mouth, 0.19; diameter of anterior suckers, 0.15. The slender portion was tubular, slightly appressed, and transversely wrinkled. It was not observed to change much in shape in any of the specimens except the smallest. A large specimen was observed to vary in length from 6 to 14 mm. The reproductive aperture as seen in a large living specimen was about the middle of the flat dilatable portion of the body and was apparently oblique.

In one specimen the digestive system was filled with the blood of its host. This was driven backward and forward by alternate contractions and dilations, making a kind of peristaltic motion. In the narrow middle portion the digestive system is reduced to two longitudinal channels which divide on the upper side of the rosette into a number of small branches, which supply the eight bothria. Under high power branches of uterus seen filling dilated part of body and filled with ova. Circulation observed in two large much-branching longitudinal channels and along each side, at least along dilated portion.

Mr. Tarr makes the following color note on one of his specimens: "The flat portion is minutely dotted with light reddish-brown dots, while the narrow part is white and the suckers flesh-colored."

The hooks seen in the genital aperture are arranged in a circle and at first were thought to be arranged in pairs. Subsequent study of them resulted in demonstrating the supposed pairs of hooks to be in reality single bifurcate hooks (Plate XL, fig. 12); of these there appear to be about fifteen. The ova are fusiform, with very long attenuated ends. The specimens which were sectioned did not have mature ova, but in those convolutions of the oviduct which were most remote from the germarium the characteristic shape of the mature ova was faintly foreshadowed in the developing ova.

The species is near *O. palmatum* Leuckart, in general appearance also resembles *O. lanceolatum* Leuckart, the hooks of the latter as figured by Dujardin bear a close superficial resemblance to those of *O. affine*. The fusiform ova resemble those of *O. denticulatum* Olsson.

7. DIPLOSTOMUM CUTICOLA Diesing.

(Plates XLI, figs. 6-10; XLII, figs. 1-5.)

Diplostomum cuticola DIESING, Syst. Helm., I, p. 306; Revis. d. Myzhelm, pp. 317-318; Archives de Médecine comparée, I, pp. 108-111, pl. IV, figs. 1, 2, 5.—LEIDY, Proc. Acad. Phil., VIII (1856), p. 45.

Body divided into two parts, anterior elongated, elliptical thin, excavated below, obtusely angular in front, much longer than posterior part, which is ovoid or ellipsoidal, with a terminal excretory pore. Anterior sucker small oval, with a cleft-like longitudinal aperture; pharynx oval; ventral sucker median, about posterior third of anterior excavated part, round, with varying aperture. Generative apertures, like a second ventral sucker in superficial appearance, behind ventral sucker. Known only in larval state, in which it exists in capsules under skin and especially under serous membrane of various fresh-water fishes.

I have two lots of these parasites, the first belongs to the National Museum collection (No. 4843) from *Lepomis auritus*; the second sent to me by Mr. N. A. Harvey, Kansas City, Missouri, January, 1894, from *Eupomotis pallidus* and *Chaenobryttus gulosus*. (Nos. 4842, 4844, U.S.N.M.)

Mr. Harvey's collections consisted of the hearts and livers of several fish, whose serous coats were thickly studded with these parasites.

One of these larvæ removed from its cyst was measured with the following result: Length, 1.09 mm.; greatest breadth, 0.37; length of oral sucker, 0.07; breadth of oral sucker, 0.05; length of pharynx, 0.04; breadth of pharynx, 0.03; diameter of ventral sucker, 0.07.

There were also some exceedingly minute cysts on the bulbus arteriosus of one of the specimens, which appear to be younger specimens of this same trematode.

The National Museum specimens are also cysts or capsules on and about the heart. They are very numerous and in size vary from minute specks to capsules over 1 mm. in diameter.

The dimensions of the larval worms do not differ materially from those given above. Most of the capsules are ellipsoidal and are usually fastened to the peritoneum by a slender pedicel. The specimens in Mr. Harvey's collection were found lying in capsules which were closely attached to the serous coat of the heart and liver.

The final host of this parasite is not known. It is probably some piscivorous bird.

8. DISTOMUM TORNATUM Rudolphi.

(Plate XLII, figs. 6-12.)

Distomum tornatum DUJARDIN, Hist. Nat. d. Helm., 1845, p. 421.—DIESING, Syst. Helm., I, 1850, p. 372.—COBBOLD, Synops. Dist., 1859, p. 28.—WAGENER, Arch. f. Naturg., XXVI, 1860, p. 176, pl. VIII, figs. 1-5.—STOSSICH, Dist. d. Pesc., 1886, p. 12.

Body unarmed, slender, whitish with the internal organs showing opaque white, yellow, or brown through the semi-transparent integument, which, in these specimens, is crossed with fine transverse lines.

Length up to 15 mm. [Rudolphi]. Anterior part cylindrical, obtuse in front truncated behind where an appendage with irregular, sometimes almost moniliform outline is protruded or retracted by invagination. The anterior sucker is directed downward; the ventral sucker is globular and prominent. The distance between the suckers may be but little more than the diameter of the ventral sucker. Space between the suckers much swollen in the vicinity of the genital orifices. The receptacle of the cirrus ends in a muscular sheath which is thickened and transversely striated. Testes globular, situated in front of the folds of the oviduct; ova very small and elliptical. No. 4868, U.S.N.M.

The above description, with which my specimens agree, is adapted from Dujardin.

Two individuals were obtained from the peritoneum of *Coryphana hippurus*, 13.75 mm. and 8 in length, respectively. The oral sucker of the larger was 0.56 in diameter; the ventral sucker of the same was 0.65 in diameter, somewhat distorted by compression. Longer diameter of ova, 0.022; shorter diameter, 0.014.

The ova in the preserved specimens are amber yellow; in the fresh specimens they appear greenish, the vitellaria were brown while the general color of the worm was whitish.

Found in *Coryphana hippurus*, Gulf Stream, August 13, 1885.

Among the National Museum entozoa sent to me for identification is a lot of distoma belonging to *D. tornatum*; also from the dolphin (*Coryphana hippurus*). No. 4868, U.S.N.M. These were collected in 1883, by the United States Fish Commission steamer *Albatross*.

The longest of these specimens measured 9.5 mm., the shortest, 3.25 in length. Diameter of anterior sucker in one of largest specimens, 0.3; of ventral sucker, 0.5; length of pharynx, 0.15; and greatest diameter of body, at ventral sucker, 0.7. Long diameter of ova, 0.02; short diameter, 0.01. The body is transversely wrinkled, producing a serrate outline, best seen on dorsal surface. The cirrus, which was retracted in all my specimens, was seen, in sections, to be covered with minute papillæ. This agrees with description of *D. tornatum* given by Stossich.

9. DISTOMUM OCREATUM Molin.

(Plate XLII, fig. 13.)

Distomum ocreatum OLSSON, Lund's Univ. Årsskrift, IV, p. 48, pl. v, figs. 96-98.—
STOSSICH, Dist. d. Pesc., p. 12.

A single specimen, described below, agrees closely with Olsson's figures and description of *D. ocreatum* Molin, which species he, as I understand him, regards as a different species from *D. ocreatum* Rudolphi. The specimen does not agree with Monticelli's figures of *Apoblema ocreatum* Rudolphi,¹ nor with Molin's figures of *D. ocreatum* Rudolphi.² Von Linstow³ refers *D. ocreatum* to *D. ventricosum*.

¹ Acad. Sci. Torino, XXVI, 1891.

² Denkschr. Wien, Akad., XIX, 1861, p. 209, pl. III, fig. 7.

³ Compend., p. 269.

There is obviously a confusion of terms here, but I have not felt justified in referring this specimen to a new species.

No. 4859, U.S.N.M.

Body terete, elongated, transversely plicate; tail shorter, retractile. Acetabulum sessile, prominent, rather large, equaling the anterior sucker, or larger. Mouth subterminal, contiguous to pharynx. (Esophagus, none. Vitelline glands two, large, juxtaposed, one nearly simple, the other trilobed. Ovary globose, median, near anterior margins of vitellaria. Uterus not descending into the caudal appendage. Testes two, globose or elliptical, median, transversely oblique, each somewhat less than the ovary. Bursa of penis ovate, situated at the right-hand anterior margin of the acetabulum. Genital aperture almost in the middle of the neck. Cirrus thick, curved, beset with minute papillæ. Excretory vessel median, forked near testes, with branches confluent between mouth and pharynx; vesicle and foramen at apex of caudal appendage. Length $\frac{2}{3}$ to 5 mm. [Olsson.]

The following dimensions are of living specimens, side view, slightly flattened: Length, 3.20 mm.; breadth, anterior, 0.20; breadth, median, 0.42; breadth, posterior, 0.20; diameter of oral sucker, 0.20; diameter of ventral sucker, 0.20; distance between suckers, variable, 0.20; length of ova, 0.025; breadth of ova, 0.014.

The color was bluish-white with a golden-yellow center, due to the voluminous uterus filled with yellow ova.

Found in intestine of *Pomotomus saltatrix*. One specimen, Woods Holl, Massachusetts, July 9, 1887.

10. DISTOMUM RUFOVIRIDE Rudolphi.

(Plates XLII, fig. 14; XLIII, figs. 1-4.)

Distomum rufoviride DUJARDIN, Hist. Nat. d. Helm., 1845, p. 421.—DIESING, Syst. Helm., I, 1850, p. 372.—MOLIN, Sitzungsber. Wiener Akad., XXXVII, 1859, p. 84.—COBBOLD, Synops. Distom., 1859, p. 22.—WAGENER, Arch. f. Naturg., XXVI, 1860, p. 178, pl. VIII, figs. 6-10.—MOLIN, Denkschr. Wiener Akad., XIX, 1861, p. 205, pl. II, figs. 1, 2, 4, 5.—OLSSON, Entozoa Skandin. Hafsfisk., III, 1868, p. 49; Bidr. till. Skandin. Helminthfauna, I, 1876, p. 20.—STOSSICH, Bull. Soc. Adriat. Trieste, VIII, 1883, p. 115.—CARUS, Prodr. Faunæ Mediterr., I, 1884, p. 125.—STOSSICH, Bull. Soc. Adriat. Trieste, IX, 1885, p. 159.—PRENANT, Recherches sur les Vers Parasites, Nancy, 1885, p. 19, pl. II, figs. 1-5.—STOSSICH, Dist. d. Pesc. Trieste, 1885, p. 13.—SONSINO, Estr. d. Pr. d. Soc. Tosc. d. Sci. Nat., 1890, p. 11.

I add the following synonymy on the authority of Stossich:

Distomum caudiporum DUJARDIN, Hist. Nat. d. Helm., p. 422.—DIESING, Syst. Helm., I, p. 342.—COBBOLD, Synops. Distom., 1859, p. 22.—WAGENER, Arch. f. Naturg., XXVI, p. 181.

Body unarmed, cylindrical, thick, subattenuate at the two extremities, more at posterior than anterior; neck more slender than body, excavate below; tail short and retractile; ventral sucker twice the size of the oral, globose or hemispherical, at the base of the neck.

Mouth subterminal, globose, the anterior lip prominent, and œsophagus very short, intestinal crura not extending to the caudal appendage.

Testes two at each side near the ventral sucker and behind it. Seminal vesicle large, ovate, on the left side; vitellaria voluminous tubular, mainly on left side; genital aperture behind oral sucker.

No. 4862, U.S.N.M. I have referred a lot of *Distoma*, from the striped bass (*Roccus lineatus*), containing seven specimens, to this species, although they fail to agree with the published descriptions of the species in all particulars. The specimens were studied only in their alcoholic condition, and since the very considerable contortions of the body which they assumed and retained in the preserving fluids make a comparison with descriptions difficult, and since they present so many characters which belong to *D. rufoviride*, I have thought it best to refer them to that species.

The points of disagreement are: The pharynx can not be characterized as "elongated," and although contiguous with the oral sucker is not "partly included in the oral cavity." The seminal vesicle is not situated "next the anterior margin of the acetabulum," but in the sectioned specimens does not extend quite so far forward as the anterior edge, while it extended posteriorly some distance beyond the posterior edge of the ventral sucker. The vitelline glands were exclusively on the left side of the body. The genital aperture instead of being in the "middle of the neck," was immediately behind the oral aperture.

The length agrees with Olsson's observations, and in life may exceed that, in which case it would come within the limits of the species i. e. 5-9 mm. (Stossich.)

Found in intestine of *Roccus lineatus*; Woods Holl, Massachusetts, September, 1884.

No notes were made at the time of collecting. The length of the longest (alcoholic) specimen is 5 mm., that of the shortest, 2.5; diameter of largest, maximum, 2. The bodies are variously contorted, but usually thickest about the middle of the body.

The following dimensions were obtained from measurements of sections which passed somewhat diagonally through the various organs, and are therefore not exact as longitudinal and transverse diameters: Length of oral sucker, 0.23 mm.; breadth, 0.20; length of pharynx, 0.14; breadth, 0.14; diameter of ventral sucker, 0.53; length of seminal receptacle, 0.62; breadth, 0.33; long diameter of ova, 0.021; short diameter, 0.12.

The ovary, 0.43 mm. in the greatest diameter noticed in sections, lies behind the testes, with the shell gland beside it (Plate XLIII, fig. 2). The vitellaria are tubular and lie behind the testes mainly on the left side; they are stained red in my carmine-stained sections, and thus differ from the corresponding organs in most of my other distoma sections, where the vitellaria are, as a rule, reddish-brown with carmine stain. Behind the ovary the body is to a great extent filled with the folds

of the uterus crowded with ova. Folds of the uterus also extend forward, lying dorsal to the ventral sucker. The anterior end of the uterus passes above the ventral sucker accompanying the vas deferens, but lying ventral to it, along the dorsal region of the neck, and opens with the vas deferens at the base of the cirrus behind the oral sucker. The vas deferens is surrounded by a prostate gland throughout its length (Plate XLIII, fig. 4).

The intestinal crura are distinct, with rather strong walls. They extend to near the posterior end of the body, although not as far as the very short retractile portion.

The excretory vessel was seen only near the caudal extremity, where it communicates as a simple vessel with the terminal pore.

11. *DISTOMUM LAEVE*, new species.

(Plates XLIII, figs. 5-8; XLIV, fig. 1.)

From *Macrourus bairdii*, United States Fish Commission Station 894. Twelve specimens 1.5 to 3.5 mm. in length.

Body roundish, elongated, attenuate both anteriorly and posteriorly from near middle of length, somewhat fusiform, smooth, with an attenuated retractile caudal appendage. Neck short, conical; ventral sucker much larger than oral, aperture nearly circular; mouth subterminal, aperture longitudinal; œsophagus, none; pharynx, ellipsoidal; intestinal crura capacious, not extending into tail; cirrus bulb pyriform in front of ventral sucker; genital aperture near posterior end of pharynx. Vitelline glands two, dark-brown, conspicuous, subglobular, situated near or a little back of middle of post-acetabular region; ovary placed transversely immediately in front of vitellaria, and touching both. Testes, two, subglobular, lying side by side transversely in contact with posterior wall of ventral sucker. Anterior seminal vessel on dorsal side of ventral sucker, a posterior seminal vessel immediately behind vitellaria. Uterus long, convoluted, occupying much of the body cavity from ventral sucker to and even back of vitelline glands, filled with small elliptical ova, 0.026 and 0.012 mm. in the two principal diameters. Excretory vessel median, from posterior end, where it communicates with a large terminal vessel, to ventral sucker, where it divides into two branches, which pass forward and unite on the dorsal side of the pharynx. The excretory vessel is filled with minute granules, which appeared white in a specimen cleared up in oil of cloves and seen under reflected light.

The body wall, particularly on the neck where least obscured by the internal organs, shows beautiful longitudinal and transverse striæ when highly magnified. These striæ are about 0.002 mm. apart.

One specimen was seen which was irregularly crossed by transverse wrinkles in the middle region of the body. Others were entirely smooth.

Dimensions of a typical specimen follow: Length, 3.5 mm.; longitudinal diameter of oral sucker, 0.13; transverse diameter of same, 0.11;

longitudinal diameter of ventral sucker, 0.31; transverse diameter of same, 0.27; length of œsophagus, 0.09; diameter of œsophagus, 0.05; distance between suckers, 0.3; length of cirrus bulb, 0.19; diameter of cirrus bulb, 0.14; genital aperture, 0.16 in front of ventral sucker.

This species is near *D. appendiculatum*.

Type.—No. 4852, U.S.N.M.

12. *DISTOMUM MONTICELLII*, new species.

(Plate XLIV, figs. 2-8.)

Body slender, cylindrical, attenuate both posteriorly and anteriorly, but most in front, from region of ventral sucker; unarmed, often with fine transverse rugæ; tail retractile. Neck very versatile in life, sometimes elongated, linear, at others contracted until the two suckers are close together, frequently in alcoholic specimens sharply curved ventrally in form of a hook. Vitelline glands, a tubular-lobed body situated behind the ovary well toward the posterior end. Ovary globular, contiguous with vitelline gland. Testes, two, globular, placed close together obliquely about halfway between ventral sucker and ovary. Uterus long, its folds lying both dorsally and ventrally between testes and vitelline glands and extending forward dorsally to the genital aperture a short distance in front of ventral sucker, and posteriorly to or even behind vitelline gland filled with ova. Cirrus bulb and seminal receptacle at base of neck, dorsally placed, whence by contraction or compression they may be forced either to the right or the left of the ventral sucker. Crura of intestine long. Ventral sucker very prominent, much larger than oral sucker, aperture circular, with perforate contractile velum. Aperture of oral sucker oval, transverse in life, longitudinal in death. Oral sucker contiguous with pharynx, i. e., œsophagus practically none. Excretory vessel proceeding from the vicinity of the œsophagus in two branches which pass on either side of the ventral sucker, uniting behind that organ about halfway between it and the anterior testes, thence proceeding to the posterior end of the body. Length, 5.5 mm.

Types.—Nos. 4855, 4856, U.S.N.M.

I have found this parasite in the stomach of the sucker (*Remora remora*) at four different times, namely, August 1, 6, 10, 1887, and July 22, 1889, Woods Holl, Massachusetts. One fish was examined each time except the last, when two were examined. Numerous specimens of this worm were found in each fish, with one exception. One of the two examined in 1889 had no parasites.

The anatomy of this species bears a very close resemblance to Monticelli's¹ *Apoblema stossichii*, about the only material difference being the position of the cirrus bulb and seminal vesicle, which in *A. stossichii* is behind the ventral sucker. The caudal appendage in *A. stossichii*

¹Atti della R. Accademia delle Scienze de Torino, XXVI.

is very short, while that of *D. monticellii* is moderately large. It is invaginated in most of my specimens, and furnishes a point of resemblance to *D. appendiculatum*. The body of *D. monticellii* is nearly smooth, fine transverse rugæ only being revealed under high magnification, while both *D. appendiculatum* and *A. stossichii* are transversely plicate.¹

I append a few notes made at the time of collecting. The worms when first removed from their host and placed in sea water were quite active. The anterior part of the body could be elongated until the attenuated neck was equal in length to one-third the body. The distance between the suckers when at rest being about 0.5 mm., increased to over 1 mm. Dimensions of a typical living specimen: Length, 5.4 mm.; greatest diameter, 1 mm.; diameter of oral sucker, 0.1 mm; diameter of ventral sucker, 0.54 mm.

The color of some of the organs is quite different when seen by transmitted light from what it is under reflected light. One specimen presented the following colors: Oral sucker dull reddish-brown, afterwards yellow; ventral sucker light yellowish-brown, with reflected light golden yellow, with reddish-brown center; intestine grayish, faint purple with reflected light; seminal receptacle and cirrus pouch pale reddish-brown, light purple with reflected light; testes reddish-brown, dark purple with reflected light; uterus with ova golden yellow; ground color of body pale yellow, with faint reddish-brown tinge in the membranous mass at the posterior end of the body; excretory vessel dark brown, bright green by reflected light.

Another specimen which had been lying in sea water for a number of hours had a transparent bluish-white ground color, the uterus with ova was a beautiful golden yellow, the testes, suckers, pharynx, crura of intestine, cirrus pouch and terminal portion (invaginated?) a little opaque; vitelline glands and excretory vessel dead opaque white.

Crura of intestines large, inflated, pulsating in life, sometimes so much inflated as to fill the body cavity back of vitelline glands. Posterior end of body usually occupied by an invaginated portion of the tail.

The ova in life measured 0.025 and 0.014 mm. in the two principal diameters; in alcoholic specimens, 0.018 and 0.011 mm. in the two diameters.

In alcoholic specimens the neck is short, conical, and curved ventrally. The ventral sucker is three times the diameter of the oral sucker. The body is of nearly uniform diameter from the ventral sucker to about the posterior third, whence it tapers gradually to the posterior end, which is truncate, the posterior end being, as a rule, invaginated. It was invaginated in all the fresh specimens examined.

The dimensions of an alcoholic specimen follow: Length, 5.12 mm.; diameter of oral sucker, 0.18 mm.; diameter of ventral sucker, 0.56

¹ Monticelli erects Dujardin's subgenus *Apobrama* into a genus.

mm.; distance between suckers, 1 mm.; diameter of pharynx, 0.1 mm.; maximum diameter of body, 0.75 mm.

In a living specimen, dorsal view, a small organ just behind the ovary was seen, in which there was active ciliary motion. The position of the organ would indicate that it is the shell gland.

The specimens were found in the stomach of their host in each case. In one instance a few specimens were also found in the gills of their host.

While the worms were active the pharynx could be seen expanding and contracting almost rhythmically and the fluid contents of the two branches of the alimentary tract was kept in motion by a kind of peristaltic action of their walls.

13. DISTOMUM GRANDIPORUM Rudolphi.

(Plate XLIV, fig. 9.)

Distomum grandiporum DIESING, Syst. Helm., I, 1850, p. 371.—MOLIN, Sitzungsab. Wiener Akad., XXXVII, 1859, p. 826, pl. II, fig. 5.—COBBOLD, Synops. Distom., 1859, p. 23.—OLSSON, Bidrag t. Skand. Helminthf., 1876, p. 20.—STOSSICH, Dist. d. Pesc., 1886, p. 14.

I refer to this species a single specimen (No. 5505, U.S.N.M.) from the stomach of the common eel.

The specimen is adult, and the very voluminous folds of the uterus are so crowded with ova that the other organs are thereby to a great extent obscured. Fig. 9 is from a sketch of the specimen much distorted by compression.

The following synopsis of the species is compiled from the synopses as given by Olsson and Stossich.

Body unarmed, terete oblong (when the tail is retracted), neck somewhat attenuate, excavate beneath. Ventral sucker larger than oral sucker (almost four times as large, *Stossich*) at base of neck, spherical, sessile, and prominent. Mouth subterminal, semiglobose. Pharynx contiguous with oral sucker; oesophagus none; intestinal branches narrow, extending to base of appendix (almost to apex of appendix, *Stossich*). Testes two, globose at each side behind the ventral sucker. (Each smaller than ovary, *Olsson*.) Seminal vesicle large, ovate, a little in front of the ventral sucker. Cirrus short, cylindrical, smooth. Vitellaria two, large, near together, immediately behind the ovary. Ovary large, globose, posterior. Uterus ample, gyri between testes and ovary, ova yellow. Male genital aperture in front of female in middle of neck. Length, 2-6 mm.

On account of the enormous development of the uterine folds and the lack of material for sectioning, the verification of all the above-named specific characters is not possible. The resemblance seems to be near enough, however, to make this identification probable. The dimensions of my specimens are: Length, 5.50 mm.; diameter of oral sucker, 0.26;

diameter of ventral sucker, 0.69; long diameter of ova, 0.017; short diameter of ova, 0.009.

Found in stomach of *Anguilla chrysypa*; Woods Holl, Massachusetts, September 2, 1885.

14. DISTOMUM AURICULATUM Wedl (?).

(Plate XLV, figs. 1-7.)

Distomum auriculatum WEDL, Sitzungsab. d. Kais. Akad., XXVI, 1857, p. 242, Pt. 4, pl. 1, fig. 2.—DIESING, Revis. d. Myzelm., p. 343.—STOSSICH, Dist. d. Pesc., p. 18.

I refer these *Distoma* provisionally to *D. auriculatum*.

Body short, linear or lance-linear, flattened; posteriorly subattenuate, anteriorly broadly rounded; mouth subterminal, large, overlapped in front by two auricular flaps symmetrically placed and each prolonged laterally like a conical papilla; four other papillæ on head, one on each side and two dorso-lateral, making, with the tips of the auricular flaps, six wartlike papillæ in all. Ventral sucker about central, smaller than the oral sucker. Œsophagus none, pharynx ellipsoidal. Vitellaria voluminous, mainly lateral, extending from posterior end on each side nearly to the head. Ova rather large in a mass behind ventral sucker. Testes about midway between posterior edge of ventral sucker and posterior end of body. Cirrus pouch in front of ventral sucker, reproductive aperture halfway between suckers. The five specimens were 2.20, 1.91, 1.90, and 1.70 mm., respectively, in length.

The dimensions of the larger specimen are here given: Length, 2.2 mm.; breadth of head, 0.5; breadth of neck, 0.41; breadth of body, 0.6; longitudinal diameter of oral sucker, 0.42; transverse diameter of the same, 0.46; longitudinal diameter of ventral sucker, 0.28; transverse diameter of same, 0.32; length of pharynx, 0.16; diameter of pharynx, 0.11. Ova, 0.07 and 0.04 mm. in two principal diameters.

The apertures of the oral and ventral suckers in these (alcoholic) specimens are subcircular.

The ovary is situated on the right side and a little way back of the ventral sucker. The intestinal crura are rather small. The excretory vessel was first seen in serial sections as a single, dorsal, thin-walled vessel in the vicinity of the testes (Fig. 5). Behind the termination of the intestinal crura its walls become a little thicker and somewhat folded (Fig. 6). At the terminal pore the walls are thick and globular (Fig. 7).

Five specimens (No. 4845, U.S.N.M.) from intestine of the lake sturgeon (*Acipenser rubicundus*); J. W. Milner, collector.

15. DISTOMUM VELIPORUM Creplin (?).

Distomum veliporum DIESING, Syst. Helm., I, p. 347.—OLSSON, Lund's Univ. Årsskrift, IV, pp. 22-24; Bidrag., p. 13.

One specimen, a fragment, the posterior part of a distomum broken in two immediately in front of ventral sucker, agrees pretty well with

descriptions of the above species. Dimensions: Length, 20 mm.; breadth at ventral sucker, 3; thickness at ventral sucker, 2.75; maximum breadth, 3.2; diameter near posterior end, 1.5; longitudinal diameter of aperture of ventral sucker, 1.4; transverse diameter of same, 0.8.

Body elongated sublinear, depressed unarmed, transversely rugose, posteriorly attenuate. The neck had evidently been reflected dorsally nearly at right angles to body.

For about 6.5 mm. back of the ventral sucker the body was filled with the voluminous folds of the uterus, the latter crowded with ova.

Long diameter of ova, 0.076 mm.; short diameter, 0.052.

Fragment of large distomum from stomach of barndoor skate (*Raja laevis*). No. 4870, U.S.N.M.; Woods Holl, Massachusetts, November 4, 1887; Vinal N. Edwards, collector.

16. DISTOMUM MACROCOTYLE Diesing.

(Plates XLV, figs. 8-10; XLVI, figs. 1-5.)

Distomum macrocotyle DIESING, Revis d. Myzhelm, p. 342.—OLSSON, Lund's Univ. Årsskrift, IV, p. 24, pl. v, figs. 100, 101.—STROSSICH, Dist. d. Pesc., p. 20.—MONTICELLI, Nat. Sicil. An., XII, 1893, p. 10 (extract).

Body unarmed, round, straightish, attenuate both posteriorly and anteriorly, linear-fusiform. Neck slender-conical, reflexed, sometimes arched. Mouth subterminal, aperture transverse, in alcoholic specimens, said to be circular in life. Ventral sucker very prominent, globose, sessile twice the diameter of the oral sucker, aperture longitudinally elliptical in alcohol, circular in life. Genital aperture in anterior part of neck near oral sucker. Testes two, large, behind ventral sucker, ventrally placed. Ovary about the middle of the post acetabular region of the body. Greater part of body filled with the folds of the uterus, which are crowded with small ova.

Sixteen of these worms (No. 4854, U.S.N.M.) were found in a lot of *Distoma* from the intestine of *Mola mola*, off Marthas Vineyard, Massachusetts, September 10, 1886; Vinal N. Edwards, collector.

Fig. 9 was made from the inner aspect of the left half of a specimen which had been split in two longitudinally. It reveals many folds of the uterus, both dorsally and ventrally placed, with an anterior prolongation dorsal in the neck. Some folds of the vas deferens are seen lying above the ventral sucker. The vitellaria are axially situated, extending from the ventral sucker to about the posterior fifth. The cirrus bulb is seen lying close behind the oral sucker.

One of the larger specimens yielded the following measurements: Length, 14 mm.; maximum diameter of body, 1.7; diameter of neck, 0.88; distance between suckers, 1.7; diameter of ventral sucker, 1.4; diameter of oral sucker, 0.65; transverse diameter of oral aperture, 0.35; longitudinal diameter of oral aperture, 0.11.

The ova measure 0.026 and 0.017 mm. in the two principal diameters. Transverse and longitudinal series of sections were prepared and

compared with similar series of *D. nigroflavum* and *D. foliatum*. The vitellaria were found to be most strongly developed above and in front of the ventral sucker, extending through the neck dorsally and axially nearly as far as the oral sucker, sparsely scattered through the body as far back as the ovary. Doubtless in younger specimens the vitellaria are more conspicuous organs than in the sectioned individuals, the larger part of whose bodies was filled with ripe ova. The testes lie close together, one immediately following the other, the anterior one a little toward the left, the posterior one a little toward the right side of the body, and the former close behind the ventral sucker. They are ventrally placed and oval in shape. The anterior 1.07 and the posterior 1.04 mm. in length. The seminal receptacle lies in voluminous folds above and in front of the ventral sucker. The vas deferens traverses a large prostate gland and ends in a relatively small cirrus immediately behind the oral sucker. At the base of the cirrus the vas deferens is joined by the uterus, which traverses the ventral region of the neck. The ovary is subglobular in shape, about 0.84 mm. in diameter, lies about the middle of the post acetabular region; on its anterior border, and lying toward the right side of the body is the shell gland (0.37 mm. in diameter), not shown in fig. 9, which was made from the left side. The posterior part of the body in the sections is filled with the voluminous folds of the uterus, which are crowded with ova. The characteristic rami of the longitudinal vessels of the body proper, as well as those of the neck, are shown in Plates XLV, fig. 10; XLVI, fig. 1.

The vessels are peculiar in being variously branched. They are filled with finely granular material, as is the case in *D. nigroflavum* and *D. foliatum*. A few minute tetragonal crystals were observed in the contents of these vessels. The branching vessels of the posterior part of the body appear to communicate with a common posterior sinus which opens to the exterior by a terminal pore. I was unable in my sections to demonstrate any communication between these vessels and the pharynx. They certainly have their origin in front of that organ. They agree in structure with intestinal crura, but otherwise resemble excretory vessels.

17. DISTOMUM GRACILE Diesing.

(Plate XLVI, figs. 6-8.)

Clinostomum gracile LEIDY, Proc. Acad. Phil., VIII (1856), p. 45.

Distomum gracile DIESING, Revis. d. Myzhelm, p. 336.—WRIGHT, Contrib. to Amer. Helm., pp. 9, 10.

Body oblong-elliptical, in dorsal or ventral view, with slight constriction opposite ventral sucker, compressed; neck short, convex above, concave below. Head obliquely truncate, oral sucker situated at the bottom of a shallow depression and surrounded in front by a prominent border, from which a lip-like projection extends back over the anterior edge of the sucker; aperture of oral sucker circular; œsophagus none, pharynx oval. Ventral sucker globular, much larger than oral sucker,

with triangular aperture. Crura of intestines voluminous, sacculated, much inflated posteriorly. Testes two oblong masses placed transversely about midway between the ventral sucker and the posterior end, and separated from each other by what I take to be the rudimentary ovary, a portion of the seminiferous vessels and some of the uterine folds. What appears to be the cirrus pouch lies immediately in front of the anterior testes and a little to the right. A median vessel, with walls of cuboid nucleated cells, which appears to be an anterior prolongation of the developing uterus, lies along the median line from near the orifice of the cirrus pouch nearly to the ventral sucker. It receives a tube of similar appearance and histological structure, which originates between the testes and passes around the left end of the anterior testes. The vitellaria are indicated by granular clusters, which extend from the posterior end nearly to the ventral sucker.

These specimens, at least the one figured (Fig. 6), upon which the above description is based, appear to be further developed than Wright's specimens and confirm his conjecture as to the probable adult form of this species. The disposition of the reproductive organs here made out for *Distomum gracile* leaves little doubt that it is very closely related to *Distomum heterostomum*. Wright¹ describes and figures a distomum which he refers provisionally to *D. heterostomum* Rudolphi, and which he has found in the mouth of the American bittern (*Botaurus minor* Gmelin), that may indeed be the adult form of *D. gracile*.

I have found five specimens of the above *Distomum* in the National Museum collection (No. 4851, U.S.N.M.). The vial contained pieces of liver of the host *Lepomis auritus*, with numerous small, encapsuled trematodes (*Diplostomum cuticole*), and one leech (*Ichthyobdella* sp.). Three of the examples were encapsuled and two free. The encapsuled specimens were folded with the ventral surface out.

Another specimen (Fig. 7), No. 4850, U. S. N. M., was found in a vial containing leeches (*Ichthyobdella* sp.) from the gills, roof of the mouth, and under the pectoral fins of *Eupomotis pallidus* and *Chenobryttus gulosus*; collected by Mr. N. A. Harvey, Kansas City, Missouri.

This specimen, alcoholic, had the following dimensions: Length, 4.5 mm.; breadth at anterior sucker, 0.92; breadth at ventral sucker, 1.13; maximum breadth, 1.5; diameter of oral sucker, 0.27; diameter of ventral sucker, 0.75.

18. DISTOMUM LAGENIFORME, new species.

(Plate XLVII, figs. 1, 2.)

The following description is based on a single specimen from the body cavity of *Remora remora*; Woods Holl, Massachusetts, August 1, 1887.

The living worm (Fig. 1) was approximately 20 mm. in length and 6 in greatest breadth, long, oval in outline, neck nearly cylindrical at

¹ Contrib. to Amer. Helm., pp. 3-6, figs. 1, 2.

anterior end, body otherwise flattened but quite thick. The color at first was purplish merging into orange-red. When placed in sea-water it voided enough dark-colored material to color the water in a small dish dark-brown.

Having a quantity of more fragile material to examine, this specimen was left in water for a number of hours. Meantime it had contracted and assumed a very different appearance (Fig. 2). The body was now nearly globular, with large transverse wrinkles on anterior half, the neck protruding like the neck of a water bottle. In dorsal view the body appears somewhat two lobed on account of a shallow longitudinal median depression. Head and neck reddish-yellow in front, merging into a deeper orange-red at base; anterior part of body bright orange-red. Posterior part of the body rich brownish-yellow, neck conical, crossed by fine transverse lines. In ventral view neck concave in both longitudinal and transverse direction, with fine transverse lines; mouth at anterior tip, but opening below, elliptical longest diameter longitudinal, border with radiating wrinkles. Aperture of ventral sucker irregularly circular, with puckered border, 0.75 mm. in diameter. Coloration beneath nearly like that above, head and neck light orange-yellow in front, merging into orange-red at base and on front of body, becoming light orange-red behind.

Type.—No. 4853, U.S.N.M

The dimensions of the living specimen, after contraction: Length, 7.25 mm.; breadth of globular body, 6.75; breadth of head, i. e., at oral sucker, 1.5; breadth of neck at base, immediately in front of ventral sucker, 3; distance between suckers, centers, 2.6; thickness of body, 5.5.

The alcoholic specimen was cut in two by a median longitudinal, dorso-ventral section, and the following points noted: The muscular pharynx follows the oral sucker directly. The cirrus pouch is in the neck, anterior to the ventral sucker; the external opening of the cirrus is apparently just back of the mouth. Behind the ventral sucker the body is crossed by cavities which contain a black or very dark-brown granular substance. No ova were seen. The following dimensions in millimeters were obtained from the alcoholic specimen: Antero-posterior diameter of oral sucker, 1.21; dorso-ventral diameter, 0.93; antero-posterior diameter of ventral sucker, 2; dorso-ventral diameter, 1.4; length of pharynx, 0.74; dorso-ventral diameter of same, 0.63.

19. *DISTOMUM SIMPLEX* Rudolphi (?).

(Plate XLVII, figs. 3-7.)

Distomum simplex DUJARDIN, Hist. Nat. d. Helm., 1845, p. 466.—DIESING, Syst. Helm., I, 1850, p. 343.—OLSSON, Lund's Univ. Årsskrift, 1868, IV, p. 34, pl. IV, figs. 81, 82.—LEVINSEN, Grönlands Trematodfauna, 1881, p. 18, pl. III, fig. 1.—STOSSICH, Dist. d. Pesc., 1886, p. 30.

Body unarmed, depressed, elongated linear, somewhat constricted in the vicinity of the testes, neck short, narrow in front, posterior end rounded. Mouth subterminal, aperture orbicular. Ventral sucker very prominent, twice the diameter of the oral sucker. (Esophagus equal

in length to the pharynx. Vitelline glands large, globose, extending laterally from the tail to the ventral sucker. Testes, two large, remote in the median line. Ovary in front of the testes trilobed on its posterior border. Seminal vesicle ovate immediately in front of ovary. Cirrus pouch behind ventral sucker. Genital aperture between pharynx and ventral sucker. Ova not numerous, large. Branches of intestine extending to posterior end. Excretory vessel single, opening by terminal pore. Length, 3.9 mm. [Various authors.]

Dujardin¹ gives the length 1.25 to 2 mm. for one and 3.6 for another, both of which he refers to this species.

A single specimen, No. 4847, U.S.N.M., from the intestine of a Tomcod (*Microgadus tomcod*), Woods Holl, Massachusetts, July 23, 1886, yielded during life the following measurements: Length, 1.8 mm.; breadth at anterior sucker, 0.14; breadth at ventral sucker, 0.34. The same specimen, after killing in corrosive sublimate and preservation in alcohol, when placed in acetic acid for examination yielded the following measurements in millimeters: Length, 2.45; diameter of oral sucker, 0.15; diameter of ventral sucker, 0.28; diameter of testes, 0.32. In both cases the specimen was subjected to some pressure and consequently more or less distorted. The ova in this specimen were few (sixteen), and measured 0.084 and 0.04 in the two principal diameters. Each in acetic acid showed a distinct nucleus near one end (Fig. 4).

I refer, also, to this species three lots of *Distoma* belonging to the United States National Museum collection, all from the sea raven (*Hemipterus americanus*). Four specimens, No. 4863, U.S.N.M., Woods Holl, Massachusetts, October 12, 1887, V. N. Edwards; No. 4864, U.S.N.M., same locality and collector, December 1, 1887; 40 specimens, Casco Bay, 1873; United States Fish Commission.

In the first and third the largest specimens are about 2.5 mm. in length. One of these specimens, the second, measures 4.1 mm. in length. The ventral sucker, 0.34 mm. in diameter in one specimen, is very prominent, and in many of the specimens the neck is bent back dorsally, making an acute angle with the body. There is a great diversity of shape. The oral sucker, 0.17 mm. in diameter, has a posterior notch. Length of pharynx, 0.10; breadth, 0.07 mm. Vitellaria mainly lateral, but a few median lobes noticed in sections, on a level with the anterior border of the ovary.

20. DISTOMUM PALLENS Rudolphi.

(Plate XLVII, figs. 8, 9.)

Distomum pallens DUJARDIN, Hist. Nat. d. Helm., p. 457.—DIESING, Syst. Helm., I, p. 348.—COBBOLD, Synops. Distom., p. 26.—CARUS, Prodr. Faunæ Mediterr., I, p. 130.—STOSSICH, Dist. d. Pesc., p. 31; Bull. Soc. Adriat. Trieste, IX, 1887, (Extract) p. 4.

A single specimen, No. 4860, U.S.N.M., of a *Distomum* found in the intestine of *Alutera schoepfi*, and which I refer with some doubt to *D.*

¹Hist. Nat. d. Helm., 1845, p. 466.

pallens Rudolphi, is here described as far as the very limited amount of material will permit.

Body subcylindrical, with somewhat rhombic-ovate outline, crossed with minute rugæ in anterior and median region. Neck short, conical, minutely papillose on dorsal side, near head. Mouth subterminal, aperture circular. Ventral sucker, red, nearly twice the diameter of the oral sucker, prominent, aperture transverse. Vitellaria lateral in posterior half, yellow in life. Testes situated about posterior fourth, opaque white. Uterus with rather numerous ova colored deep brown, and situated in a mass immediately behind the ventral sucker. Branches of intestine extend to near posterior end.

The following dimensions were obtained from measurements of the living specimen, slightly compressed: Length, 3.10 mm.; breadth, anterior, 0.40; breadth, median, 0.86; breadth, posterior, 0.60; diameter of oral sucker, 0.24; diameter of posterior sucker, 0.46; distance between suckers, centers, 0.68.

In the alcoholic specimen the dimensions of the suckers were unchanged from what they were in life and the pharynx measured 0.154 mm. in length and 0.168 in breadth.

The ova measure 0.067 mm. in length and 0.034 in breadth.

I find no mention of papillæ or rugæ in my notes made at the time of collecting. The alcoholic specimen, however, is crossed by minute rugæ and the anterior region is minutely and, at least opposite the oral sucker on the dorsal surface, densely papillose.

Found in *Alutera schæpfi*; Woods Holl, Massachusetts, July 24, 1887.

21. DISTOMUM VALDEINFLATUM Stossich.

(Plates XLVII, figs. 10-14; XLVIII, figs. 1, 2.)

Distomum valdeinflatum STOSSICH, Bull. Soc. Adriat. Trieste, VIII, 1883, p. 114, pl. I, fig. 4.—CARUS, Prodr. Faunæ Mediter., I, 1884, p. 127.—STOSSICH, Dist. d. Pesc., 1886, p. 35.

Body terete, subspherical behind; neck long, cylindrical, covered with spines which are evanescent toward the posterior part of the body; os terminal; acetabulum sessile larger than oral sucker, at the base of the neck. Head cercinate, armed with a double crown of hooks, sixteen hooks in each, those of the anterior circle the stronger. No. 4869, U.S.N.M. Length, 2.5 to 3 mm.

I refer to this species certain *Distoma* found inclosed in globular capsules and attached, usually by a slender peduncle, to the peritoneum of the host, *Alutera schæpfi*.

The capsules consisted of an outer cyst of connective tissue containing a thin hyaline sac in which lay a larval *Distomum*. The posterior end of the latter was swollen and globular and when compressed, in a living specimen, was seen to be filled with white food-material (parenchyma), which was in communication with the posterior ends of the intestine.

In specimens which had been killed in corrosive sublimate and preserved in alcohol, the embryos were found to be surrounded by coagulated material, which easily separated from them. One case was noticed where the whole cyst had degenerated into tough, yellowish, concentric layers.

Two capsules (alcoholic) measured 1.75 mm. and 2.4 in diameter, respectively.

Body subcylindrical; neck short; densely covered with short, subtriangular spines. Oral aperture transverse, somewhat triangular, surrounded by oblong, stoutish spines. The latter are somewhat obscurely arranged in two rows; this is most evident at the anterior border. Of these oral spines the lateral are longest. Their number, in maturest specimens, is about thirty-four. The ventral sucker is larger than the oral; the pharynx is oblong-pyriform, muscular, nearer ventral than oral sucker; the branches of the intestine capacious.

The following measurements were made of an alcoholic specimen: Length, including terminal globular sac, 2 mm.; diameter of head, 0.38; diameter of neck, 0.28; diameter at ventral sucker, 0.60; diameter of ventral sucker, 0.30; breadth of oral aperture, 0.19; length of pharynx, 0.22; breadth of pharynx, 0.16; length of longest oral spines, 0.16. Transverse sections showed a cirrus in front of and dorsal to ventral sucker, which was 0.018 mm. in diameter near its extremity, and apparently about 0.11 in length. In sections, maximum diameter of ventral sucker, 0.43; other diameters of same, 0.25; diameter of oral sucker, 0.26.

These embryos bear much resemblance to adult *Distoma* found in *Roccus lineatus*, *D. tenue*, and may indeed be identical.

Found in peritoneum of *Alutera schæpfi*, numerous; Woods Holl, Massachusetts, August 5, 1889.

22. DISTOMUM CONTORTUM Rudolphi.

(Plate XLVIII, figs. 3-7.)

Distomum contortum DEJARDIN, Hist. Nat. d. Helm., 1845, p. 469.—DIESING, Syst. Helm., I, 1850, p. 394; Sitzungsab. Wiener Akad., XXXII, 1858, p. 353.—COBBOLD, Synops. Distom., 1859, p. 29.—OLSSON, Lund's. Univ. Arsskrift, IV, 1868, p. 39, pl. v, figs. 104, 105; Bidrag. t. Skandin. Helminthf., 1876, p. 17.—CARUS, Prodr. Faunae Mediterr., I, 1884, p. 126.—STROSSICH, Dist. d. Pesc., 1886, p. 40.—SONSINO, Proc. Verb. d. Soc. Tosc. d. Sci. Nat., 1890, p. 3 (extract).

Twelve specimens in the United States National Museum collection No. 4848. Name of host not given, probably *Mola mola*. The label in the bottle reads: "Station ?, 1886, U. S. Fish Commission."

I do not find any mention made of the very peculiar spines which characterize these specimens in any of the descriptions of *D. contortum* which I have read. For this reason alone I am in some doubt as to whether they should be identified as *D. contortum* or referred to a new species.

The twelve specimens were felted together in a single mass, the indi-

viduals holding on to one another by their ventral suckers. When separated from this tangled mass, they were found to be much distorted. Where a ventral sucker of one individual had been applied to the body of another, there was a knob-like protuberance which represented the portion that had been embraced by the sucker. Sometimes the bodies and sometimes the necks were strangled to a slender filament where they had been compressed. Fortunately, two or three worms were found which had not been distorted in any other way than by contraction. The ventral suckers were globular, prominent, and in some cases decidedly pediceled. Those which were not distinctly pediceled showed by their wrinkled condition that they were capable of considerable extension.

Body cylindrical, transversely wrinkled (a contraction character), tapering from median region in each direction, but most posteriorly. Posterior end somewhat bluntly pointed: greatest diameter back of ventral sucker. Neck rather short, arcuate excavated on ventral surface, convex on dorsal surface. Dorsal surface and lateral margins armed with spheroidal tuberculate spines. Ventral sucker much larger than oral, aperture about twice the diameter of the mouth. Slight constriction back of oral sucker, making a rounded head. Oral aperture subterminal, with flat spines surrounding it on inner margin, with lip projecting anteriorly in a blunt point. The subglobose head with sparse spines on dorsal surface. Genital aperture immediately behind mouth. The dark-brown branching vitellaria show through the body wall along the sides, from a little in front of the posterior end to a point about halfway between the posterior end and the ventral sucker. The anterior portion of the body, including the ventral sucker and neck, yellowish white. The œsophagus opens by a conical papilla into the oral sucker. (Figs. 4, 6.) This papilla is 0.22 mm. in length, 0.14 and 0.08 in diameter at base and apex, respectively. There are twenty flat spines, more or less, on the inner margin of the oral aperture. The spines on the neck are spheroidal, with from four to six small round tubercles pointing posteriorly and postero-laterally. (Fig. 5.)

The specimens were so much distorted that the measurements obtained can not be of much service. One of the least distorted examples yielded the following measurements: Length, 8 mm.; diameter of head, 0.3; diameter of body at ventral sucker, 0.55; greatest diameter, 0.72; diameter at posterior end, 0.2; longitudinal diameter of oral sucker, 0.6; longitudinal diameter of ventral sucker, 0.7; diameter of oral aperture, 0.15; diameter of ventral aperture, 0.3; length of neck, to middle of ventral sucker, 1.6. Measurements made of specimen lying on its side.

Three ova measured 0.036, 0.033, and 0.030 mm., respectively, in length, and 0.020 in shorter diameter.

The longest of these specimens measured about 12 mm. in length, but had been capable, evidently, of much greater elongation.

Testes two, close together, one following the other, just back of the constriction of the body behind the ventral sucker. In the specimen sectioned they lay somewhat toward the left side. The ovary follows the posterior testis closely, lies rather more toward the right side of the body than the testes and dorsal. The shell gland is on its anterior border. The vitellaria are not very abundant in this (mature) specimen. They are for the most part lateral and dorsal, but are also scattered among the folds of the uterus, from the vicinity of the testes to near the posterior end. In younger stages of the worm these glands are probably very voluminous. They are reddish-brown in carmine-stained sections. The anterior tube of the uterus lies on the ventral side of the neck and joins the cirrus at its base. The vas deferens is very voluminous. Its convolutions lie dorsally and extend from the middle of the neck to near its base. The seminal receptacle is also very voluminous, lying at the base of the neck, and dorsal to the ventral sucker. The intestinal crura are very distinct, thick walled, and extend to near the posterior end of the body. The excretory vessels (Fig. 7) were seen only near the posterior end of the body, the two uniting in a single vessel, which lies between the terminal portions of the intestinal crura and ends in a terminal pore. The uterus, filled with ova, occupies the greater part of the body back of the ovary.

The musculature of the ventral body-wall back of the ventral sucker is very strongly developed.

23. *DISTOMUM NIGROFLAVUM* Rudolphi.

(Plates XLVIII, figs. 8-11; XLIX, figs. 1, 2.)

Distomum nigroflavum DUJARDIN, Hist. Nat. d. Helm., 1845, p. 469.—DIESING, Syst. Helm., I, 1850, p. 394; Sitzungsab. Wiener Akad., XXXII, 1858, p. 353.—COBBOLD, Synops. Distom., 1859, p. 29.—OLSSON, Lund's Univ. Årsskrift, IV, p. 25, pl. v, figs. 102, 103.—CARUS, Prodr. Faunae Mediterr., I, 1884, p. 126.—STROSSICH, Dist. d. Pesc., 1886, p. 40.—SONSINO, Notizie di trematodi. Estr. d. Proc. Verb. Soc. Tosc. Sci. Nat., 1890, p. 4.

In a lot of *Distoma* (No. 4857, U.S.N.M.) from the intestine of the sunfish (*Mola mola*) I find three distinct kinds, which I have referred to the following species: *D. nigroflavum* Rudolphi, *D. macrocotyle* Diesing, and *D. foliatum* mihi. I have not had an opportunity of studying specimens in life, and therefore do not know what difference may exist in the living specimens. The alcoholic specimens possess a general superficial likeness, especially *D. nigroflavum* and *D. foliatum*; but while there is a very considerable variation of size and shape, the three species stand stiffly apart from each other.

Body cylindrical, linear, often much contorted in a dorso-ventral plane; neck short, cylindrical, usually reflected dorsally. Mouth terminal. Ventral sucker larger than oral, pedicellate; the pedicel sometimes narrow and contracted, sometimes swollen and containing folds of the uterus. Reproductive aperture about middle of under side of neck; cirrus, everted in several cases, rather stout with a swollen base. The

testes are two, elliptical, situated about the middle of the post-acetabular region. In one example they were contiguous; in others they were removed from each other by a space a little less than the length of a single testes. In the more mature specimens the testes are remote. The testes in one specimen measured 1.12 and 1.03 mm., respectively, and the ovary was about 1 mm. back of the posterior testis. The vas deferens and seminal receptacle lie in voluminous folds behind and above ventral sucker. The uterus is very long and occupies the greater part of the body from the ventral sucker nearly to the posterior end, and is crowded with ova, which are 0.03 and 0.02 mm. in their two principal diameters.

No spines of any kind were noticed either on the neck or on the lips of the ventral sucker. Since the spines of *D. nigroflavum* are said to be deciduous, this is a difference that must not be made too much of. The specimens were of various lengths; the largest measured 35 mm. in length and 1.12 in diameter. The specimens were variously contracted and distorted, especially about the anterior end.

The vitellaria are in slender thread-like folds, seen in transverse sections to be rather centrally situated, except where crowded to one side by the testes. They are reddish-brown, in sections stained with borax carmine, and lie between the anterior edge of the ovary and the ventral sucker.

The ovary, in sections, is seen to be made up of nucleated cells which appear to be polygonal, usually hexagonal, especially in the central portions. These cells are about 0.017 mm. in diameter.

The shell-gland is an oval body lying adjacent to the front edge of the ovary and is about one-third the diameter of that organ.

The lumens of the longitudinal vessels, especially in the anterior part of the body, are filled with a fine granular substance, brown in color, and, when highly magnified, is seen to have minute tetragonal crystals scattered through it. On account of the irregular contraction of the body and of the vessels themselves, the granular contents are in places gathered into masses of considerable relative size. Toward the posterior end of the body the vessels, in all individuals sectioned, were empty. Behind the ovary the body is largely occupied by the folds of the uterus.

Certain glandular bodies, which lie adjacent to the folds of the seminal receptacle behind the ventral sucker (Fig. 11) and contain numerous nucleated cells, appear to be continuous with the prostatic cells which surround the vas deferens, near the base of the cirrus pouch, at which place the uterus joins the vas deferens. These organs have the same relative arrangement as the corresponding organs in *D. macrocotyle*. (Plate XLVI, fig. 3.) The cirrus is relatively larger and not situated so close to the oral sucker; and the seminal receptacles are behind instead of above and in front of the ventral sucker.

Found in intestines of *Mola mola*, thirteen specimens; off Marthas Vineyard, September 10, 1886. Collected by Vinal N. Edwards.

24. *DISTOMUM FOLIATUM*, new species.

(Plates XLIX, figs. 3-5; L, figs. 1-3; LI, figs. 1-4.)

Type.—No. 4849, U.S. N. M. Body cylindrical, somewhat linear, but with constrictions and enlargements, much contorted in alcoholic specimens (not seen living). Neck usually arcuate, strongly reflected. Mouth ringent, aperture transverse directed downward, upper lip projecting. Dorsum of head and neck with crest of (six or eight) nodular eminences, which were white in alcoholic specimens; seen in sections to consist of strong muscular fibers, as in the pharynx and suckers. Ventral sucker consisting of four foliate flaps (Plates XLIX, fig. 3; L, figs. 1-3; pedicellate, the pedicel variable, usually greatly swollen and containing voluminous folds of the uterus, vitellaria, and seminal receptacle, in some cases separated by a constriction from the body. (Plate L, fig. 2.) In most cases there is a profound constriction of the body immediately behind the ventral sucker. The pedicel is sometimes directed forward, continuing the general direction of the axis of the body; in other cases it is at right angles to the body and continues the general direction of the axis of the neck. The specimens studied were all mature, and the very voluminous folds of the uterus filled the body from a short way behind the oral sucker to near the posterior end of the body. The uterus was crowded with small elliptical ova. The œsophagus is very short; the pharynx oblong, its length exceeding half the diameter of the oral sucker. The cirrus bulb is relatively small and lies near ventral surface of the neck, but a short distance back of the oral sucker, the genital aperture being on a level with the anterior end of the pharynx. The anterior duct of the uterus along ventral side of neck; seminal receptacle in voluminous folds in pedicel and nearly whole length of neck. Testes two, large, lying a little in front of the post-acetabular region of the body. Vitellaria distributed from a point just behind the oral sucker as far back as the ovary, most abundant in neck and in constricted part of body between ventral sucker and anterior testis, reddish-brown in carmine-stained sections.

Dimensions are not of much value in the identification of forms of such extremely variable contractile shapes, and the measurements here given must be expected to differ greatly from those of living specimens. The largest measured at least as much as 16 mm. in length.

A medium-sized specimen yielded the following measurements: Length, 12 mm.; length of neck, 2.54; length of oral sucker, 0.82; depth of oral sucker, side view, 0.65; diameter of neck, 0.85; maximum diameter of body, 1.28; minimum diameter of body, 0.6; diameter of ventral sucker, 1.9; length of œsophagus, 0.09; length of pharynx, 0.48. Average diameters of ova, 0.032 and 0.022 in the two principal directions.

An examination of a good series of transverse sections revealed many interesting details, the more important of which are here recorded. The connection between the œsophagus and the intestinal crura was not

demonstrated; what appeared to be a left branch of the œsophagus was traced for some distance, about half the length of the neck. In this minute vessel which leads back from the pharynx several nucleated cells, oval in shape, and about 0.01 mm. in length, were observed, which I take to be the red blood-corpuscles of the host. What are taken to be branches of the intestine in this species, and in the related species *D. nigroflavum* and *D. macrocotyle*, begin as two small lateral vessels on either side of the neck on a level with the pharynx but not communicating with it (Plate LI, fig. 3, *i. i.*); at least I was unable to demonstrate any communication in my sections. They are irregular in dimensions, becoming much enlarged in some portions of the body, so that the transverse sections of the two vessels constitute more than half the area of the entire section of the body. At such places they are filled with a finely granular substance, light brown in color, in carmine-stained sections. A few of the tetragonal crystals observed in the corresponding vessels of *D. nigroflavum* and *D. macrocotyle* were seen in these.

In addition to the very voluminous tubular seminal receptacle which extends from the pedicel of the ventral sucker to near the anterior end of the neck, a posterior seminal receptacle was observed between the shell-gland and the posterior testis. The vas deferens and uterus have the same general plan as in the two related species, but the prostatic gland traversed by the former is not so large as in *D. macrocotyle*.

The ovary in one specimen measured 0.43 mm. in diameter and was situated 0.28 mm. back of the posterior testis. The shell-gland was situated adjacent to the anterior edge of the ovary, toward the right side, and was 0.23 mm. in diameter. In another the ovary was 0.53 and the shell-gland 0.21 mm. in diameter. The ovary consisted of polygonal nucleated cells, as in *D. nigroflavum* and *D. macrocotyle*.

The testes in two specimens which were cut into series of longitudinal sections presented the following individual differences: In one specimen the length of the anterior testis was 1.02 mm., that of the posterior testis 0.74, the former situated toward the right and the latter toward the left side of the body. In the other specimen these conditions were reversed, i. e., the length of the anterior testes was 0.68, that of the posterior testes 0.80, while the former was situated toward the left and the latter toward the right side of the body. One must conclude from these facts that relative position of internal organs in these forms, within certain not too narrow limits, does not supply safe criteria for establishing specific differences.

Olsson represents, in a longitudinal section of the neck of *D. nigroflavum*, what he regards as glands of doubtful significance (Plate LI, fig. 2.) This structure is identical in position with the nuchal crest of *D. foliatum*.

Thirty specimens of this remarkable worm were found in a lot of distoma from the intestine of the sunfish (*Mola mola*), taken off Marthas Vineyard, September 10, 1886. Vinal N. Edwards, collector.

These forms have many points of resemblance with *D. nigroflavum* and indeed agree with the descriptions of that species in one or two particulars in which the specimens referred to that species fail to agree, notably in the prominent upper lip and the position of the genital aperture. Whatever may be the proper disposition of these two forms as to designation, there is no doubt in my mind as to their belonging to different species. The thirty specimens of *D. foliatum* and the thirteen specimens of *D. nigroflavum*, although presenting the greatest diversity among themselves, make two distinct groups with absolutely no hint of intermediate forms.

The *Distoma* of *Mola* would well repay a careful study. Either they constitute a number of distinct species related to each other in a remarkable way, or a few species capable of the most astonishing variation.

25. **DISTOMUM NITENS**, new species.

(Plates LI, figs. 5, 6; LII, fig. 1.)

Body terete, linear, moderately attenuate both posteriorly and anteriorly, neck about one-third entire length, conical, variable with state of contraction, armed with exceedingly minute bristle like spines; mouth subterminal, ventral sucker larger than oral, prominent with transverse aperture. Pharynx prominent, œsophagus short and broad. Cirrus pouch in front of ventral sucker and on right side inclosing a part of the vas deferens within its muscular walls; reproductive aperture between oral and ventral suckers. Vitellaria a number of roundish masses distributed laterally along the middle region of the body. Ovary not far back of ventral sucker, globular; testes two, rather large, situated side by side about the middle of the body or a little back of the middle. Uterus very voluminous, its folds filling all the posterior third of the body and the greater part of the middle third filled with small elliptical ova, about 0.033 and 0.018 mm. in the two principal diameters.

Type.—No. 4858, U.S.N.M.

Found in intestine of *Tylosurus caribbeus*, two specimens; Woods Holl, Massachusetts, July 27, 1886.

The following measurements were made on a living specimen: Length, 2.8 mm.; diameter anterior, 0.28; diameter behind ventral sucker, 0.6; diameter at posterior end, 0.1; diameter of oral sucker, 0.028; diameter of ventral sucker, 0.4; distance between suckers, 0.6.

The two specimens had been subjected to some pressure during the preliminary examination, during which they became much altered in dimensions from the foregoing. The sketch (Fig. 5) as well as the description given above was based on the distorted specimens. The alcoholic specimens measured 5 and 5.5 mm. in length, respectively. Other dimensions of the larger: Median breadth, 1.12 mm.; diameter of oral sucker, 0.47; diameter of ventral sucker, 0.66; diameter of pharynx, 0.41; distance between suckers, 1.04; diameter of ovary, 0.45;

length of testis, 0.65; length of cirrus pouch, 0.57; diameter of cirrus pouch, 0.26.

The thin-walled intestinal tracts extend to within about 1 mm. of the posterior end of a specimen 5 mm. in length.

26. *DISTOMUM TENUE*, new species.

(Plate LII, figs. 2-8.)

Head disciform, surrounded by a double row of spines; mouth terminal, triangular, at times appearing circular from invagination of its border; neck cylindrical attenuate in front of pharynx; neck and anterior part of body closely beset with short triangular spines, becoming sparse or even entirely wanting toward posterior end of body.

Body rather slender, linear-lanceolate, slightly depressed. Ventral sucker prominent, sessile at base of neck, much larger than oral sucker, with circular aperture. Pharynx large, remote from head, œsophagus of good length, rather slender, tubular, branches of intestine capacious. Genital aperture in front of ventral sucker. Testes situated toward posterior end of body. Folds of uterus mainly near center of body; ova rather large, elliptical.

The foregoing is a description of a species of *Distomum* found at two different times in the striped bass (*Roccus lineatus*). This species, it will be observed, possesses many characters common to *D. cesticillus* Molin, but is very much smaller than that species besides occurring in a very different host.

There appear to be twenty-one spines in each row surrounding the mouth, the spines of one row alternating with those of the other. These are conical and slightly recurved. In some specimens, kept in water over night, the part bearing these two rows of spines became invaginated so as to conceal them. The mouth in fresh specimens had three toothlike folds within the sucker. The spines on the body are short, triangular, appressed. Immediately back of the oral armature there is a brief interval which is without spines. The spines on the neck are arranged symmetrically in transverse rows. They become smaller in the vicinity of the ventral sucker, back of it they are still smaller, while the posterior part of the body is smooth, or very sparsely covered with minute spines.

Types.—Nos. 4866, 4867, U.S.N.M.

Length of oral spines, 0.051; breadth at base, 0.018 mm.; length of spines on neck, 0.025; breadth at base, 0.014; length of spines near posterior end, 0.007; breadth, 0.002. The first five or six transverse rows of spines on the neck are broken for a short interval on the ventral side. (Fig. 3.)

The œsophagus is pyriform, its larger end lying near the anterior margin of the ventral sucker; in one specimen, living, somewhat distorted by compression; the length of the œsophagus was 0.44, its maximum diameter 0.34 mm.

The vitellaria are voluminous, peripheral in posterior region. Genital aperture immediately in front of ventral sucker. The ova were not numerous in any of the specimens examined and comparatively large. They were for the most part seen lying close behind the ventral sucker, though a few were seen in the uterus near the reproductive aperture in front of that organ; long diameter of ova, 0.088; short diameter, 0.044 mm.; length of posterior testis, 0.27; length of anterior testis, 0.24; length of ovary, 0.12.

The following dimensions are of a living example slightly compressed: Length, 2.9; breadth, anterior, 0.28; at ventral sucker, 0.6; near posterior end, 0.54; diameter of oral sucker, 0.26; of ventral sucker, 0.38. In one lot the specimens in life varied from 1.4 to 3.6 mm. in length. They were very variable in shape.

Found in rectum of *Roccus lineatus*; Woods Holl, Massachusetts, August 18, 1887, and August 3, 1889; rather numerous.

27. *DISTOMUM TENUE TENUISSIME*, new subspecies.

(Plate LII, figs. 9-12.)

Body slender, linear or linear-lanceolate, slightly depressed; mouth terminal armed with spines, which appear to be evanescent; neck attenuate, somewhat concave below, crossed by fine transverse lines, with evanescent spines; pharynx large, nearer ventral than anterior sucker; ventral sucker nearly twice the diameter of oral sucker, both with circular apertures. Testes large, in posterior third of body, vitellaria voluminous, in posterior two-thirds of body, obscuring other organs; reproductive aperture in front of ventral sucker. Ova collected in mass near center of body, as much as 0.11 mm. in length and 0.06 in shorter diameter.

Type.—No. 4865, U.S.N.M.

Two specimens, 3.75 and 4.5 mm. in length, respectively, from the peritoneum of the white perch (*Morone americana*), while resembling *D. tenue* in many particulars do not admit of classification with that species. This most obvious difference is the much more slender habit of body of the specimens from *M. americana*. These specimens are mature and have nearly smooth bodies. They have lost some of the oral spines also. An examination of more abundant material might warrant the union of the two varieties in the species *D. tenue*.

The ova are rather numerous and very irregular in size, an average of several measurements made of ova from the largest specimen was, long diameter, 0.093, short diameter, 0.058 mm.; the smallest seen measured 0.04 by 0.026 in the two principal diameters. The ova in one of the specimens were observed to be undergoing segmentation.

The following dimensions are of an alcoholic specimen: Length, 3.15 mm.; diameter of oral sucker, 0.14; diameter of ventral sucker, 0.34; distance between suckers, 0.67; length of pharynx, 0.28; diameter of

pharynx, 0.14; maximum diameter of body, 0.52; diameter at posterior end, 0.22; length of oral spines (weak and indistinct), about 0.04.

Found in the peritoneum of *Morone americana*; Woods Holl, Massachusetts, September 2, 1885.

CYSTS WITH TREMATODE OVA.

Nos. 4865, 5503, U.S.N.M. Associated with the two *Distoma* from the white perch (*Morone americana*) were numerous minute cysts accompanied with patches of dark-brown pigment, on the serous covering of the liver, mesentery, etc. Upon examination there were found the remains of a distomum, little more than the convoluted uterus packed with ova. The latter were small, 0.018 and 0.012 mm. in the two principal diameters. Scattered through the serous membrane were numerous globular cysts, with thick walls of connective tissue, each containing one or more of these ova. Some of the cysts seem to have formed around a cluster of ova. One cyst containing two ova measured 0.048 and 0.04 mm. in its two principal diameters; another, globular, 0.053 mm. in diameter contained three ova; another with five ova was 0.06 in diameter; the walls of the cysts are relatively thick, in the last case being 0.017. One large cyst, containing approximately fifty ova, was 0.11 and 0.08 in its two principal diameters.

Some ova were found in the serous membrane without cyst, others with cysts just beginning, and others with well-developed thick-walled cysts. Some of the larger cysts contained black pigment patches associated with the ova. There were also patches of pigment in the serous membrane.

A diseased ovary of a white perch (*M. americana*), collected by Mr. S. E. Meek, Fulton Market, New York City, October 6, 1886, from a fish taken somewhere in Long Island, New York, may be noticed properly in this connection.

The center of the ovary is occupied by an elongated mass of waxy consistency and appearance. This mass is made up of the tissue of the ovary, ova, and connective tissue, and cysts containing parasites, which in most cases have undergone degeneration, but in a few cases revealed ova identical in size and appearance with those from the serous coat of the liver, etc., described above.

My conclusion is that these waxy masses (42 mm. long and 14 mm. thick) are caused by the presence of trematodes, whose ova not having been liberated and allowed to come under conditions where development would take place, have become encysted and given rise to this pathological condition of the ovaries.

28. DISTOMUM species.

(Plate LIII, figs. 1, 2.)

Body elliptical, or ovate oblong a little depressed, smooth. Oral sucker orbicular, squarish, situated a short distance back of anterior end. Ventral sucker a little less than oral sucker. Aperture of both

suckers circular. Testes two, large, close together, a little back of middle of body. Vitellaria filling body behind testes and extending forward along each side to and beyond the ventral sucker. Uterus lying in a few folds in front of anterior testis. Ova not very numerous.

One specimen (No. 5504, U.S.N.M.) was obtained from the intestine of *Lagocephalus lewigatus*, Woods Holl, Massachusetts (Narragansett Bay), July 22, 1887.

The alcoholic specimen was found to be in poor condition and these notes are made up from a few notes and an incomplete sketch made at the time of collecting.

The dimensions of the living worm: Length, 2.8 mm.; diameter of oral sucker, 0.24; diameter of ventral sucker, 0.24; distance between suckers, 0.41; breadth of body at oral sucker, 0.68; breadth at ventral sucker, 0.83; maximum breadth of body, 1.04. The ova were not measured in the living specimen. In the preserved specimen they were much collapsed, so that satisfactory measurements could not be obtained. The ova measured 0.066 and 0.051 in length, respectively, and 0.035 in shorter diameter; another which appeared to be surrounded by a thin pellicle measured 0.035 and 0.022 in the two principal diameters.

29. DISTOMUM RACHION Cobbold (?).

(Plate LIII, figs. 3-7.)

Distomum rachion COBBOLD, Trans. Lin. Soc., XXII, p. 158, pl. XXXI, figs. 9, 10.—STOSSICH, Dist. d. Pesc., p. 43.

It has the following dimensions: Length, 3 mm.; diameter, anterior, 0.3; median, 0.55; posterior, 0.2; diameter of ventral sucker, 0.18; aperture, 0.09; diameter of oral sucker, 0.3; aperture, 0.16; length of pharynx, 0.2; diameter, 0.14; length of œsophagus, 0.1.

The specimen has about as many points of agreement with descriptions of *D. areolatum* Rudolphi, as with those of *D. rachion*. It appears, however, to be nearer the latter than the former, and since its agreement with that species appears to be close I notice it under the name *D. rachion*. Further, *D. rachion* was found by Cobbold in the Haddock, while *D. areolatum* has its habitat in the *Pleuronectidæ*.

It is oblong linear, flattened, squarish in front, obtuse behind, maximum breadth near middle, whence it tapers gradually to the tail, narrowing scarcely at all anteriorly, laterally arcuate; posterior extremity emarginate with terminal pore; neck covered densely with squamose spines becoming sparsely scattered back of ventral sucker, and very few near posterior end. Back of the ventral sucker the spines are confined to the lateral regions. The spines appear flat and scale-like on neck and are uniformly disposed in close transverse rows; posteriorly they are slender. Diameter of squamose spines, 0.01 mm.; length about the same. Ova not numerous, about 30, lying behind ventral sucker, rather large, 0.07 and 0.04 mm. in the two principal diameters. Length of cirrus pouch, 0.21; greatest diameter, 0.16.

A single specimen belonging to the United States National Museum collection (No. 4861, U.S.N.M.), from the intestine of the cod (*Gadus callarias*), is referred provisionally to the species above named.

30. DISTOMUM CLAVATUM Rudolphi.

(Plate LIII, figs. 8-11.)

Distomum clavatum DIESING, Syst. Helm., I, p. 366; Nachtr. zur Revis. d. Myzohelm., p. 431.—WAGENER, Troschel's Archiv., XXVI, I, p. 182, pl. VIII, figs. 11, 12.—COBBOLD, Jour. Linn. Soc., IX, pp. 200-205.—JOURDAN, Revue sc. Natur. Montpellier, 1881, II, pp. 438-449, pls. VII, VIII [Von Linstow, Compend. d. Helminth. and Nachtrag to Compend.].—CARUS, Prodr. Faune Mediterr., I, p. 131.—STOSSICH, Dist. d. Pesc., p. 46.

I refer a lot of distoma, ten in number, from the stomach of the swordfish (*Xiphias gladius*), United States National Museum (No. 4846), to this species. The host was taken by the United States Fish Commission (1883) trawl lines, station 2091, steamer *Albatross*.

The specimens are all nearly of the same size. The largest specimen (alcoholic) presented the following dimensions: Length, 18 mm.; diameter of head, 1.75; diameter of body at ventral sucker, 4.5; diameter of body behind ventral sucker, 4.2; diameter of mouth, 1.75. Ventral sucker, 5.5 long and 4.5 broad; aperture of ventral sucker, 2.5 long and 1.8 broad; breadth of neck, 0.25.

The color is dark brown, approaching dark olivaceous in posterior half of body proper. Body and neck for most part transversely wrinkled, in some simply roughened, irregularly rugose in posterior region. Neck much more slender than body, not quite half the length of the body, strongly arched, cylindrical, more or less flattened or even concave on under side. Mouth circular with wrinkled or puckered margin, opening ventrally. Ventral sucker sessile, much larger than oral, irregularly corrugated, with deep cavity and oblong-elliptical aperture, its longer axis coinciding with the longitudinal axis of the body. Genital aperture about midway between oral and ventral sucker. Body proper nearly cylindrical or only slightly appressed, slightly arcuate, enlarging near its posterior third and ending in a blunt point in which there is a minute terminal pore, usually profoundly wrinkled transversely.

The mouth cavity is deep and communicates almost immediately with the pharynx. Testes two, lying close together and in specimen examined both touching posterior edge of ventral sucker, and together filling body cavity from dorsal to ventral wall. Behind the testes lie the folds of the uterus filled with minute golden-brown ova, which are 0.034 and 0.024 mm. in the two principal diameters. Several ova were noticed with a cap or opercle at one end. (Fig. 11.) In longitudinal median vertical section this organ looks like a sacculated lumen filled with dark granular material. In posterior transverse section the two lumens of the intestinal crura appear in the midst of the vitellaria, laterally

placed with reference to each other, with their walls, in section exposed, contiguous. The vitellaria also extend forward on each side of the uterine folds.

Transverse and longitudinal sections reveal the following facts with regard to the arrangement of the vessels of the excretory and digestive systems: A plexus of anastomosing vessels is seen in front of the pharynx (Fig. 8), from which the two lateral vessels of the intestine are soon differentiated. The pharynx follows the oral sucker immediately and opens into a short œsophagus (Fig. 10) which extends posteriorly for a short distance in a blind prolongation, anteriorly it communicates with the two intestinal vessels. (Fig. 9.) The remaining vessels of the plexus, which I take to represent the excretory system, continue as several vessels for some distance back of the pharynx, but appear as only two principal lateral vessels in sections about the anterior limit of the ventral sucker. In sections through the ventral sucker and testes the longitudinal vessels are much compressed and crowded against the body wall. In the posterior half of the body the intestinal tracts occupy the greater part of the space, are compressed laterally, and contain a very dark-brown or black food material. The walls of the intestine are very much folded, even amounting almost to distinct rami, and are beset with distinct villi, 0.041 mm. in depth. The excretory vessels are indistinct in sections of the middle of the body; there is, however, a very prominent posterior vessel which terminates in a distinct pore.

The vitellaria in the serial sections begin as small brownish-yellow tubular masses in the vicinity of the testes, where they are arranged laterally near the periphery. Behind the testes they are more abundant, but nowhere very voluminous.

The body wall is very thick and muscular, and the body cavity back of the testes mainly occupied by the very large intestinal vessels.

31. *DISTOMUM* species (larva).

(Plates LIII, figs. 12, 13; LIV, fig. 1.)

No. 4871, U.S.N.M. From pericardium of *Stizostedion canadense*, Washington, Pennsylvania (market), fish from Lake Erie; collected March 7, 1891.

These specimens are small, immature, in capsules, 0.35 to 0.85 mm. in diameter. Diameter of oral sucker, 0.094 mm.; diameter of ventral sucker, 0.055 mm. The specimens are too immature for identification.

Sections of a cyst with its contained embryo show that the outer half of the wall of the cyst is built up of concentric layers of connective tissue secreted from the tissues of the host; the inner half of the wall consists of an embryonic envelope, which communicates with the embryo by a special duct. The opening of this duct, as relates to the embryo, is ventral, and is situated a little way back of the ventral sucker.

32. MONOSTOMUM ORBICULARE Rudolphi.

(Plate LIV, figs. 2-5.)

Monostomum orbiculare DIESING, Syst. Helm., I, p. 320.—PARONA, Intorno al Monostomum, Torino, 1887.

No. 4872, U.S.N.M. The description of this species given by Diesing is very brief, and, like Dujardin's¹ description, is taken directly from Rudolphi's brief account. I have not seen Parona's paper. The worm is described by the older helminthologists as being from 2 to 3 mm. in length, orbicular, convex above, concave or rarely plane below; oral aperture terminal oval oblong sometimes slightly projecting.

Specimens of *Monostoma*, 14 in number, from the intestine of *Lobotes surinamensis* (Woods Holl, Massachusetts, August 6, 1887), agree with the above synopsis of specific characters.

Measurements of a typical specimen, in life, yielded the following results: Length, 2.7 mm.; diameter of sucker, 0.26; breadth of body at sucker, 0.52; maximum breadth, 1; breadth near posterior end, 0.26; distance of sucker from anterior end of body, 0.04; diameter of reproductive aperture at posterior end, 0.1. Two other specimens were measured with very nearly corresponding results, the diameter of the sucker being exactly the same in each case. The measurements were made on specimens which were lying freely in water. The specimens present but little variety of form. They are ovate, broadest about the anterior third, tapering very little toward the anterior end, which is broadly rounded and usually marked with very fine transverse lines, making a finely serrate outline when flattened under the compressor. They taper gradually toward the posterior end, which is bluntly rounded and carries the aperture of the generative organs at its tip. The oral sucker is on the ventral side very near the anterior margin, its diameter equal to about one-tenth the length of the body.

The uterus is voluminous and filled with small ova which are nearly globular. The folds of the uterus lie for the most part along the left side of the body, but there is a large mass of ova near the posterior end which lies mainly on the left side of the middle line. The testes are two, oval, and lie about the middle of the body on the right side. The ovary is a globular organ, also lying on the right side at about the anterior third. The vitellaria lie along both right and left sides of the anterior third and across the anterior end behind the sucker. In life they appear to be branched organs of a light purple color. The long, oval, muscular cirrus pouch lies near the median line, about the posterior third of the body, its aperture directed posteriorly and a little to the left. The muscular pharynx lies a little to the right of the median line and a little in front of the middle of the body. It presents the appearance of a strong globular bulb connected with a tubular anterior prolongation less muscular, apparently a part of the œsophagus. The

¹ Hist. Helm., p. 360.

œsophagus, from the mouth to the pharynx, was not very clearly shown. So far as it could be made out, it is as shown in the sketch. (Fig. 3, *ph.*)

The ova are nearly globular, 0.018 and 0.015 mm. in the two diameters in life, 0.17 and 0.15 in the two diameters in alcoholic specimens.

Ova were observed making their escape from the right side of the terminal pore of a living specimen.

The bodies of all the specimens were flat, depressed, and somewhat convex above.

EXPLANATION OF PLATES.

<i>a.</i> oral sucker.	<i>p g.</i> prostate gland
<i>c.</i> cirrus.	<i>ph.</i> pharynx.
<i>c p.</i> cirrus pouch.	<i>s g.</i> shell gland.
<i>ex.</i> excretory vessel.	<i>s r.</i> seminal receptacle.
<i>g.</i> uterine gland.	<i>t.</i> testis.
<i>i.</i> intestine.	<i>u.</i> uterus.
<i>m.</i> mouth.	<i>r d.</i> vas deferens.
<i>o.</i> ovary.	<i>rd'.</i> vitelline duct.
<i>æ.</i> œsophagus.	<i>v g.</i> vitelline gland.
	<i>r s.</i> ventral sucker.

Sketches on which the enlargement is not otherwise noted were made with an Abbe camera lucida and Zeiss objectives and eye pieces, as indicated in the explanations. They were reduced about one-fourth in linear dimensions in the process of printing. Except where otherwise stated, all sketches are by the author.

PLATE XL.

Nitzschia papillosa, new species, from gills of *Acipenser sturio*.

- Fig. 1. Sketch of alcoholic specimen, distorted, posterior third side view, anterior two-thirds ventral view. Enlarged about eighteen times.
2. Ventral view of another specimen, alcoholic. Enlarged about eighteen * times.
3. Ventral view of head greatly enlarged. Enlarged about two hundred and twenty-five times; *m*, mouth; *b s*, buccal sucker.
4. Everted cirrus. Enlarged about two hundred and twenty-five times.
5. Transverse section through ovary. Zeiss 2/A, draw-tube open.
6. Longitudinal, horizontal section through ovary and testis. Zeiss 2/A, draw-tube open.

Tristomum lave Verrill, from gills of *Gymnosarda pelamys*.

7. Dorsal view, alcoholic specimen. Enlarged about six times.
8. Ventral view, alcoholic specimen. Enlarged about six times.

Tristomum coccineum Cuvier, from gills of *Xiphias gladius*.

9. Ventral view of portion of anterior. Enlarged about six times; from sketch of living specimen by Margaret B. Linton.
- b. s.*, buccal sucker; *p.*, granules of marginal papillæ; *r.*, vagina.

Octoplectanum affine, new species, from mouth of *Paralichthys dentatus*.

10. Ventral view of alcoholic specimen. Enlarged about three times.
11. Single plectanum of same. Zeiss 2/A, draw-tube open.
12. Hooks from genital atrium: *a*, Zeiss 2/D, draw-tube open; *b* and *c* still more highly magnified.
13. Ovum. Enlarged one hundred and eighty times.

PLATE XLI.

Octoplectanum affine, new species.

- Fig. 1. Ventral view anterior end, alcoholic. Zeiss 2/A, draw-tube open; *h*, armature of genital atrium.
2. Ventral view of a single plectanum, life, much enlarged.
3. Dorsal view of posterior end, showing plexus of vessels; from sketch of living specimen by Margaret B. Linton.
4. Longitudinal vertical section through ovary. Zeiss 2/A, draw-tube open.
5. Developing ova from same. Zeiss 2/D, draw-tube open.

Diplostomum cuticole Diesing.

6. Ventral view of specimen removed from cyst; from *Eupomotis pallidus*. 2/A, draw-tube closed.
7. Specimen from *Lepomis auritus*. Enlarged about fifty times.
8. Ventral sucker of specimen shown in Fig. 6. Zeiss 2/D, draw-tube closed.
9. Ventral sucker of another specimen from *Eupomotis pallidus*. Zeiss 2/D, draw-tube closed.
10. Cyst with inclosed embryo, from *Eupomotis pallidus*. Enlarged about sixteen times.

PLATE XLII.

Diplostomum cuticole Diesing.

- Fig. 1. Ventral view of specimen from *Lepomis auritus*. Enlarged about thirty times.
2. Cyst with inclosed embryo, from same. Enlarged about twenty-two times.
3. Oral sucker of embryo from same. Enlarged about two hundred and twenty-five times.
4. Oral sucker and pharynx of specimen from *Eupomotis pallidus*. Zeiss 2/D, draw-tube closed.
5. Heart of *E. pallidus*, with cysts. Enlarged three times.

Distomum tornatum Rudolphi, from *Coryphæna hippurus*.

6. Ventral view of alcoholic specimen. Enlarged eight times.
7. Side view of anterior part of body. Enlarged thirty times.
8. Side view of specimen, stained and mounted entire in Canada balsam. Enlarged about six times. *a*. Ova Zeiss 4/D, draw-tube open.
9. Longitudinal section, horizontal, through testes and ovary; anterior end to the right. Specimen from same lot as Nos. 6 and 7. Zeiss 2/A, draw-tube open.
10. Transverse section of specimen from same lot, through anterior testis and seminal receptacle. Zeiss 2/A, draw-tube open.
11. Transverse section of same specimen through posterior margin of ventral sucker. Zeiss 2/A, draw-tube open.
12. Longitudinal vertical section through specimen from same lot, showing cirrus. Zeiss 2/A, draw-tube open.

Distomum ocreatum Molin, from *Pomatomus saltatrix*.

13. Ventral view, alcoholic. Enlarged about thirty-two times.

Distomum rufoviride Rudolphi, from *Roccus lineatus*.

14. Section of anterior sucker and pharynx. Zeiss 2/A, draw-tube open.

PLATE XLIII.

Distomum rufoviride Rudolphi.

- Fig. 1. Longitudinal vertical section through head. *l.* lip. Zeiss 2/A, draw-tube open.
2. Section through ovary and part of testis. Specimen somewhat distorted, and section not quite at right angles to axis of body. Zeiss 2/A, draw-tube open.
3. Transverse section through vas deferens, prostate gland, and uterus. 2/D, draw-tube open.
4. Diagram of cirrus, vas deferens, prostate gland, seminal receptacle, and uterus.

Distomum laeve, new species, from *Macrourus bairdii*.

5. Ventral view of specimen, alcoholic. Enlarged six times.
6. Side view of same. Enlarged six times.
7. Ventral view of anterior end. Enlarged about one hundred and eighty times.
8. Transverse section through ovary, vitelline glands, and posterior excretory vessel. Zeiss 4/A, draw-tube open.

PLATE XLIV.

Distomum laeve, new species.

- Fig. 1. Dorsal view, partly diagrammatic. Enlarged forty times. *sr* anterior, and *sr'* posterior seminal receptacle, *ex* posterior excretory vessel, *ex'*, *ex'*, anterior branches of same.

Distomum monticellii, new species, from *Remora remora*.

2. Ventral view of living specimen. Enlarged twenty times.
3. Diagrammatic side view of anterior end.
4. Cirrus pouch and seminal receptacle as seen through the wall of the body of a specimen made transparent with oil of cloves.
5. Transverse section of body through the posterior edge of the genital aperture. Zeiss 4/A, draw-tube open. *g. a.* genital aperture.
6. Transverse section through anterior half of ventral sucker. Zeiss 2/A, draw-tube open.
7. Transverse section through posterior part of ovary and anterior lobes of vitelline gland.
8. View of ventral sucker in life, showing velum.

Distomum grandiporum Rudolphi, from *Anguilla chryssa*.

9. Sketch of specimen compressed, stained and mounted in Canada balsam. Enlarged twenty-seven times.

PLATE XLV.

Distomum auriculatum Wedl?, from *Acipenser rubicundus*.

- Fig. 1. Ventral view of specimen in oil of cloves. Enlarged twenty-two times.
2. Same of another specimen. Enlarged twenty-seven times.
3. Dorsal view of head of same. Enlarged thirty times.
4. Transverse section of body near base of cirrus pouch. Zeiss 4/A, draw-tube open.
5. Transverse section of body through testis. Zeiss 4/A, draw-tube open.
6. Transverse section near posterior end of body. Zeiss 4/A, draw-tube open.
7. Transverse section of excretory vessel at terminal pore. Zeiss 2/D, draw-tube open.

Distomum macrocotyle Diesing, from *Mola mola*.

- Fig. 8. Side view of alcoholic specimens, slightly enlarged.
9. Partial sketch of longitudinal vertical section of body. A specimen was cut, bisected longitudinally with a razor, and the inner aspect of the left half sketched. Enlarged about eight times.
 10. Transverse section through neck, showing branches of the intestine, vas deferens, uterus, etc. Zeiss 2/A, draw-tube open.

PLATE XLVI.

Distomum macrocotyle Diesing.

- Fig. 1. Transverse section toward posterior end of body. Zeiss 2/A, draw-tube open.
2. Longitudinal vertical section through posterior end of body, showing common longitudinal vessel; *i. e.*, the two vessels *i. i.* in Fig. 1, anastomose near the posterior end of the body.
 3. Diagram of cirrus, vas deferens, uterus, etc.
 4. Transverse section of uterus. Zeiss 2/D, draw-tube open.
 5. Transverse section of vas deferens and portion of prostate gland. Zeiss 2/D, draw-tube open.

Distomum gracile Diesing, from *Lepomis auritus* and *Eupomotis pallidus*.

6. Ventral view of specimen from gills of *E. pallidus*. Enlarged thirty times, *u.* developing uterus. This is probably a younger stage of the adult which Wright found in the mouth of the American bittern and referred provisionally to *D. heterostomum*.
7. Ventral view of specimen from *L. auritus*. Enlarged fifteen times.
8. Side view of anterior end of same. Enlarged fourteen times.

PLATE XLVII.

Distomum lageniforme, new species, from *Remora remora*.

- Fig. 1. Dorsal view, life. Enlarged three times. See text for color notes.
2. Ventral view of same after lying some time in water. Enlarged three times. This bears a strong superficial resemblance to *D. cymbiforme* Rudolphi, from *Chelonia* and *Thalassochelys*, but in view of the great difference of hosts it is not likely that the species are identical.

Distomum simplex Rudolphi? from *Microgadus tomcod* and *Hemitripteris americanus*.

3. Ventral view of specimen from *Microgadus* made transparent with acetic acid. Enlarged forty-five times.
4. Ova of same, acetic acid. Zeiss 2/D, draw-tube open.
5. Ventral view of specimen from *Hemitripteris*. Enlarged twenty-two times.
6. Transverse section of body of specimen from same host through ovary. Zeiss 2/A, draw-tube open.
7. Longitudinal horizontal section of body of specimen from same host showing ovary, testis, etc. Zeiss 2/A, draw-tube open.

Distomum pallens Rudolphi from *Alutera schoepfi*.

8. Side view. Enlarged about five times.
9. Ventral view. Enlarged twenty-seven times.

Distomum valdeinflatum Stossich from *Alutera schapfi*.

- Fig. 10. Ventral view of living specimen. Enlarged twenty-seven times.
 11. View of mouth with circumoval spines. Zeiss 2/A, draw-tube open.
 12. Sketch of individual compressed. Enlarged twenty-seven times.
 13. Spines from back of neck. Zeiss 2/D, draw-tube closed.
 14. Single oral spine. Zeiss 2/D, draw-tube closed.

PLATE XLVIII.

Distomum valdeinflatum Stossich.

- Fig. 1. Part of transverse section just behind the pharynx. Zeiss 2/A, draw-tube open.
 2. Portion of body wall of neck. Zeiss 4/D, draw-tube open.

Distomum contortum, Rudolphi host not known, probably *Mola mola*.

3. Side view of alcoholic specimen. Enlarged fourteen times.
 4. Side view of head of same showing oval sucker with pharyngeal papilla. Enlarged forty-six times.
 5. Tuberculated spines of neck. Enlarged two hundred and twenty-five times.
 6. Longitudinal vertical section of head showing cirrus. Zeiss 2/A, draw-tube open.
 7. Transverse section near posterior end of body. Zeiss 2/A, draw-tube open.

Distomum nigroflavum Rudolphi, from *Mola mola*.

8. Side view, alcoholic specimen. Enlarged four and one-half times. This specimen has numerous folds of the uterus in the pedicel of the ventral sucker.
 9. Side view of another specimen. Enlarged nine times. In this specimen the testes are juxtaposed.
 10. Side view of a specimen with testes remote. Enlarged three times.
 11. Transverse section of body a short distance back of ventral sucker, showing testis, seminal receptacle, prostate and vitelline glands, etc. Zeiss 2/A, draw-tube open.

PLATE XLIX.

Distomum nigroflavum Rudolphi.

- Fig. 1. Longitudinal vertical section, showing posterior testis, ovary, shell gland, etc. Enlarged about thirty times. The granular contents of the longitudinal vessel showing a few of the characteristic crystals noted in text. The latter are greatly enlarged in the sketch.
 2. Transverse section of body back of ovary. Zeiss 2/A, draw-tube open.

Distomum foliatum, new species, from *Mola mola*.

3. Side view, alcoholic. Enlarged nine times.
 4. Longitudinal vertical section, enlarged about thirty times, showing testes, ovary, shell-gland, vitelline glands, uterus, etc.
 5. Transverse section of vas deferens and prostate gland; enlarged from Fig. 3, cells partly diagrammatic. Zeiss 2/D, draw-tube open.

PLATE L.

Distomum foliatum, new species.

- Fig. 1. Side view of specimen. Enlarged about twenty-six times.
 2. View of neck from above. Enlarged about four and one-half times.
 3. Front view of pedicel and ventral sucker. Enlarged about four and one-half times.

PLATE LI.

Distomum foliatum, new species.

- Fig. 1. Part of section of ventral sucker as seen in a transverse section of the body. Zeiss 2/A, draw-tube closed.
2. Part of section of ventral sucker, from longitudinal vertical section of the body. Zeiss 2/A, draw-tube closed.
3. Transverse section of the neck through the pharynx. *cr.* nuchal crest. Zeiss 2/A, draw-tube open.
4. Transverse section of neck a little farther back than fig. 3, *cr.* nuchal crest. Zeiss 2/A, draw-tube open.

NOTE.—The vessels *ii* in this and the preceding figure have been identified as intestinal rami, although the connection between them and the œsophagus could not be demonstrated from the sections. They originate in front of the pharynx as shown in Fig. 3, where they already have the characteristic structure of intestinal vessels. It is probable that in this and the preceding species, as well as in *D. macrocotyle*, the communication between œsophagus and intestinal rami is something like that demonstrated in *D. clavatum*. Plate LIII, figs. 8-10.

Distomum nitens, new species, from *Tylosurus caribbaeus*.

5. Lateral view, partly diagrammatic, specimen somewhat distorted by compression. Enlarged about twenty-three times.
6. Ova. Zeiss 2/D, draw-tube open.

PLATE LII.

Distomum nitens.

- Fig. 1. Cirrus bulb as seen through transparent walls of body. *rd'* portion of vas deferens inclosed within muscular walls of cirrus bulb. Enlarged forty-five times.

Distomum tenue, new species, from *Roccus lineatus*.

2. Superficial view, life. Enlarged twenty-five times. Sketch by Margaret B. Linton.
3. View of same, compressed. Enlarged twenty-five times. Sketch by Margaret B. Linton.
4. Partial view of ventral sucker of same. Enlarged two hundred and twenty-five times. Sketch by Margaret B. Linton.
5. Sketch of alcoholic specimen, enlarged.
6. Ventral view of anterior end of same, more enlarged.
7. Ventral view of alcoholic specimen in acetic acid. Enlarged twenty-five times.
8. Transverse section of body through ovary. *t.* anterior edge of testis. Zeiss 2/A, draw-tube open.

Distomum tenue tenuissime, new subspecies, from *Roccus lineatus*.

9. Side view of alcoholic specimen. Enlarged twelve times.
10. Ventral view of another specimen. Enlarged twenty-four times.
11. Head of same, enlarged. Zeiss 2/A, draw-tube open.
12. Cysts of connective tissue of host containing ova.

PLATE LIII.

Distomum, species, from *Lagocephalus lævigatus*.

- Fig. 1. Ventral view of specimen in oil of cloves. Enlarged twenty-two times.
2. Ovum of same. Zeiss 4/D, draw-tube open.

Distomum racion Cobbold, from *Gadus callarias*.

- Fig. 3. Ventral view of specimen. Enlarged twenty-seven times.
4. Squamose spines of neck. Enlarged two hundred and twenty-five times.
 5. Outline of margin of neck. Enlarged two hundred and twenty-five times.
 6. Margin of body near posterior end. Enlarged two hundred and twenty-five times.
 7. Ovum. Enlarged two hundred and twenty-five times.

Distomum clavatum Rudolphi, from *Xiphias gladius*.

8. Transverse section of body through anterior edge of pharynx. *x.* sections of vessels, which at this level have the same structure as the vessels *i. i.*, shown in the two succeeding figures to be the intestinal cruri. *n. n.* nerves? Zeiss 2/A, draw-tube closed.
9. Transverse section through middle of pharynx showing the anteriorly extending œsophagus in communication with the intestinal cruri. *n. n.* nerves? Zeiss 2/A, draw-tube closed.
10. Transverse section through the posterior edge of the pharynx, showing the communication of the œsophagus with the pharynx. *n. n.* nerves? Zeiss 2/A, draw tube closed.
11. Ova. Enlarged three hundred and seventy-five times.

Distomum species, larva encysted in *Stizostedion canadense*.

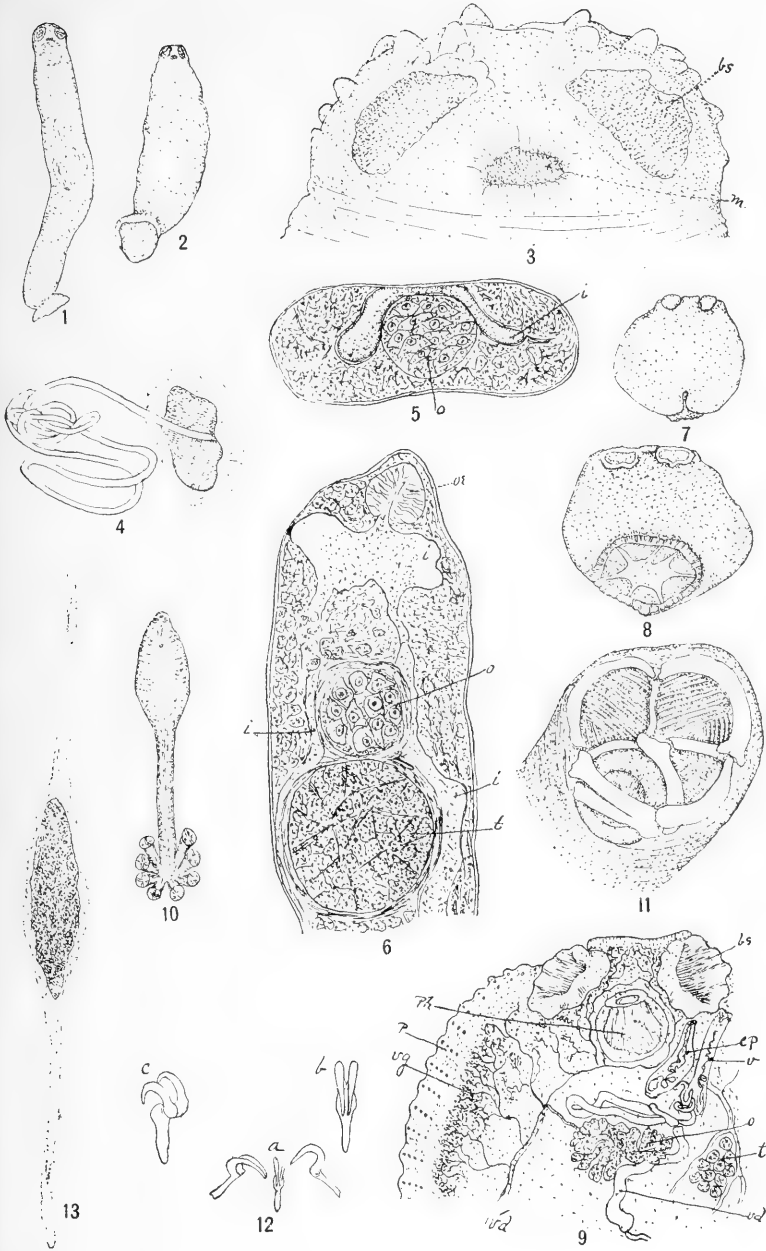
12. Longitudinal vertical section. *nd* nutrient duct. Zeiss 2/A, draw-tube open.
13. Longitudinal vertical section of posterior end through external aperture of the nutrient duct (*nd*). Zeiss 2/A, draw-tube open.

PLATE LIV. *Distomum* species.

- Fig. 1. Section of cyst with contained embryo through communication of nutrient duct with surrounding food material. Zeiss 2/A, draw-tube open. *cy.* connective tissue cyst. *gr.* granular nutritive parenchymatose layer. *np.* nutritive pore of embryo.

Monostomum orbiculare Rudolphi, from *Lobotes surinamensis*.

2. Ventral view. Sketched from living specimen by Margaret B. Linton. Enlarged forty-five times.
3. Ventral view of another specimen in oil of cloves. Zeiss 2/A, draw-tube closed.
4. Transverse section of body near posterior end. Zeiss 2/A, draw-tube open.
5. Ova. Zeiss 4/D, draw-tube open.

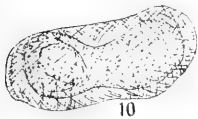
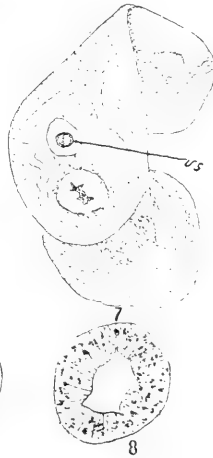
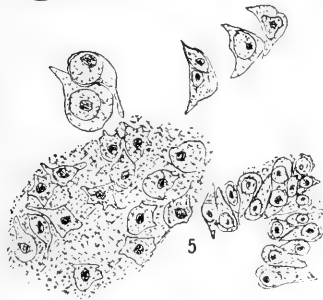
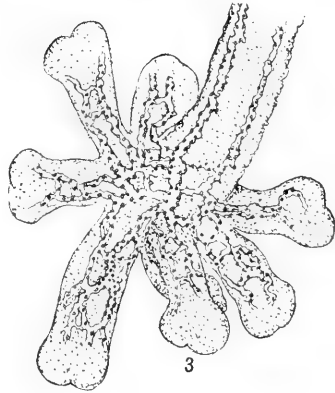
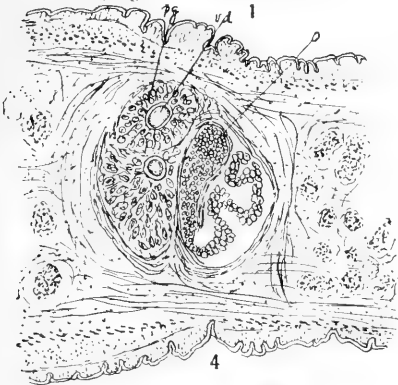
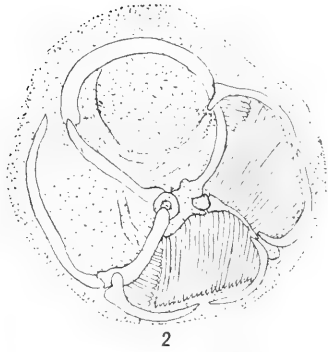
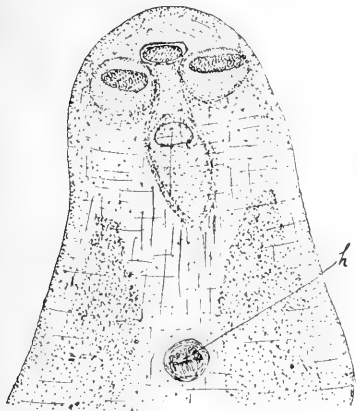


PARASITIC WORMS.

NITZSCHIA FROM STURGEON AND COD; TRISTOMUM FROM OCEANIC BONITO, SWORDFISH, AND SUNFISH (*Mola*); OCTOPLECTANUM FROM FLOUNDER.

FOR EXPLANATION OF PLATE SEE PAGE 542.



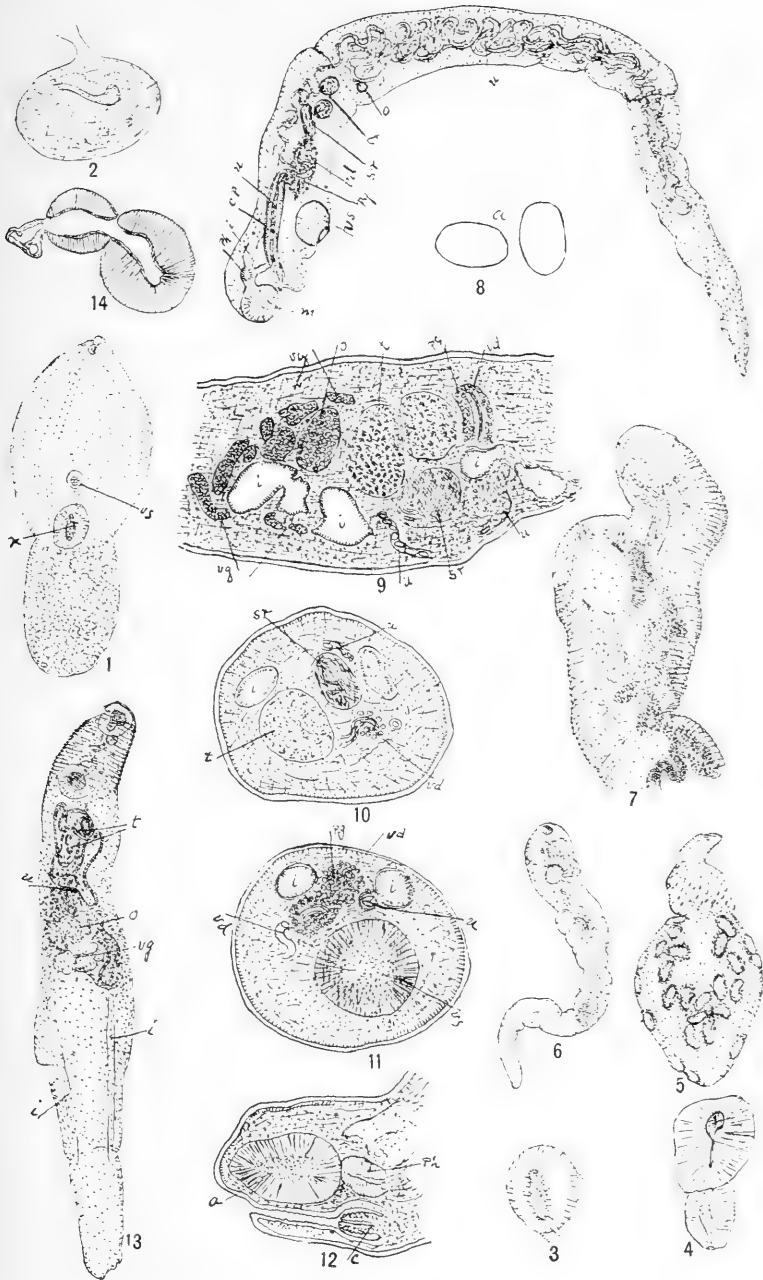


PARASITIC WORMS.

OCTOPLECTANUM FROM FLOUNDER ; DIPLOSTOMUM FROM BREAM, ETC.

FOR EXPLANATION OF PLATE SEE PAGE 543.

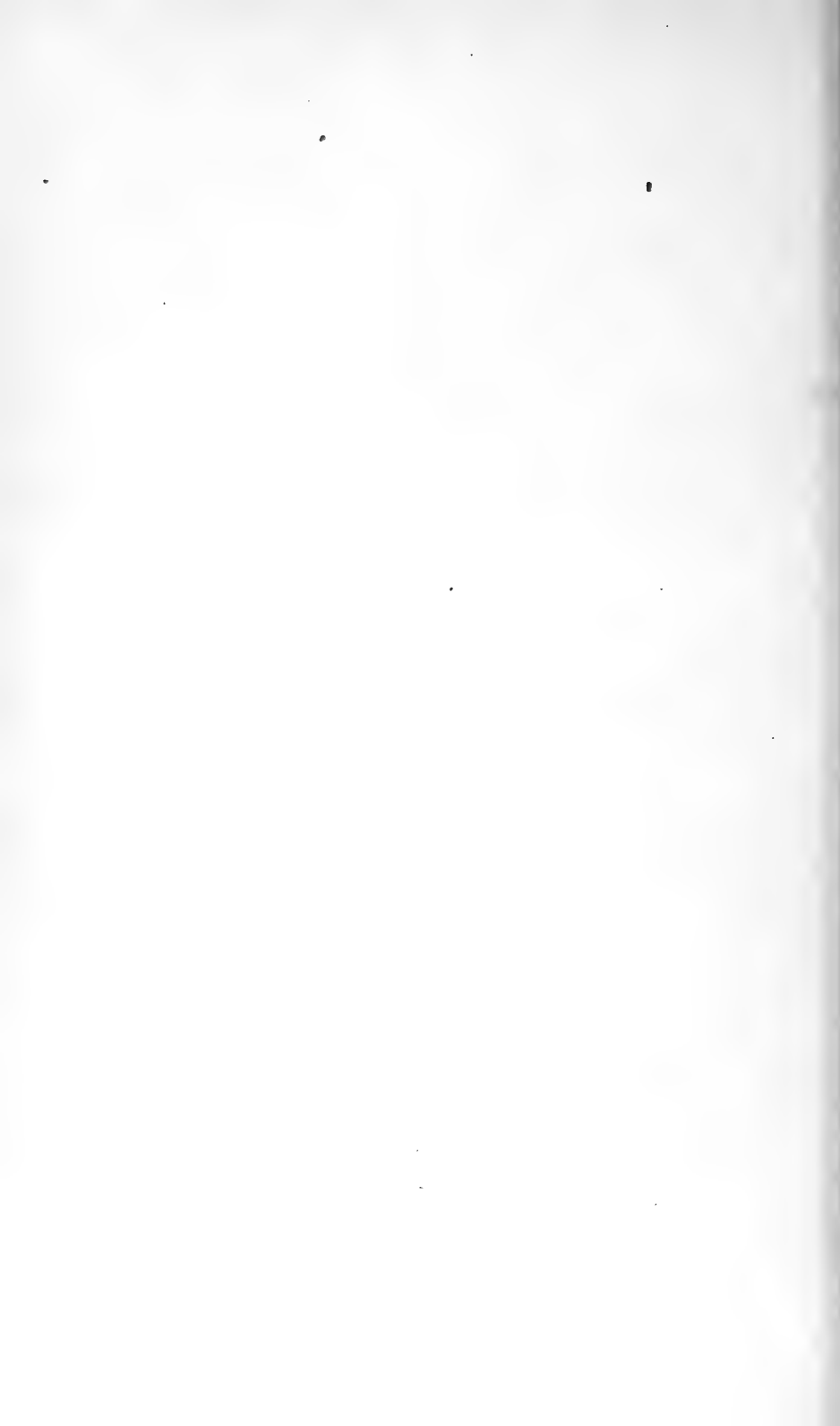


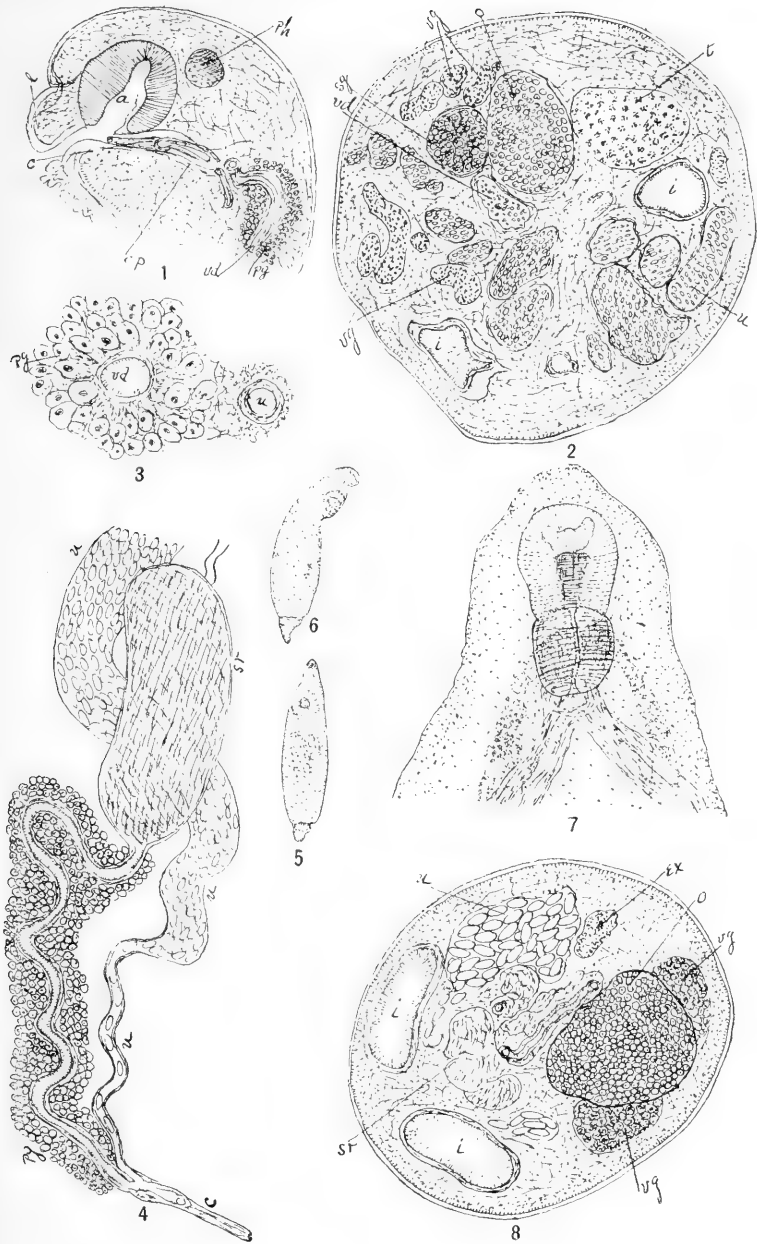


PARASITIC WORMS.

DIPLOSTOMUM FROM BREAM, ETC.: DISTOMUM FROM DOLPHIN, BLUEFISH, AND STRIPED BASS.

FOR EXPLANATION OF PLATE SEE PAGE 543.



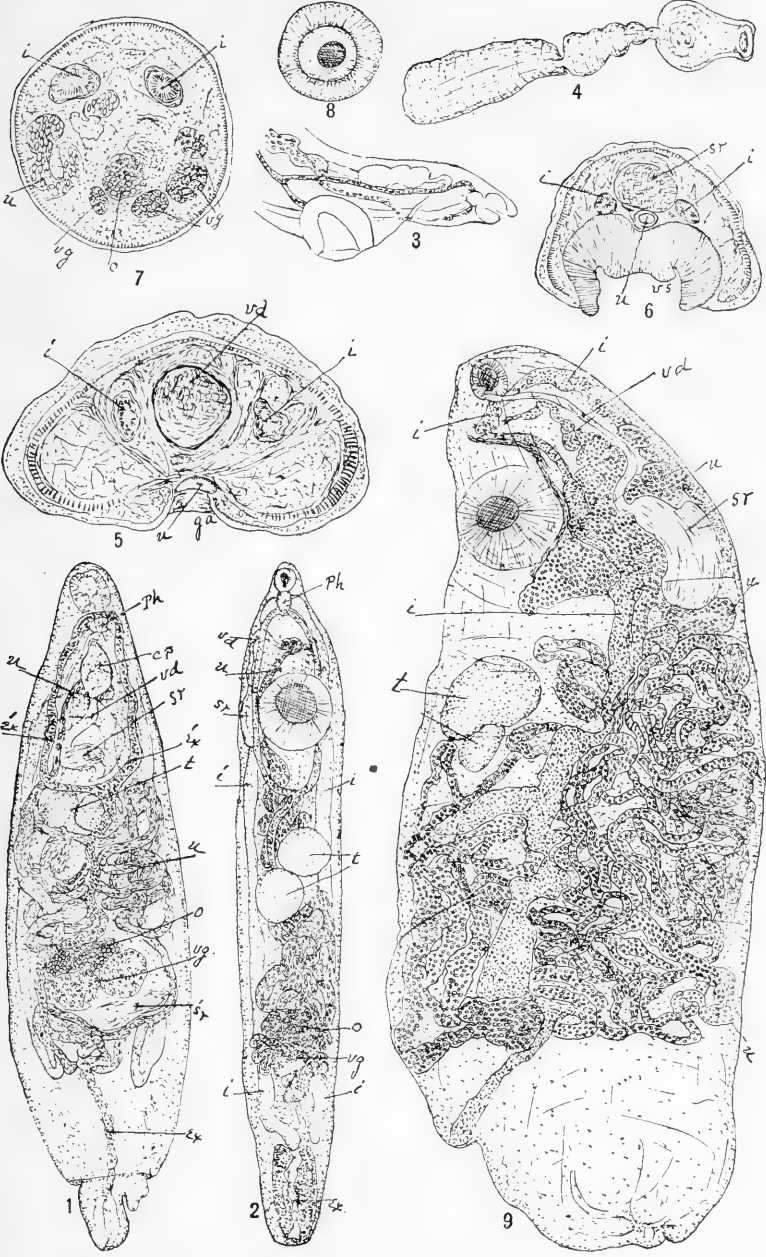


PARASITIC WORMS.

DISTOMUM FROM STRIPED BASS AND MACROURUS.

FOR EXPLANATION OF PLATE SEE PAGE 544.

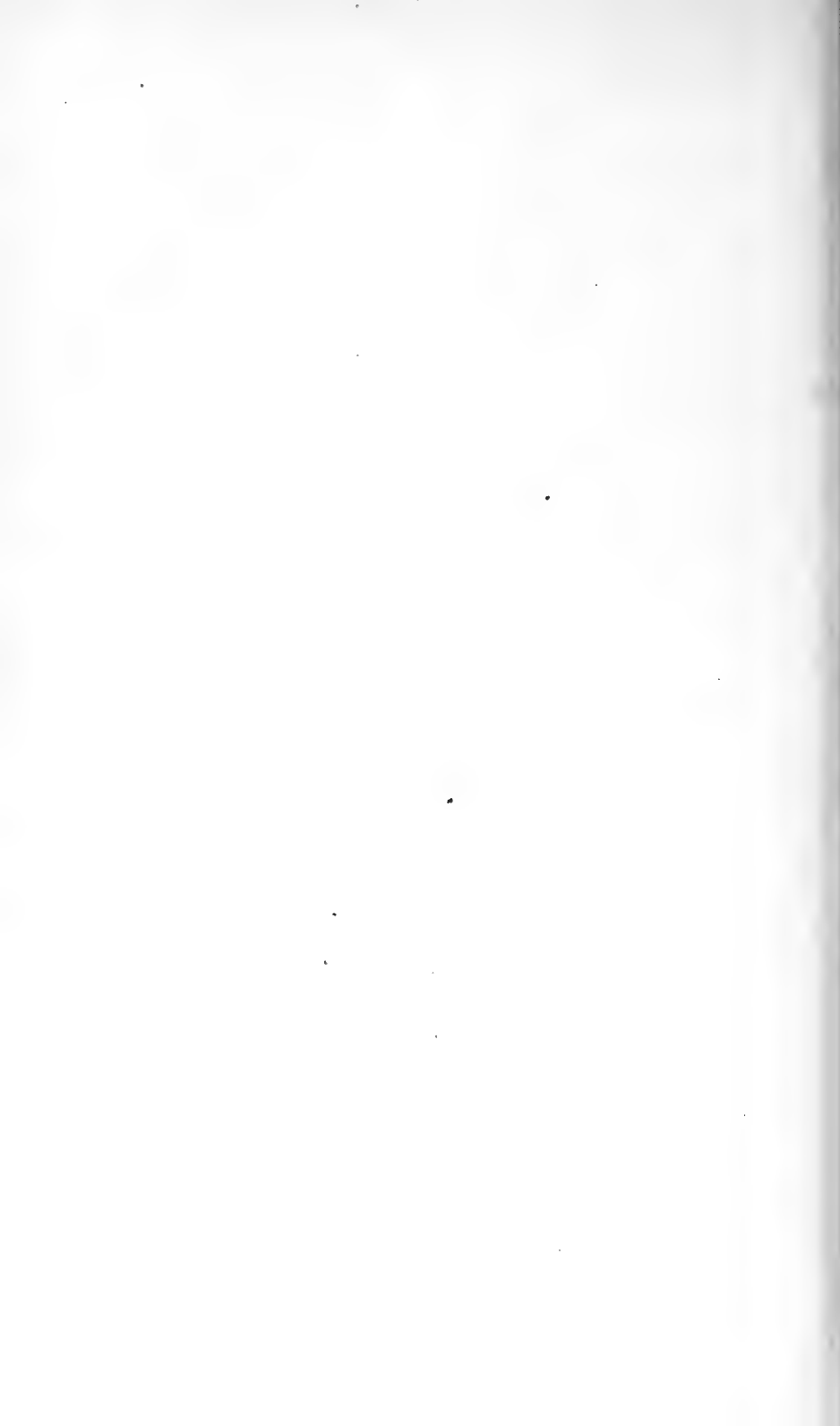


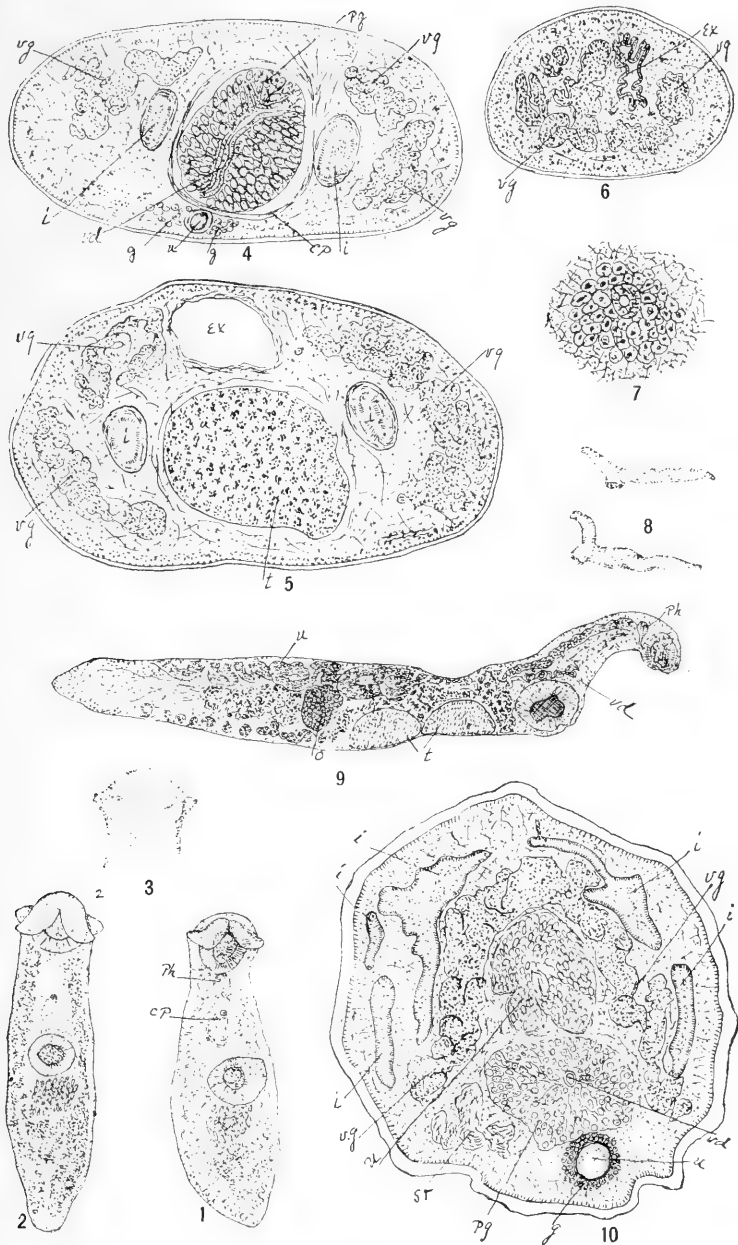


PARASITIC WORMS.

DISTOMUM FROM MACROURUS, SUCKER (*Remora*), AND COMMON EEL.

FOR EXPLANATION OF PLATE SEE PAGE 544.



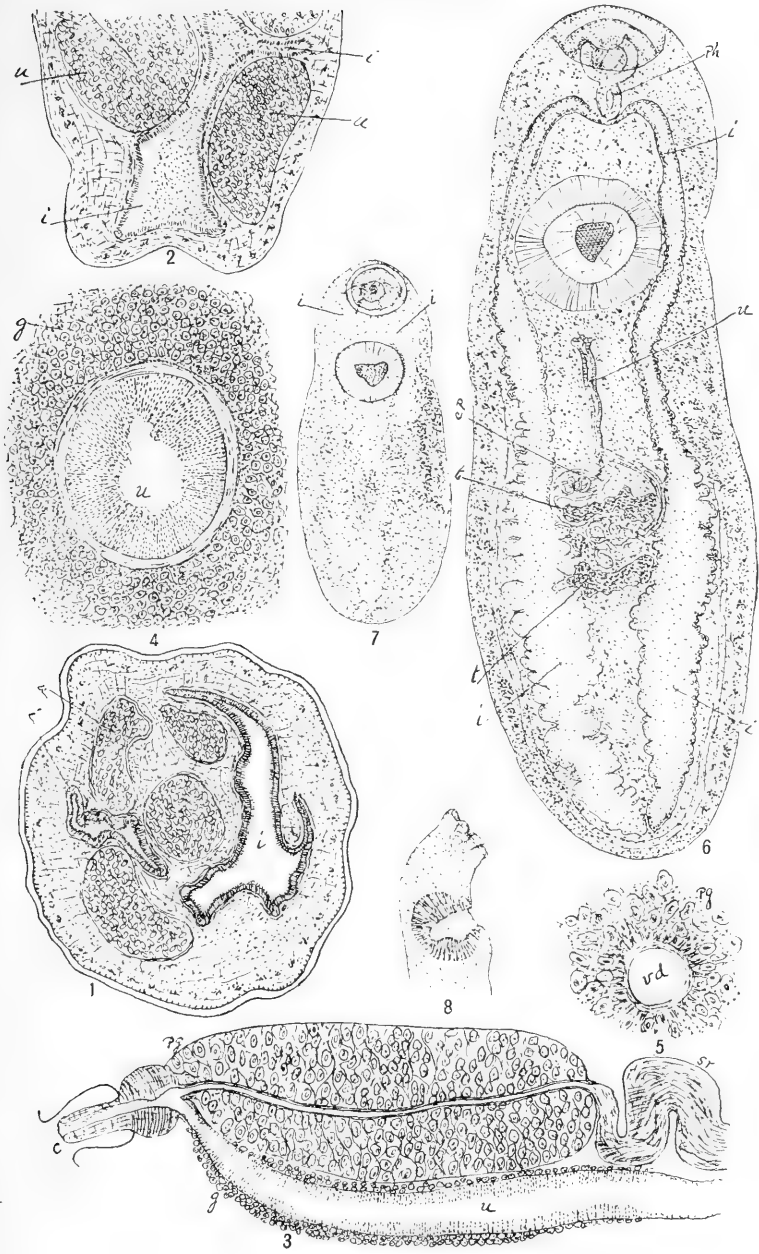


PARASITIC WORMS.

DISTOMUM FROM STURGEON AND SUNFISH (*Mola*).

FOR EXPLANATION OF PLATE SEE PAGES 544, 545.



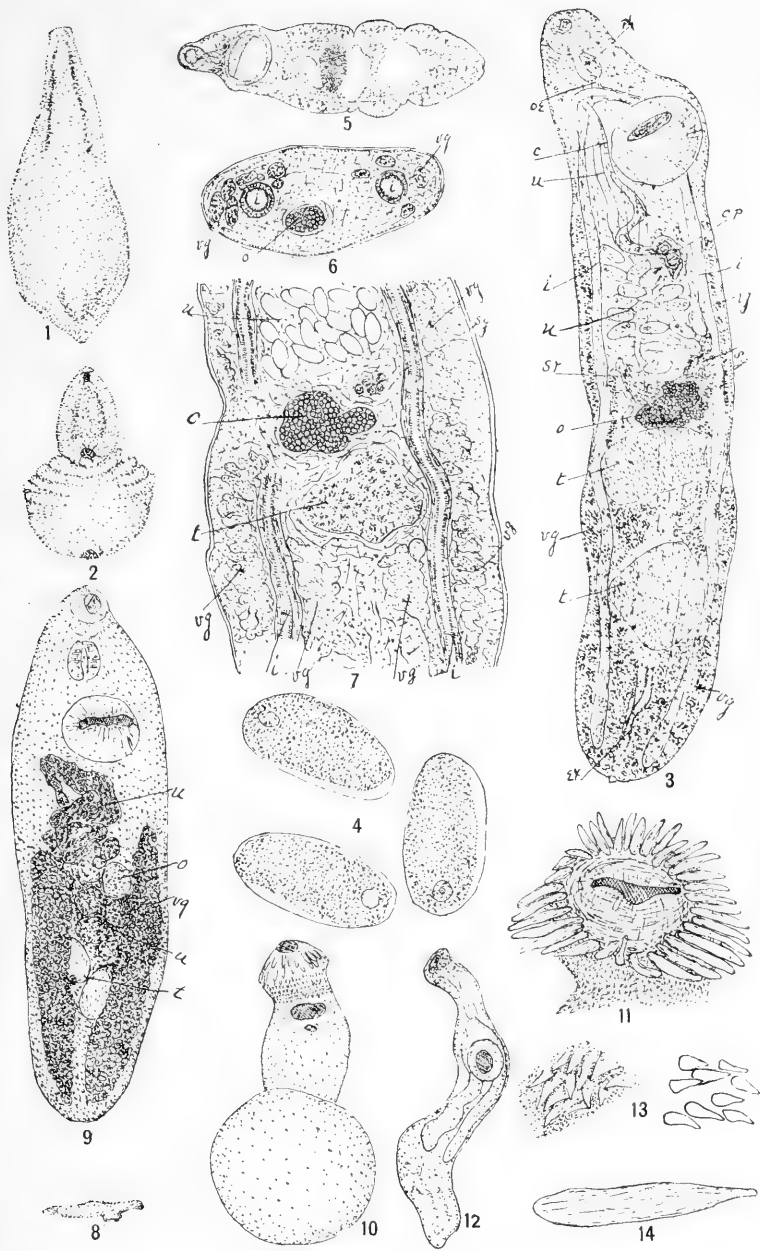


PARASITIC WORMS.

DISTOMUM FROM SUNFISH (*Mola*), BREAM, ETC.

FOR EXPLANATION OF PLATE SEE PAGE 545.



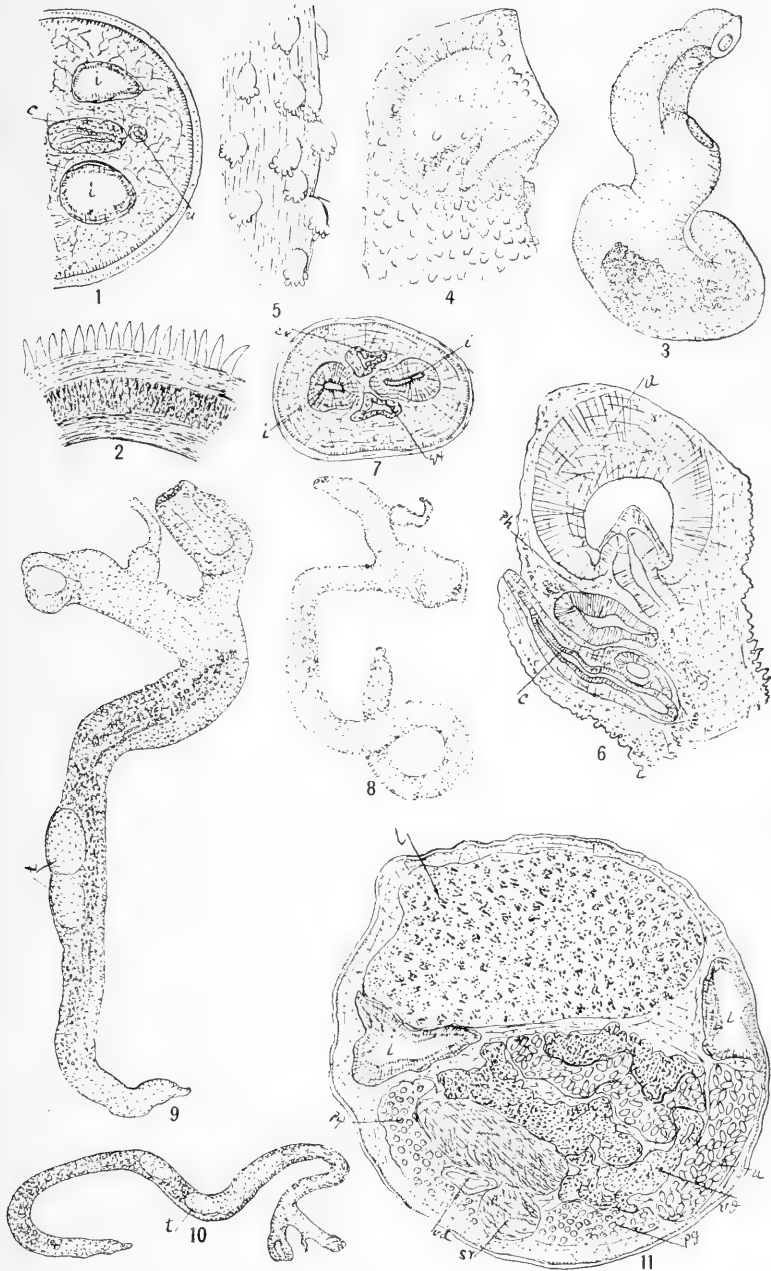


PARASITIC WORMS.

DISTOMUM FROM SUCKER (*Remora*), SEA RAVEN, AND FILEFISH.

FOR EXPLANATION OF PLATE SEE PAGES 545, 546.



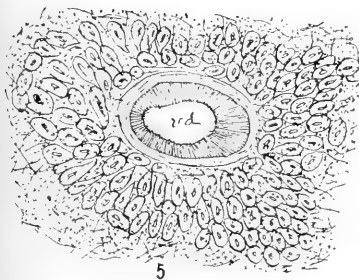
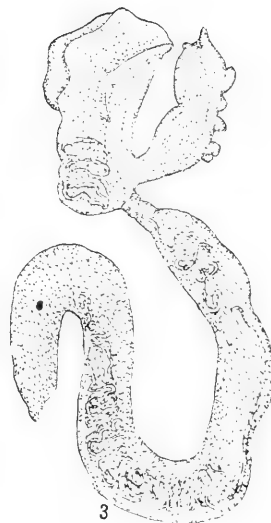
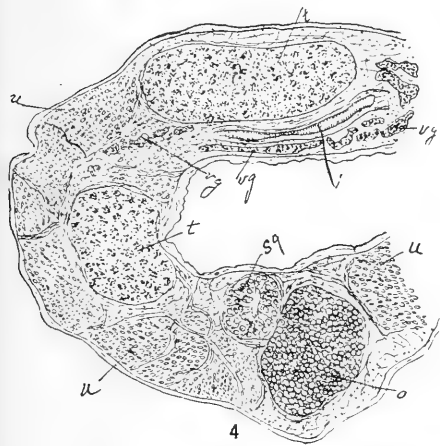
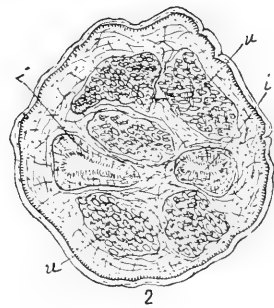
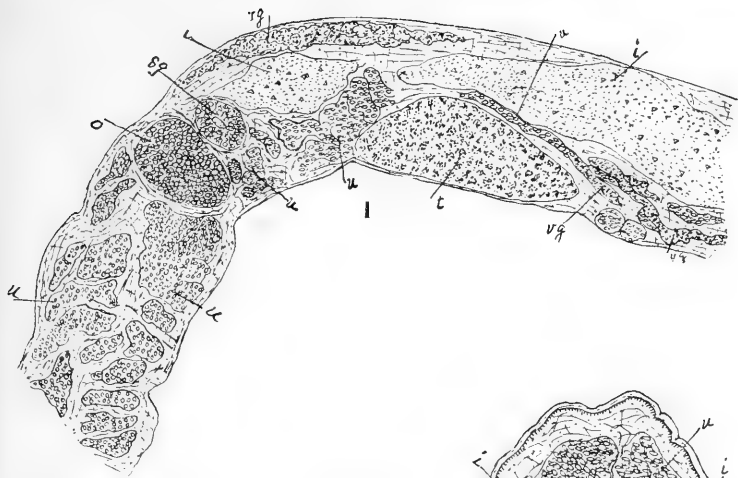


PARASITIC WORMS.

DISTOMUM FROM FILEFISH AND SUNFISH (*Mota*).

FOR EXPLANATION OF PLATE SEE PAGE 546.





PARASITIC WORMS.

DISTOMUM FROM SUNFISH (*Mola*).

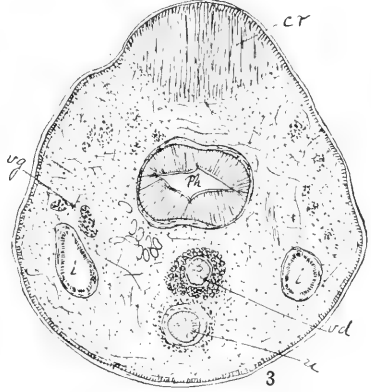
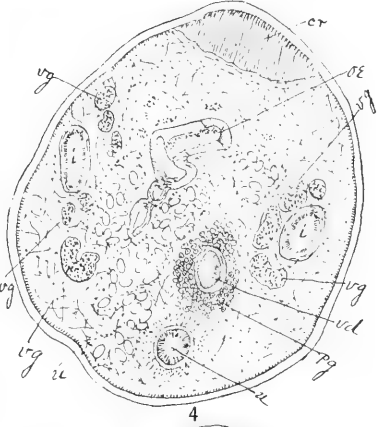
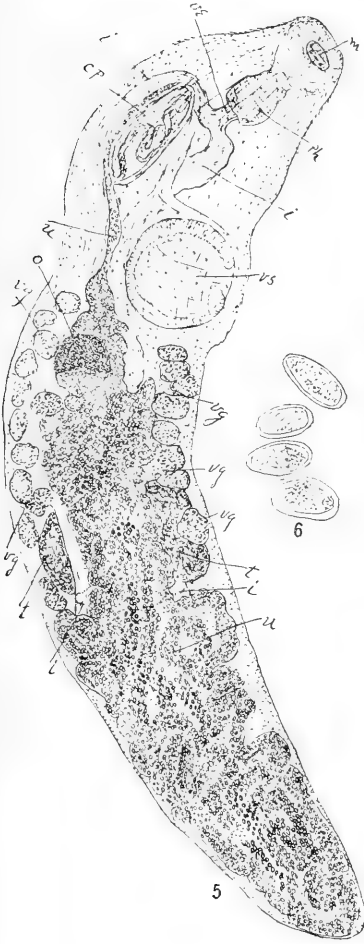
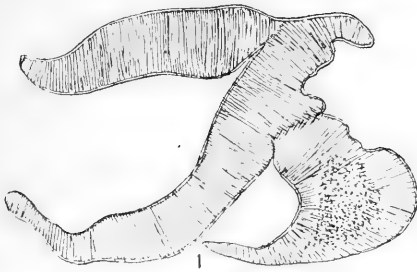
FOR EXPLANATION OF PLATE SEE PAGE 546.



PARASITIC WORMS.

DISTOMUM FROM SUNFISH (*Mola*).

FOR EXPLANATION OF PLATE SEE PAGE 546.

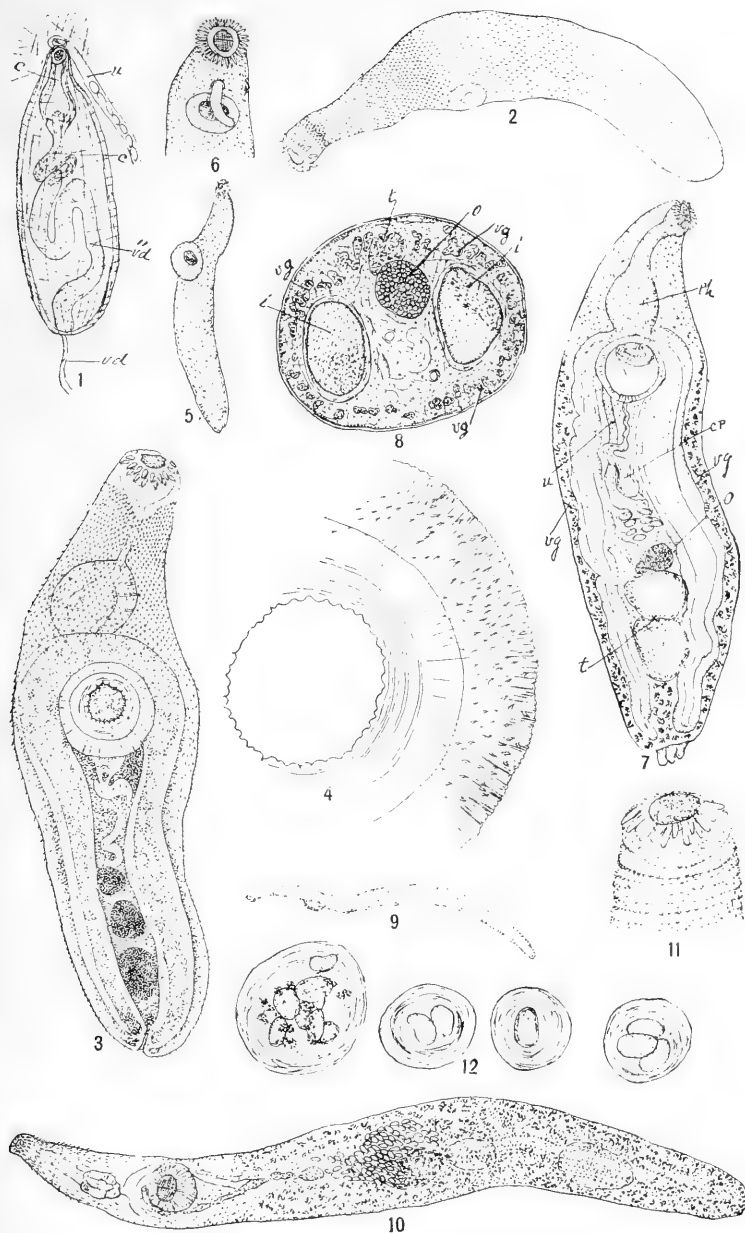


PARASITIC WORMS.

DISTOMUM FROM SUNFISH (*Mola*) AND GARFISH (*Tylosurus*).

FOR EXPLANATION OF PLATE SEE PAGE 547.



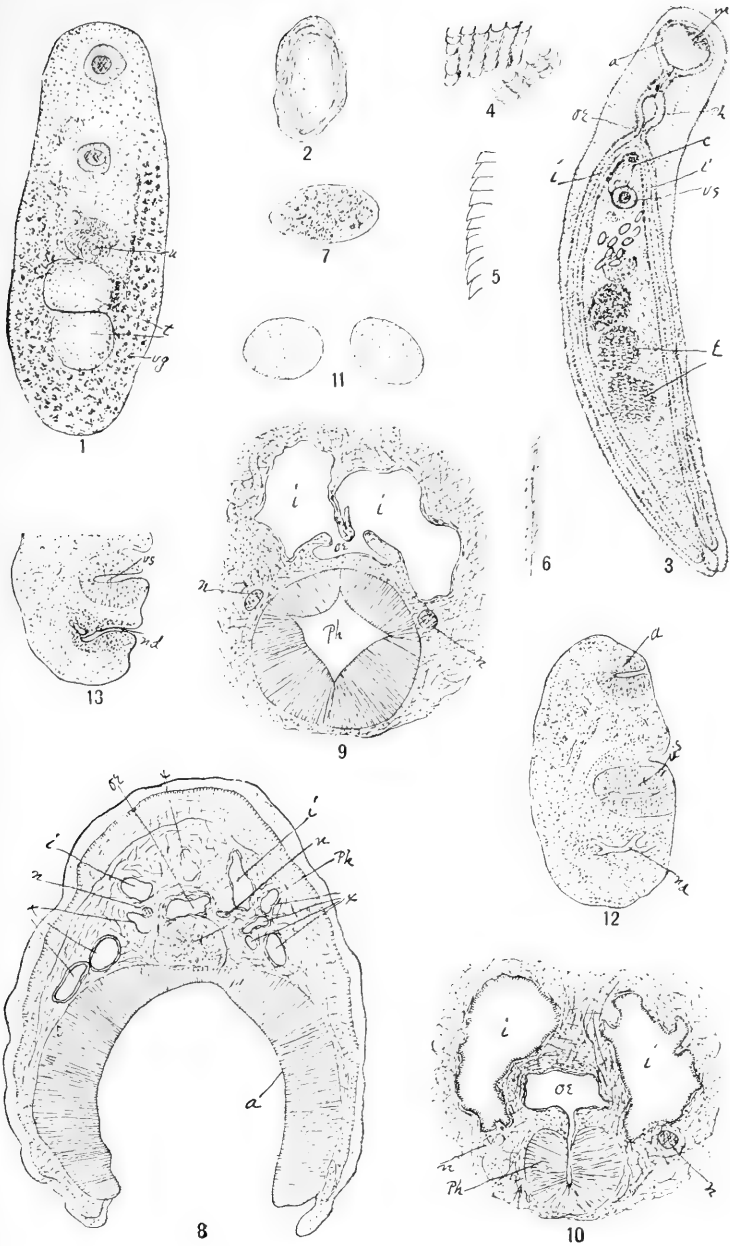


PARASITIC WORMS.

DISTOMUM FROM GARFISH (*Tylosurus*), STRIPED BASS, AND WHITE PERCH.

FOR EXPLANATION OF PLATE SEE PAGE 547.

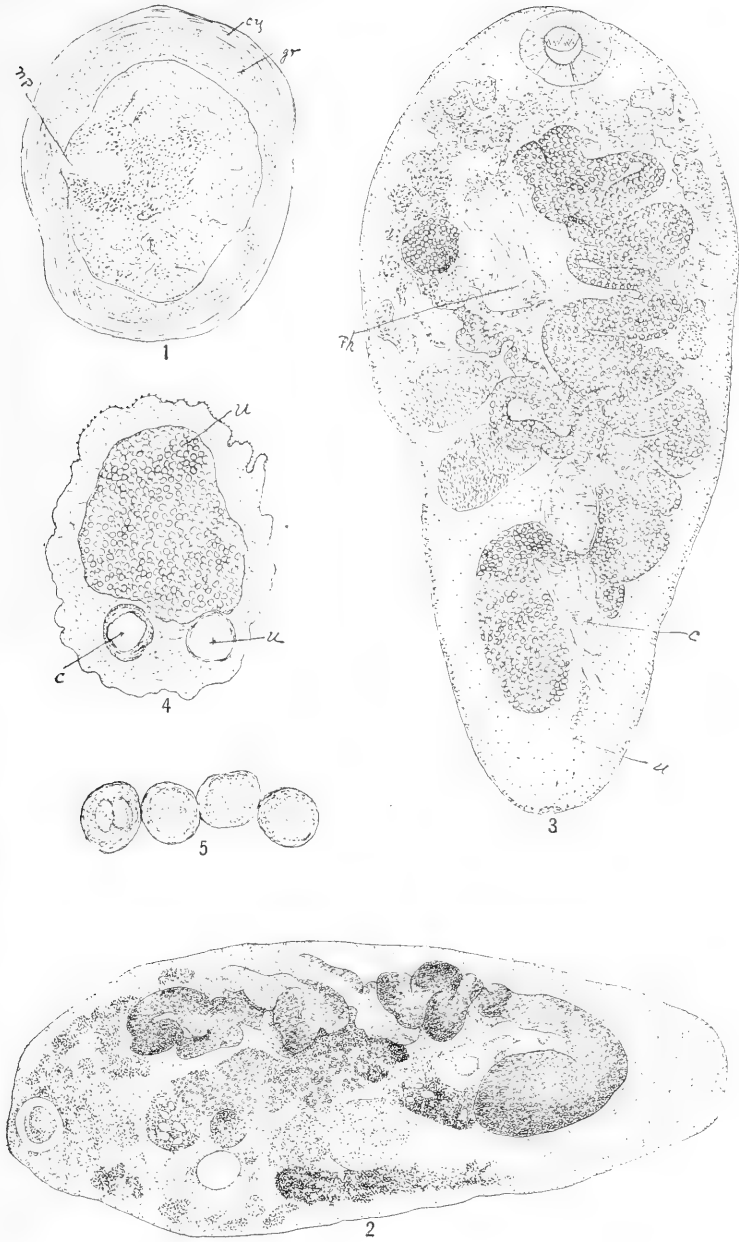




PARASITIC WORMS.

DISTOMUM FROM SMOOTH PUFFER, COD, SWORDFISH, AND SAND PIKE.

FOR EXPLANATION OF PLATE SEE PAGES 547, 548.



PARASITIC WORMS.

DISTOMUM FROM SAND PIKE; MONOSTOMUM FROM FLASHER (*Lobotes*).

FOR EXPLANATION OF PLATE SEE PAGE 548.



CONTRIBUTIONS TO PHILIPPINE ORNITHOLOGY.

PART I.—A LIST OF THE BIRDS KNOWN TO INHABIT THE PHILIPPINE AND PALAWAN ISLANDS, SHOWING THEIR DISTRIBUTION WITHIN THE LIMITS OF THE TWO GROUPS.

By DEAN C. WORCESTER, A. B.,

Assistant Professor of Zoology, University of Michigan,

and

FRANK S. BOURNS, M. D.,

Ann Arbor, Michigan.

INTRODUCTION.

In 1888, while identifying the birds collected by ourselves in the Philippines during the preceding year, Doctor Bourns and myself began the preparation of a distribution table for the birds of the group. This table was ready for publication in 1890, but the opportunity of visiting the islands for a second time presented itself, and it seemed best to us to withhold the list until we could make it more complete.

Complications in the affairs of the Minnesota Academy of Science, resulting from the financial troubles of 1893, put a stop to work on our collections for more than a year after our return, and before the identification of our material was completed Mr. W. R. Ogilvie Grant's important series of papers had begun to appear in the *Ibis*. I have felt unwilling to let the list leave my hands until this series of papers should be concluded.

The unfortunate interruption in the field work on which Mr. Grant's papers were based, resulting from the rebellion of a part of the native population of the Philippines against Spanish rule, has necessarily brought the series to an end, and although it is to be hoped that Mr. Whitehead may return to the archipelago at some future time and conclude his work in the highlands of the larger islands, I have decided to publish the list in its present state as a basis for some conclusions at which I have arrived concerning the zoological relationships between the various islands of the Philippine group and the laws governing the distribution of their birds.

Although other duties have prevented Doctor Bourns from cooperating with me in the final work on the list, his past services both at home and in the field certainly entitle him to be considered one of its joint authors.

Thinking it desirable to show the exact bearing of the work done by the Menage expedition on that of our predecessors and successors, I have indicated it in the table by using stars, while the work of other collectors, including that of the Steere expedition, is shown by crosses.

Species peculiar to the Philippines are italicised. Genera and species which occur in the Palawan group, but have not been found in the Philippines, are left unnumbered.

An X followed by a question mark indicates that I consider the identity of the specimens obtained from the locality indicated to be doubtful. An * followed by a question mark indicates that birds of the genus, and probably of the species, designated were seen by us, but were not obtained, so that their occurrence in the localities in question is open to doubt. These doubtful species are omitted in the totals on the last page.

While it has been my desire to make the list as complete as possible, it has seemed to me best to be conservative in the admission of species, and none have been intentionally included for which a definite locality, and in nearly every instance a *definite collector* as well, could not be assigned.

It is needless to say that in the preparation of this list I have made use of the British Museum Catalogue of Birds. I have also made use of the material gathered by Doctor Steere in 1874, and that obtained by the Steere expedition in 1887-88. I am indebted to Doctor Steere for the loan, on several occasions, of material belonging to him personally.

I have made such use of the material gathered by Doctor Bourns and myself in 1890-1893 as has been practicable under the circumstances. During the summer months of 1894 we were able to identify most of our specimens, and upon our departure from Minneapolis fortunately took some material for further study. Material which it was impracticable to take with us we had expected to have sent to us for further study after our departure. In this, however, we were disappointed, and we were obliged to leave several important species unidentified.

In addition to the sources above referred to, I have derived information from numerous papers, a list of which follows.

DEAN C. WORCESTER.

ANN ARBOR, MICHIGAN, July 31, 1897.

DISTRIBUTION LIST—Continued.

Names of species.	Cagayan Sulu.																
	Cuyo.	Balabac.	Palawan.	Calamianes.	Bohol.	Sigulor.	Cebu.	Masbate.	Negros.	Guimaras.	Panay.	Tablas.	Romblon.	Sibuyan.	Mindoro.	Luzon.	
351. <i>Anthothreptes chlorigaster</i> Sharpe.....																X	
352. <i>Anthothreptes griseigularis</i> Tweeddale.....																X	
353. <i>Dicaeum retrocinctum</i> Gould.....															X	X	
354. <i>Dicaeum haemastictum</i> Sharpe.....															X	X	
355. <i>Dicaeum rubrinotifer</i> Lesson.....															X	X	
356. <i>Dicaeum dorsale</i> Sharpe.....															X	X	
357. <i>Dicaeum pallidior</i> Bourne and Worcester.....															X	X	
358. <i>Dicaeum sibirgouanense</i> Bourne and Worcester.....															X	X	
359. <i>Dicaeum intermedium</i> Bourne and Worcester.....															X	X	
360. <i>Dicaeum assimilis</i> Bourne and Worcester.....															X	X	
361. <i>Dicaeum xanthopygium</i> Tweeddale.....															X	X	
362. <i>Dicaeum cinereigulare</i> Tweeddale.....															X	X	
363. <i>Dicaeum besti</i> Steere.....															X	X	
364. <i>Dicaeum sibirgouanense</i> Sharpe.....															X	X	
365. <i>Dicaeum hypoleucum</i> Sharpe.....															X	X	
366. <i>Dicaeum mindanense</i> (Kittlitz).....		X	X												X	X	
367. <i>Dicaeum pygmaeum</i> (Kittlitz).....															X	X	
368. <i>Dicaeum everetti</i> Tweeddale.....															X	X	
369. <i>Dicaeum luzonense</i> Grant.....															X	X	
370. <i>Dicaeum obscurum</i> Grant.....															X	X	
371. <i>Prionochilus johannci</i> Sharpe & <i>Prionochilus inexpectatus</i> Hartert.....		X	X	*											X	X	
372. <i>Prionochilus bicolor</i> Bourne and Worcester.....															X	X	
373. <i>Prionochilus inexpectatus</i> Hartert.....															X	X	
374. <i>Prionochilus quadricolor</i> Tweeddale.....															X	X	
375. <i>Piprioma aerythrasum</i> (Bourne and Worcester) <i>Zosterops everetti</i> Tweeddale.....															X	X	
376. <i>Zosterops everetti</i> Tweeddale.....															X	X	
377. <i>Zosterops neyrei</i> Bonaparte.....															X	X	
378. <i>Zosterops nigrorum</i> Tweeddale.....															X	X	
379. <i>Zosterops squytorensis</i> Bourne and Worcester.....															X	X	
380. <i>Zosterops luzonica</i> Grant.....															X	X	
381. <i>Zosterops aureiloris</i> Grant.....															X	X	
382. <i>Zosterops basilanica</i> Steere.....															X	X	
<i>Parus amabilis</i> Sharpe & 383. <i>Parus cleans</i> Lesson.....															X	X	
384. <i>Parus uckerhiae</i> (Blasius).....															X	X	
385. <i>Parus semihirvatus</i> (Salvadori).....															X	X	
386. <i>Hyloterpe philippinensis</i> Walden.....						*									X	X	
387. <i>Hyloterpe homocera</i> Blasius.....															X	X	
<i>Hyloterpe whiteheadi</i> Sharpe.....															X	X	

462. <i>Figynotus goiavier</i> (Scopoli).....	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²		
463. <i>Irena cyanogastra</i> Vigors.....	X ¹																								X ¹	
464. <i>Irena melanochlamys</i> Sharpe.....	X ²																									X ²
465. <i>Irena tweedalli</i> Sharpe <i>a</i>	X ²																									X ²
466. <i>Artamides sumatrensis</i> (P. L. S. Müller) <i>a</i>	X ²																									X ²
467. <i>Artamides striatus</i> (Boddart).....	X ²																									X ²
468. <i>Artamides gullenardii</i> Salvadori.....	X ²																									X ²
469. <i>Artamides kochii</i> (Knitter).....	X ²																									X ²
470. <i>Artamides pangayensis</i> Steere.....	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²
471. <i>Artamides mindorensis</i> Steere.....	X ²																									X ²
472. <i>Artamides cebuensis</i> (Irunt).....	X ²																									X ²
473. <i>Edolaisona caerulescens</i> (Blyth).....	X ²																									X ²
474. <i>Edolaisona mindanensis</i> (Tweeddale).....	X ²																									X ²
475. <i>Edolaisona pangayensis</i> Steere.....	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²	X ²
476. <i>Edolaisona everetti</i> Sharpe.....	X ²																									X ²
477. <i>Pterococcus igneus</i> Blyth <i>a</i>	X ²																									X ²
478. <i>Pterococcus cinereus</i> Lafresnaye.....	X ²																									X ²
479. <i>Pterococcus marchesei</i> Guillemard.....	X ²																									X ²
480. <i>Pterococcus legyensis</i> Steere.....	X ²																									X ²
481. <i>Pterococcus nopus</i> Wardlaw Ramsay.....	X ²																									X ²
482. <i>Lalage melanoleuca</i> (Blyth).....	X ²																									X ²
483. <i>Lalage minor</i> (Steere).....	X ²																									X ²
484. <i>Hemichelidon sibirica</i> (Gmelin) <i>a</i>	X ²																									X ²
485. <i>Gerygone simplex</i> Cabanis.....	X ²																									X ²
486. <i>Alseonax latirostris</i> Raffles.....	X ²																									X ²
487. <i>Muscicapula griseicticta</i> (Swinhoe).....	X ²																									X ²
488. <i>Muscicapula mindanensis</i> Blasius.....	X ²																									X ²
489. <i>Muscicapula saharensis</i> Bourns and Worcester.....	X ²																									X ²
490. <i>Muscicapula luzoniensis</i> Grant.....	X ²																									X ²
491. <i>Xanthopygia narcissina</i> (Temminck) <i>a</i>	X ²																									X ²
492. <i>Xanthopygia anomala</i> (Tomlinck) <i>a</i>	X ²																									X ²
493. <i>Hypothymis azurea</i> (Boddart).....	X ²																									X ²
494. <i>Hypothymis superciliosus</i> Sharpe.....	X ²																									X ²
495. <i>Hypothymis samarensis</i> Steere.....	X ²																									X ²
496. <i>Cyanomyias celestis</i> (Tweeddale).....	X ²																									X ²
497. <i>Cyanomyias leytanae</i> Steere.....	X ²																									X ²
498. <i>Rhipidura nigritorques</i> Vigors.....	X ²																									X ²
499. <i>Rhipidura cyaniceps</i> (Cassin).....	X ²																									X ²
500. <i>Rhipidura albiventer</i> Sharpe.....	X ²																									X ²
501. <i>Terpsiphona albilis</i> (A. Hay).....	X ²																									X ²
502. <i>Zosterops rufus</i> (G. R. Gray).....	X ²																									X ²
503. <i>Zosterops tinnamomus</i> Sharpe.....	X ²																									X ²

a Palawan group only.

DISTRIBUTION LIST—Continued.

Names of species.	Geography																																									
	Cagayan Sulm.	Cuyo.	Balabac.	Palawan.	Calamianes.	Bohol.	Singitior.	Cebu.	Masbate.	Negros.	Gunaras.	Panay.	Tablas.	Romblon.	Sibuyan.	Mindoro.	Luzon.	Marinduque.	Catanduanes.	Tnga.	Samar.	Leyte.	Diuagat.	Panaon.	Nipah.	Camiguin.	Bazol.	Sakunfok.	Mindanao.	Basilan.	Malampa.	Sulu.	Tapac.	Siasi.	Tawi Tawi.	Bongao.	Sibutu.					
<i>Zoecephilus cyaneus</i> Sharpe a	X*																																									
<i>Rhinomyias ruficauda</i> Sharpe																																										
<i>Rhinomyias lasinias</i> Grant.																																										
<i>Rhinomyias albigularis</i> Bourne and Worcester.																																										
<i>Rhinomyias ocellaris</i> Bourne and Woocess ter.										X*																																
<i>Culicicapa billianthen</i> (Wallace)										X*																																
<i>Culicicapa ceylonensis</i> (Swainson) a										X*																																
<i>Cryptolopha xanthopygia</i> Whitehead a																																										
<i>Cryptolopha nigrorufa</i> Moseley.																																										
<i>Cryptolopha flavigularis</i> Bourne and Worcester.																																										
<i>Cryptolopha olivacea</i> (Moseley)																																										
<i>Stoparola panayensis</i> (Sharpe)																																										
<i>Stoparola nigropunctata</i> Grant.																																										
<i>Siphia banyumas</i> (Horsfield) a																																										
<i>Siphia philippinensis</i> (Sharpe)																																										
<i>Siphia lemprieri</i> Sharpe a.																																										
<i>Siphia enganensis</i> Grant.																																										
<i>Siphia erithacus</i> Sharpe a.																																										
<i>Siphia herioti</i> Wardlaw-Ramsay.																																										
<i>Calciceps periphatanica</i> Grant.																																										
<i>Cotile sinensis</i> (Gray)																																										
<i>Hirundo gutturalis</i> Scopoli.																																										
<i>Hirundo javanica</i> Sparrman.																																										
<i>Hirundo striolata</i> (Boie)																																										
<i>Pitta erythrogastra</i> Temminck																																										
<i>Pitta kochi</i> Brüggemann.																																										
<i>Pitta atricapilla</i> Lesson.																																										
<i>Pitta muelleri</i> (Bonaparte)																																										
<i>Pitta steerii</i> (Sharpe)																																										
<i>Pitta propinqua</i> (Sharpe)																																										
Total known species	15	5	69	181	80	54	87	125	98	171	96	118	71	47	65	134	286	74	48	4	150	119	39	20	10	7	1	2	207	119	8	108	6	6	97	61	38					

a Palawan group only.

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CONTRIBUTIONS TO PHILIPPINE ORNITHOLOGY.

PART II.—NOTES ON THE DISTRIBUTION OF PHILIPPINE BIRDS.

BY DEAN C. WORCESTER,

Assistant Professor of Zoology, University of Michigan.

STATEMENT OF STEERE'S CONCLUSIONS AND REVIEW OF RECENT ORNITHOLOGICAL WORK IN THE PHILIPPINES.

Although the ornithology of the Philippines has long attracted the attention of naturalists, so far as I am aware the first attempt to discuss at any length the interesting zoogeographical problems presented by the distribution of birds within the limits of the group was that of Doctor J. B. Steere, who in 1888 published in *Nature* a brief paper in which he proposed to assign the name "zoological province" to the Philippines as a whole, and to divide them into six "subprovinces," as follows: "First, the northern Philippines, consisting of Luzon and Marinduque and a number of small islands about Luzon; second, Mindoro; third, the central Philippines, made up of the islands of Panay, Negros, Guimaras, Cebu, Bohol, and Masbate; fourth, the eastern Philippines, comprising the islands of Samar and Leyte; fifth, the southern Philippines, embracing the great island of Mindanao, with Basilan and perhaps Sulu, and, sixth, the western Philippines, consisting of the islands of Paragua, or Palawan, and Balabac."

In a second paper, which appeared simultaneously in the *Auk* and the *Ibis* for July, 1894, the same author makes a more detailed examination of the distribution of the genera and species of nonmigratory land birds, basing his conclusions entirely on the collections made by the Steere expedition.

Of these collections he says that, while not comprising all species known from the islands, they are so nearly complete that any just conclusions drawn from their study must be accepted as truth, which further exploration will only strengthen, and from the facts at his disposal he attempts to deduce several somewhat radical and far-reaching laws of evolution and distribution.

Since the appearance of these papers our knowledge of the distribution of Philippine birds has been materially increased. Mr. A. H. Everett has collected on Tawi Tawi, Sibutu, and Balabac. Mr. John Whitehead has done marvelous things in the highlands of Luzon, and has collected

in Catanduanes and Fuga. Doctor Bourns and I have collected in Tawi Tawi, the Caliamianes Islands (Culion and Busuanga), Masbate, Tablas, Romblon, and Sibuyan, and, apart from the extension of our knowledge to these previously nearly or quite unknown areas, much has been learned as to the distribution of species over many of the better-known islands of the group.

It seems to me, therefore, that the time has come for a reexamination of the problems in question. Even were the data at my disposal no more complete than those of which Steere chose to avail himself, I should still be disposed to dissent from some of his conclusions.

WHAT ARE THE PHILIPPINES?

Steere makes the Philippines *political* and the Philippines *zoological* identical areas. With this view of the case I am unable to agree. Everett has long since¹ discussed Steere's "subprovince," the *Western Philippines*, and has shown by evidence that seems to me incontrovertible that Balabac and Palawan belong not to the Philippine, but to the *Bornean* group of islands.

Since the appearance of Everett's paper Bourns and I have collected for some weeks on the islands of Culion and Busuanga, the birds and mammals of which were practically unknown before our visit; for although the French naturalist M. Alfred Marche spent some time here during his long sojourn in the archipelago, his collections seem to have been scattered without being systematically worked up, and his results lost to the world. Save for a few scattering references in his "Luçon et Palouan," I have been able to find no record whatever of his discoveries in the Calamianes Islands.

Although our own work there must not be considered in any sense exhaustive, it was still sufficient to leave no room for doubt as to the zoological affinities of this hitherto practically unknown group. I shall attempt to show, first, that the Calamianes Islands belong zoologically with Palawan; second, that they form with Palawan and Balabac an extension of the Bornean group of islands, and therefore can not be included with the Philippines proper.

CULION AND BUSUANGA.

Culion and Busuanga are by far the most important islands of the Calamianes group. They lie so near each other and are so connected by small islets that they form a practically continuous area, and such differences as exist between their birds are purely the result of their somewhat different physical characteristics.

Culion has little forest. It is moderately hilly, but has no mountains of any considerable height. Its hills are for the most part covered with impenetrable bamboo thickets. In the center of the island is a marshy plain of large extent. Busuanga, on the other hand, has a good deal

¹ Proc. Zool. Soc., April 16, 1889, pp. 220-228.

of fairly good forest remaining, and one would naturally expect to meet with deep-woods birds here which would be found with great difficulty, if at all, in Culi6n.

During our stay we obtained representatives of 80 species of birds. Reference to the accompanying distribution table will show that they were, with a few unimportant exceptions, all well-known Palawan forms.

The exceptions are:

- | | |
|-----------------------------------|---------------------------------|
| 1. <i>Hypotaenidia striata</i> . | 6. <i>Merops bicolor</i> . |
| 2. <i>Haliastur intermedius</i> . | 7. <i>Collocalia francica</i> . |
| 3. <i>Elanus hypoleucus</i> . | 8. <i>Cisticola exilis</i> . |
| 4. <i>Polliaetus ichyaetus</i> . | 9. <i>Lanius nasutus</i> . |
| 5. <i>Strix candida</i> . | |

Merops bicolor is the only strictly Philippine species in the list, and with this possible exception every one of the nine will eventually be recorded from Palawan, while the occurrence of such characteristic Palawan forms as the following leaves no room for doubt as to the relationship of the Calamianes birds:

- | | |
|--|--------------------------------------|
| 1. <i>Gymnolaemus marchei</i> . | 11. <i>Prionochilus johannaæ</i> . |
| 2. <i>Dryococcyx harringtoni</i> . | 12. <i>Orthotomus ruficeps</i> . |
| 3. <i>Prioniturus cyaneiceps</i> . | 13. <i>Cittocincla nigra</i> . |
| 4. <i>Tiga everetti</i> . | 14. <i>Chloropsis palawanensis</i> . |
| 5. <i>Chrysocolaptes erythrocephalus</i> . | 15. <i>Criniger frater</i> . |
| 6. <i>Mainatus palawanensis</i> . | 16. <i>Irena tweeddalii</i> . |
| 7. <i>Chibia palawanensis</i> . | 17. <i>Artamides sumatrensis</i> . |
| 8. <i>Buchanga palawanensis</i> . | 18. <i>Zecephus cyanescens</i> . |
| 9. <i>Aethopyga shelleyi</i> . | 19. <i>Siphia lemprieri</i> . |
| 10. <i>Cinnyris aurora</i> . | |

The present disparity in the number of species known from Palawan and the Calamianes will doubtless disappear to a large degree as the birds of the latter islands become better known. It is not to be expected, however, that their bird fauna will ever be found to equal in richness that of Palawan, with its lofty mountains and magnificent forests.

BALABAC.

Until within a short time the birds of Balabac were known to us only through the very incomplete collections made by Steere in 1874, and by the Steere Expedition in 1887, the small prospect of important discoveries, together with the extreme unhealthfulness of the island, having kept collectors away from it. More recently, however, Mr. A. H. Everett, to whom Philippine ornithology owes so much, has made a collecting trip to the island, the result being to establish the fact of a very close relationship between the birds of Balabac and Palawan.

Sixty-nine species are at present known from the island. Of these all but *Anthus richardi*, *Limonidromus indicus*, *Pandion leucocephalus*, *Demiégretta sacra*, and *Turtur tigrinus* have been recorded from Palawan. I saw a specimen of *Turtur tigrinus* at the office of the "inspección de montes" in Manila which was said to have been obtained in Palawan, and the remaining four species will doubtless eventually be

found there. The only noteworthy difference as yet brought out between the avifaunae of the two islands is the apparent absence of *Polyplectron napoleonis* in Balabac.

CUJO.

Cujo is known to us only through the few birds collected there by Doctor A. B. Meyer, and the five species listed throw no light on the zoological position of the island. But little forest remains on it and it seems to be very poor in birds.

THE ZOOLOGICAL POSITION OF THE PALAWAN GROUP.

In the Palawan group of islands, then, I include Balabac, Palawan, Culion, Busuanga, and the small islands immediately adjacent to them.

I have attempted to show that these islands should be classed together. It would remain to show that taken as a whole their affinities were decidedly with Borneo rather than with the Philippines proper had this not already been done in the paper by Mr. Everett previously referred to.

Although our knowledge of Palawan birds has been somewhat increased since this paper appeared, such additional facts as have been ascertained have simply strengthened Everett's conclusions, and little remains to add to what he has already said. I trust, therefore, that I shall be excused if I give a brief resumé of his argument, with such small additions and subtractions of my own as seem to me to be called for.

Mr. Everett arranges the birds of the Palawan group in three tables, as follows:

Table I shows the Palawan species which are common to Borneo or other parts of western Indo-Malaya and to the Philippines, together with the species which are of wide general distribution or are migrants from continental Asia. In other words, it includes the birds which afford no evidence of value.

Table II shows the Palawan species which are identical with or allied to species inhabiting the Philippines, Sanghir, Celebes, etc., but which are not found in Borneo or western Indo-Malaya except as migrants or stragglers.

Table III shows the Palawan species which are identical with or allied to species inhabiting Borneo or western Indo-Malaya, but which are not found in the Philippines except as migrants or stragglers.

The following species of Everett's Table III must be transferred to his Table I, for the reasons indicated below:

Corvus pusillus, because it is abundant in Mindoro. *Alcedo meninting*, abundant in Tawi Tawi. *Ceyx erythra*, abundant in Tawi Tawi and occurs in Mindoro. *Haleyon pileata*, recorded from Tawi Tawi and Basilan. *Cuculus sonnerati*, shot by myself in Romblon. *Chalcococcyx xanthorhynchus*, recorded from Mindoro and Cebu. *Centropus javensis*,

common throughout the Philippines. *Spizaetus limnaetus*, recorded from Mindoro, Luzon, Marinduque, and Panay. *Baza leucopais*, recorded from Samar and Romblon. *Treron nipalensis*, common in Mindoro.

Adding these ten species, together with thirty others which have been added to the avifauna of the Palawan group since Mr. Everett's paper was published, Table I will stand as follows:

- | | |
|------------------------------------|--|
| 1. <i>Megapodius cumingi</i> . | 48. <i>Butorides amurensis</i> . |
| 2. <i>Excalfactoria lineata</i> . | 49. <i>Ardetta cinnamomea</i> . |
| 3. <i>Gallus gallus</i> . | 50. <i>Gorsachius melanolophus</i> . |
| 4. <i>Treron nipalensis</i> . | 51. <i>Fregata minor</i> . |
| 5. <i>Osmotreron vernans</i> . | 52. <i>Circus spilonotus</i> . |
| 6. <i>Ptilopus banguueyensis</i> . | 53. <i>Astur trivirgatus</i> . |
| 7. <i>Carpophaga aenea</i> . | 54. <i>Accipiter gularis</i> . |
| 8. <i>Myristicivora bicolor</i> . | 55. <i>Spizaetus limnaetus</i> . |
| 9. <i>Chalcophaps indica</i> . | 56. <i>Butastur indicus</i> . |
| 10. <i>Caloenas nicobarica</i> . | 57. <i>Haliaetus leucogaster</i> . |
| 11. <i>Hypotaenidia striata</i> . | 58. <i>Haliaastur intermedius</i> . |
| 12. <i>Rallina fasciata</i> . | 59. <i>Pernis ptilonorhynchus</i> . |
| 13. <i>Amaurornis phoenicura</i> . | 60. <i>Elanus hypoleucus</i> . |
| 14. <i>Hydrochelidon hybrida</i> . | 61. <i>Falco communis</i> . |
| 15. <i>Sterna bergii</i> . | 62. <i>Falco severus</i> . |
| 16. <i>Sterna siuensis</i> . | 63. <i>Pandion haliaetus</i> . |
| 17. <i>Sterna melanauchen</i> . | 64. <i>Pandion leucocephalus</i> . |
| 18. <i>Anous stolidus</i> . | 65. <i>Polioaetus ichhyaetus</i> . |
| 19. <i>Charadrius fulvus</i> . | 66. <i>Strix candida</i> . |
| 20. <i>Squatarola helvetica</i> . | 67. <i>Eurystomus orientalis</i> . |
| 21. <i>Aegialitis geoffroyi</i> . | 68. <i>Haleyon coromandus</i> . |
| 22. <i>Aegialitis dubia</i> . | 69. <i>Alcedo ispida</i> . |
| 23. <i>Aegialitis peroni</i> . | 70. <i>Alcedo meninting</i> . |
| 24. <i>Aegialitis cantiana</i> . | 71. <i>Ceyx euerythra</i> . |
| 25. <i>Aegialitis vereda</i> . | 72. <i>Haleyon coromandus</i> . |
| 26. <i>Aegialitis mongolica</i> . | 73. <i>Haleyon chloris</i> . |
| 27. <i>Esacus magnirostris</i> . | 74. <i>Haleyon pileatus</i> . |
| 28. <i>Strepsilas interpres</i> . | 75. <i>Chaetura gigantea</i> . |
| 29. <i>Gallinago megala</i> . | 76. <i>Collocalia lowi</i> . |
| 30. <i>Tringa subminuta</i> . | 77. <i>Collocalia fuciphaga</i> . |
| 31. <i>Tringa ruficollis</i> . | 78. <i>Collocalia francica</i> . |
| 32. <i>Tringoides hypoleucus</i> . | 79. <i>Coccyzus coromandus</i> . |
| 33. <i>Totanus calidris</i> . | 80. <i>Hierococcyx sparverioides</i> . |
| 34. <i>Totanus glareola</i> . | 81. <i>Cuculus canorus</i> . |
| 35. <i>Totanus brevipes</i> . | 82. <i>Cuculus intermedius</i> . |
| 36. <i>Terekia cinerea</i> . | 83. <i>Cuculus sonnerati</i> . |
| 37. <i>Limicola platyrhyncha</i> . | 84. <i>Cacomantis merulinus</i> . |
| 38. <i>Numenius lineatus</i> . | 85. <i>Chalcococcyx xanthorhynchus</i> . |
| 39. <i>Numenius variegatus</i> . | 86. <i>Centropus siuensis</i> . |
| 40. <i>Numenius phaeopus</i> . | 87. <i>Centropus javanicus</i> . |
| 41. <i>Glareola orientalis</i> . | 88. <i>Corvus pusillus</i> . |
| 42. <i>Ardea purpurea</i> . | 89. <i>Sturnia violacea</i> . |
| 43. <i>Ardea sumatrana</i> . | 90. <i>Munia oryzivora</i> . |
| 44. <i>Herodias intermedia</i> . | 91. <i>Motacilla ocularis</i> . |
| 45. <i>Demiegretta sacra</i> . | 92. <i>Motacilla melanope</i> . |
| 46. <i>Bubulcus coromandus</i> . | 93. <i>Motacilla flava</i> . |
| 47. <i>Butorides javanica</i> . | 94. <i>Limonidromus ināicus</i> . |

- | | |
|---------------------------------------|--------------------------------------|
| 95. <i>Anthus maculatus.</i> | 106. <i>Cisticola exilis.</i> |
| 96. <i>Anthus rufulus.</i> | 107. <i>Monticola solitaria.</i> |
| 97. <i>Anthus cervinus.</i> | 108. <i>Pericrocotus cinereus.</i> |
| 98. <i>Anthus gustavi.</i> | 109. <i>Lalage terat.</i> |
| 99. <i>Anthus richardi.</i> | 110. <i>Hemichelidon sibirica.</i> |
| 100. <i>Lanius nasutus.</i> | 111. <i>Hemichelidon ferruginea.</i> |
| 101. <i>Artamus leucogaster.</i> | 112. <i>Hypothymis azurea.</i> |
| 102. <i>Phylloscopus borealis.</i> | 113. <i>Culicicapa ceylonensis.</i> |
| 103. <i>Phylloscopus zanthodryas.</i> | 114. <i>Hirundo gutturalis.</i> |
| 104. <i>Acrocephalus orientalis.</i> | 115. <i>Hirundo jaranica.</i> |
| 105. <i>Cisticola cisticola.</i> | |

Here, then, are 115 species which afford us no evidence as to the relationship between the groups of islands in question. Moreover, I am inclined to remove several species from Mr. Everett's Table III, and make for them a separate table. It does not seem to me that the evidence furnished by such species as *Cittocinclla nigra*, *Ptilocichla falcata*, and *Iole striaticeps* is by any means unequivocal. *Cittocinclla nigra* has a close ally in *C. cebuensis*. *Orthotomus* has representatives in the majority of the islands of the Philippine group. *Iole* has numerous Philippine species. *Chloropsis palawanensis* has an ally in *C. flavipennis* of Cebu and Mindanao. *Irena* has species in Basilan, Mindanao, Leyte, Samar, and Luzon.

I shall of course admit that in several instances the closest allies of the species in question are Bornean, and *Orthotomus ruficeps* is a Bornean species, but so long as there is not more difference between them and their nearest Philippine allies than exists between the Philippine species *inter se*, I fail to see that any very satisfactory conclusions can be drawn from them. I propose, therefore, to assign them to Table IV, which includes those Palawan species with allies not only in Borneo or western Indo-Malaya, but in the Philippines as well, and which hence furnish us with evidence of doubtful value.

- | | |
|---------------------------------|-----------------------------------|
| 1. <i>Arachnothera dilutor.</i> | 6. <i>Chloropsis palawanensis</i> |
| 2. <i>Hyloterpe whiteheadi.</i> | 7. <i>Iole striaticeps.</i> |
| 3. <i>Orthotomus ruficeps.</i> | 8. <i>Irena tweeddalii.</i> |
| 4. <i>Cittocinclla nigra.</i> | 9. <i>Chibia palawanensis.</i> |
| 5. <i>Ptilocichla falcata.</i> | |

Table II (Everett's Table II with additions) shows the Palawan species, which are identical with, or allied to, species inhabiting the Philippines, Sanghir, Celebes, etc., but which are not found in Borneo or western Indo-Malaya, except as migrants or stragglers. Species peculiar to the Palawan group are distinguished by the prefix of an *.

- | | |
|-------------------------------------|---|
| 1. <i>Turnix fasciata.</i> | 10. <i>Caprimulgus manillensis.</i> |
| 2. <i>Ptilopus leclancheri.</i> | 11. <i>Collocalia troglodytes.</i> |
| 3. <i>Macropygia tenuirostris.</i> | 12. <i>Collocalia whiteheadi.</i> |
| 4. <i>Turtur dussumieri.</i> | 13. <i>Eudynamis mindanensis.</i> |
| 5. <i>Spizaetus philippinensis.</i> | 14. <i>Cacatua haematuropygia.</i> |
| 6. <i>Baza leucopais.</i> | 15. <i>Tanygnathus luconensis.</i> |
| 7. <i>Scops everetti.</i> | *16. <i>Prioniturus cyaneiceps.</i> |
| 8. <i>Pelargopsis gouldi.</i> | *17. <i>Chrysocolaptes erythrocephalus.</i> |
| 9. <i>Merops bicolor.</i> | *18. <i>Thriporax hargitti.</i> |

- | | |
|----------------------------------|-------------------------------------|
| 19. <i>Calornis panayensis</i> . | 28. <i>Lanius lucionensis</i> . |
| 20. <i>Oriolus chinensis</i> . | 29. <i>Rhipidura nigritorquis</i> . |
| 21. <i>Munia jagori</i> . | *30. <i>Zeocephus cyanescens</i> . |
| 22. <i>Uroloncha everetti</i> . | 31. <i>Calicicapa helianthea</i> . |
| *23. <i>Aethopyga shelleyi</i> . | *32. <i>Siphia lemprieri</i> . |
| 24. <i>Cinnyris sperata</i> . | 33. <i>Pitta erythrogastra</i> . |
| *25. <i>Cinnyris aurora</i> . | *34. <i>Pitta propinqua</i> . |
| 26. <i>Dicaeum pygmaeum</i> . | 35. <i>Pitta atricapilla</i> . |
| *27. <i>Parus amabilis</i> . | |

There remain only the birds of Table III, which shows the Palawan species identical with, or allied to, species inhabiting Borneo or western Indo-Malaya, but not found in the Philippines, except as migrants or stragglers. Species peculiar to the Palawan group are distinguished by the prefix of an *.

- | | |
|--|--|
| *1. <i>Polyplectron napolconis</i> . | 19. <i>Dendrophila frontalis</i> . |
| 2. <i>Turtur tigrinus</i> . | 20. <i>Chalcostetha insignis</i> . |
| 3. <i>Spilornis davisoni</i> . | 21. <i>Anthothreptes malaccensis</i> . |
| 4. <i>Ninox scutulata</i> . | *22. <i>Prionochilus johannae</i> . |
| *5. <i>Syrnium whiteheadi</i> . | 23. <i>Turdinus rufifrons</i> . |
| 6. <i>Batrachostomus javensis</i> . | *24. <i>Mixornis woodi</i> . |
| 7. <i>Batrachostomus affinis</i> . | *25. <i>Anuropsis cinereiceps</i> . |
| *8. <i>Gymnolaemus marchei</i> . | *26. <i>Aegithina viridis</i> . |
| 9. <i>Caprimulgus macrurus</i> . | 27. <i>Micropus melanocephalus</i> . |
| 10. <i>Caprimulgus jotaka</i> . | *28. <i>Criniger frater</i> . |
| 11. <i>Surniculus lugubris</i> . | *29. <i>Criniger palawanensis</i> . |
| 12. <i>Eudynamis honorata</i> . | *30. <i>Pycnonotus cinereifrons</i> . |
| *13. <i>Dryococcyx harringtoni</i> . | 31. <i>Artamides sumatrensis</i> . |
| *14. <i>Tiga everetti</i> . | 32. <i>Pericrocotus igneus</i> . |
| *15. <i>Hemilophus pulverulentus</i> . | *33. <i>Cryptolopha xanthopygia</i> . |
| *16. <i>Mainatus palawanensis</i> . | *34. <i>Siphia banyumas</i> . |
| *17. <i>Buchanga palawanensis</i> . | *35. <i>Siphia erithacus</i> . |
| 18. <i>Oriolus xanthonotus</i> . | |

We have then a total of 194 species of birds known from the group. Of these 124 do not yield any satisfactory evidence. Of the remaining seventy 35 are related to Bornean and 35 to Philippine species. This at first sight might not seem very conclusive, but if we examine the species of Table III we shall note that of the 35 genera included 15 are without known representatives in the Philippines. We shall note further that the two genera peculiar to the group, *Gymnolaemus* and *Dryococcyx*, are allied to genera belonging to the typical Indo-Malayan subarea. Last of all we shall note that the percentage of peculiar species is much higher among the Bornean than among the Philippine species, there being 18 of the former against 7 of the latter.

Everett's final conclusion is as follows: "Not only has a larger proportion of the existing bird population entered the group from the Bornean side than has invaded it from the Philippines, but the western element represents the fundamental ornith, since it exhibits a markedly higher degree of differentiation, which is certainly indicative of its greater antiquity and longer isolation."

This conclusion seems to me to be wholly justified by the facts,

especially when one remembers the negative as well as the positive evidence, and notes the entire absence in the Palawan group of such characteristic Philippine genera as *Penelopides*, *Loriculus*, *Iyngipicus*, *Sarcops*, *Dicrurus*, *Megalurus*, *Copsychus*, and *Rhinomyias*.

It is interesting to note that the evidence furnished by the mammals proves even more conclusively than that afforded by the birds the close relationship of the islands of the Palawan group both with each other and with Borneo. Excluding bats, 5 of the 18 genera remaining have no Philippine representatives, while of the 22 species but 5 occur in the Philippines. Of these 5 only *Paradoxurus philippinensis* can be regarded as a distinctively Philippine species, and according to Mr. Everett even this occurs in Borneo.

CAGAYAN SULU.

Cagayan Sulu is known to us only through the paper of Doctor Guillemard on the birds collected there during the voyage of the yacht *Marchesa*. Guillemard obtained 15 species of birds, the only novelty being *Mixornis cagayanensis*. The evidence, so far as it goes, indicates that the island is to be considered Bornean.

Too little is at present known of its avifauna, however, to make it safe to pass a final judgment. Bourns and I had planned to work it thoroughly. Unfortunately for us a boat load of Cagayan Sulu natives were captured by a Spanish gunboat while engaged in piratical operations on the coast of Tawi Tawi. They were brought to Sulu, where we were at the time, and were compelled to work in chains on the streets for some weeks. They were finally allowed to return to their homes, where they promptly stirred up so much ill feeling as to render the island, which had hitherto been peaceful enough, altogether too dangerous for a collecting ground. We therefore passed it by.

It is barely connected with Borneo by the hundred-fathom line, and I have little doubt that such evidence as may be obtained in future will confirm that already at our disposal.

THE PHILIPPINES PROPER.

Turning now to the Philippines proper, by which term I mean to designate the remaining islands included in our distribution list, I propose to first discuss Steere's remaining subdivisions and to then consider some of the more general problems involved.

Steere's five remaining "subprovinces" are, in my judgment, very far from being zoologically equivalent. In some instances the differences depended on in establishing their boundaries are simply the occurrence of different representative species of the same genera in the areas in question. In other cases whole genera present in one area are lacking in another, while in Cebu, which Steere has not considered worthy of separate rank, we miss entire families which are represented in the islands with which he has united it.

Where such contradictory results are arrived at the principle on which they are based must be unsound or its application faulty.

I propose to take up the various known islands singly where their bird faunae show marked differences, in groups where the faunae of several islands are practically identical, and to discuss the relationships involved, without however attempting to divide the islands into a number of zoologically equivalent groups. I shall preface my remarks in each case with a few brief notes on the physical characteristics of the various islands, so far as they are known to me personally.

For determining the relationships of the islands *inter se* I shall depend chiefly on the distribution of those species which are peculiar to the Philippines, or to the Philippine and Palawan groups, not forgetting to note the absence of genera or families where such absence occurs.

My evidence is necessarily of two kinds—*positive*, based on the known occurrence of the forms in question, and *negative*, based on the apparent absence of the same. Manifestly the positive evidence is of a more satisfactory character than the negative, for it may be urged that failure to discover a given form in a given place is by no means a proof of its nonexistence there. This may or may not be true. Failure to discover *Halcyon winchelli* in an island would not serve to convince me that it was lacking. The single specimen obtained by Bourns in Samar in 1888 has never been duplicated. On the other hand, I would undertake to determine, and that in a very short time, whether a given island contained an *Orthotomus*, a *Penelopides*, or a *Chrysocolaptes*.

My negative evidence, then, is based on the apparent nonoccurrence of species and genera which, after our long experience in the Philippines, I consider it improbable that we should have overlooked.

Species peculiar or nearly peculiar to the group I shall for convenience designate *Philippine species*. In the distribution list they will be found italicised.

The total number of species recorded from the islands is 526. Of these 323 are apparently confined quite strictly to the group.

THE CENTRAL PHILIPPINES.

This "subprovince," as defined by Steere, embraces the islands Panay, Negros, Guimaras, Cebu, Bohol, and Masbate. It can, I think, be readily shown that while Panay, Guimaras, Negros, and Masbate are so closely related as to be properly classed together, Cebu ought not to be included with them. While the evidence in the case of Bohol is far less complete than in that of Cebu, what there is of it seems to me to indicate rather a relationship with Leyte and Mindanao than with the central islands.

Panay is some 90 miles in greatest length by 60 in greatest width. In most parts of the island the last traces of forest have disappeared.

Good collecting ground may still be found in the mountains in the northwestern portion of the island.

Negros lies southeast of Panay, from which it is separated by a shallow channel, apparently nowhere more than 20 fathoms in depth, and but 4 miles wide at its narrowest point. The greatest length of Negros is 145 miles, its greatest width about 45. It offers excellent collecting ground, as its central chain of mountains, which runs practically the whole length of the island, is abundantly clothed with forest, and may be reached in a hundred places. The highest peak of the chain, Malaspina or Canloön, attains a height of 8,192 feet.

Numerous collectors have worked in the lowlands of Negros, and three members of the Steere expedition made a short trip into the highlands, but Whitehead is the only collector who has ever carried on systematic work in the island at any considerable elevation.

Guimaras is to all intents and purposes a part of Panay, from which it is separated by a narrow and shallow passage. Its forest is being rapidly cleared away. We found collecting much better in 1888 than in 1890.

Masbate is an island of irregular outline, its greatest length being some 70 miles. In its interior lie extensive grassy plains. Fairly large tracts of forest may still be found within a short distance of Palanoc, the capital and chief port of the island. Masbate lies some 25 miles northeast of Panay, the deepest water indicated in the intervening channel being 31 fathoms. So far as I am aware, the only work done on the birds of Masbate has been that of the Menage and Steere expeditions.

Panay was the scene of Sonnerat's work, and has since been visited by numerous collectors; but owing to the scarcity of forest and the difficulty of reaching it the birds of this island are much less well known than are those of Negros. We were exceedingly anxious to find good collecting ground in Panay, and after wasting much time in fruitless search finally reached fairly well wooded country at Calantas, near Batan, in the northern part of the island. The locality proved to be very unhealthy, however, and we were forced to establish our headquarters 10 miles from the forest, so that our work was carried on under difficulties.

We saw high and apparently well wooded mountains farther to the west.

One hundred and eighteen species of birds are recorded from Panay, 96 from Guimaras, 98 from Masbate, and 171 from Negros. Eliminating the wide-ranging species, which are useless for our purpose, and confining ourselves to the Philippine forms, we find Panay has 55, Guimaras 48, Masbate 50, and Negros 80.

We must take Negros as our standard, since it is best known, and upon referring to the distribution list we shall find that almost without exception those species which have been found in Panay, Guimaras, and Masbate, have been found in Negros also.

Individuality is given to the avifauna of these four islands by the occurrence of the following species, the known distribution of which is indicated in the table:

Species characteristic of the Central Philippines.

Names of species.	Negros.	Panay.	Guimaras.	Masbate.	Tablas.	Romblon.	Sibuyan.	Cebu.	Bohol.
1. <i>Phabotreron maculipectus</i>	x								
2. <i>Phabotreron nigrorum</i>	x	x	x	x	x		x	x	
3. <i>Spilornis panayensis</i>	x	x	x	x	x	x	x		
4. <i>Batrachostomus menagei</i>	x	x							
5. <i>Alcyon nigrirostris</i>	x	x						x	
6. <i>Halcyon moseleyi</i>	x	x							
7. <i>Penelopides panini</i>	x								
8. <i>Cranorrhinus waldeni</i>	x	x	x	x					
9. <i>Loriculus regulus</i>	x	x	x	x	x	x	x		
10. <i>Nantholaema intermedia</i>	x	x		x				x	
11. <i>Iynegipicus maculatus</i>	x	x	x					x	
12. <i>Chrysocolaptes xanthocephalus</i>	x	x	x	x					
13. <i>Dicrurus mirabilis</i>	x	x	x	x				x	
14. <i>Oriolus nigrostriatus</i>	x			x					
15. <i>Aethopyga bonita</i>	x			x				x	
16. <i>Aethopyga magnifica</i>	x	x			x		x	x	
17. <i>Cinnyris guimarasensis</i>	x	x	x						
18. <i>Dicaeum haematostictum</i>	x	x	x						
19. <i>Dicaeum dorsale</i>	x	x		x					
20. <i>Zosterops nigrorum</i>	x	x		x					
21. <i>Hyloterpe winchelli</i>	x	x		x	x		x	x	
22. <i>Brachypteryx brunneiceps</i>	x								
23. <i>Orthotomus castaneiceps</i>	x	x	x	x					
24. <i>Turdus nigrorum</i>	x								
25. <i>Cittociocla superciliaris</i>	x			x					
26. <i>Cittociocla nigrorum</i>	x								
27. <i>Dasyerodtopha speciosa</i>	x	x							
28. <i>Artamides panayensis</i>	x	x	x	x					
29. <i>Edolisoma panayensis</i>	x	x	x						
30. <i>Rhipidura albiventris</i>	x	x	x	x					
31. <i>Rhinomyias albigularis</i>	x		x						
32. <i>Stoparola panayensis</i>	x	x							
Total.....	30	22	15	15	5	2	5	8	0

It will be noted that all but ten of these thirty-two species are, so far as we at present know, strictly confined to Negros, Panay, Guimaras, and Masbate. Not one of them has been found in Bohol, and only eight of them are known to occur in Cebu.

The apparent differences between Negros, Panay, and Guimaras which this table brings out admit of ready explanation. It will be noted at once that they are nearly all negative—i. e., they consist in the nondiscovery in some of the islands of species which have been found in others. In but a single case have we an instance of the occurrence of different representative species of one of the genera of this table in any two of these islands.

If we compare Negros with Panay, for instance, we note that *Phabotreron maculipectus*, *Halcyon moseleyi*, *Oriolus nigrostriatus*, *Aethopyga bonita*, *Brachypteryx brunneiceps*, *Turdus nigrorum*, and *Cittociocla nigrorum* are recorded from Negros, but not from Panay.

Phabotreron maculipectus, *Aethopyga bonita*, and *Rhinomyias albigularis* are all deep-woods forms, rare and shy. Each of these species

was discovered by Bourns and myself in Negros after our work in Panay was concluded. *Haleyon moseleyi* and *Oriolus nigrostriatus* are rare birds, while the remaining three species are known only from Whitehead's specimens, and at least two of them are highland forms.

Taking into consideration that the highlands of Panay have never been visited by a collector, and remembering that there are 171 species of birds known from Negros, against but 118 from Panay, it is small wonder that these 7 comparatively rare species should be recorded from Negros, but not from Panay. I venture to prophesy that almost every one of these apparent differences will disappear as Panay becomes better known.

It is interesting to note in this connection that only one of the Panay species of this list is not recorded from Negros, and this species is a "frogmouth," known only from the single specimen obtained by Bourns and myself. Its discovery in Panay was the merest chance, and we never saw a second specimen.

The same course of reasoning which has been employed in discussing the differences between Negros and Panay may be applied to the apparent differences between Guimaras on the one hand and Negros and Panay on the other.

In the case of Masbate, however, we have some differences of a positive character. *Acyone nigrirostris* and *Dicaeum haematostictum* are here replaced by *Acyone cyanipectus* and *Dicaeum rubriventer*. As Masbate is but 20 miles from the coast of Luzon, and this gap is partially bridged by the intervening island of Ticao, it is not to be wondered at that some Luzon forms should have straggled in.

Seemingly the most important difference between Masbate and Negros is the occurrence in the two islands of different species of *Cittocincla*. On the whole, however, the relationship between Masbate and the islands with which I have joined it is vastly stronger than between it and Luzon.

From these facts it seems to me evident that Negros, Panay, Guimaras, and Masbate should be grouped together, and probable that they have in the past been actually connected.

They are separated from the eastern and southern islands on account of the following differences: First, the occurrence of twenty-two peculiar species of birds, and ten others which range only to the Tablas-Romblon-Sibuyan group, or to Cebu; second, the absence of such genera as *Phlogoenas*, *Hydrocorax*, *Harpactes*, *Surniculus*, *Bolbopsittacus*, *Microstictus*, *Zosterornis*, *Maeronus*, *Ptilocichla*, *Poliolophus*, *Irena*, *Pericrocotus*, *Arachnothera*, and *Muscicapula*.

Glancing for a moment at the mammals, we note that these islands have a spotted deer peculiar to them, and a little tiger cat (*Felis bengalensis*) which has not been recorded from any other island of the Philippines proper, while they lack the genera *Sciurus*, *Sciuropterus*, *Galeopithecus*, and *Tarsius*, as well as other characteristic mammals of

the northern and eastern islands. In short, the evidence furnished by the mammals is strongly confirmatory of the conclusions already reached from our examination of the birds.

CEBU.

Cebu extends in a northeast-southwest direction for 120 miles, its greatest width being slightly more than 20 miles. At its southern extremity it approaches to within about 4 miles of Negros. As already indicated, Steere has included it in his "subprovince," the central Philippines, and a glance at the map certainly would not lead one to expect a fundamental difference between the avifaunae of Cebu and Negros. Nevertheless, I shall attempt to show that such a difference exists.

The first really important ornithological work ever done in Cebu was that of Mr. A. H. Everett, who made some interesting finds there during his famous collecting tour of the islands.

The Steere expedition visited the island in 1888, and Bourns and I made vigorous efforts to find forest in the high hills back of the town of Carmen. We met with most indifferent success, finding only now and then a small patch of trees at the summit of some steep incline. The ground was often so treacherous that we were obliged to hunt on all fours, and many of the birds shot were lost, falling far below us, where we could not reach them. Two new species, *Cittocincla cebuensis* and *Ninox spilonotus*, were obtained, and *Chloropsis flavipennis* was seen, but none of Mr. Everett's other new species were met with.

In 1891, while skirting the west coast in a small sugar steamer, we were so fortunate as to discover what we had been assured did not exist in the island, namely, a fair-sized patch of forest on tolerably smooth ground. We were unable to stop at the time, but returned the following year and collected for several weeks with good success, not only rediscovering all of Everett's new species, but adding a fine new *Phabotreron*, an *Iole*, and a *Piprisoma* to the list ourselves. We also added 37 known species to the Cebu list, bringing the total up to 125.

The following species are seemingly peculiar to the island of Cebu: *Phabotreron frontalis*, *Loriculus chrysonotus*, *Oriolus assimilis*, *Dicacum pallidior*, *Cryptolopha flavigularis*, *Cittocincla cebuensis*, *Iole monticola*, *Edoliisoma cebuensis*, and *Artamides cebuensis*.

Apart from the presence of these peculiar species, other important differences separate Cebu from the central Philippines. The latter islands have another long-billed *Phabotreron* (*P. maculipectus*), another *Oriolus* (*O. nigrostriatus*), another *Dicacum* (*D. dorsale*), another *Edoliisoma* (*E. panayensis*), and another *Artamides* (*A. panayensis*). We do not find any close ally of the large *Iole monticola* in the central islands, nor is there any species known which at all resembles the beautiful *Prionochilus quadricolor* of Cebu. These peculiar species furnish us with important evidence, but it is by no means the only evidence at our disposal. *Chloropsis flavipennis* affords us another example of a

genus conspicuous in the central islands by its absence, while Cebu lacks the genera *Chrysocolaptes* and *Orthotomus*, and is without a single known representative of the *Bucerotidae* and *Timeliidae*.

What have we to set over against this by way of proof of relationship with the central Philippines? Simply the occurrence of eight species of birds characteristic, on the whole, of the central group, but in three instances at least (*Aethopyga magnifica*, *Hyloterpe winchelli*, and *Phabotreron nigrorum*) ranging beyond it to the north as well as to Cebu.

It seems to me evident from the large number of important forms in the central Philippines which do not occur in Cebu, and from those in Cebu which are wanting in the central Philippines, that the avifaunae of the two islands were originally very distinct. The wonder is not that eight species should have made their way, in one direction or the other, over 4 miles of sea, but rather that thirty-four species should have failed to cross, or, having crossed, should have failed to establish themselves.

In this connection it is interesting to note the absence of deer in Cebu. *Felis bengalensis* probably occurs, as the natives described it to us. We saw a cap made of its fur, and also saw what was apparently the result of a cross between it and a domestic cat.

The channel which separates Cebu from Negros, although narrow, is everywhere very deep, the chart showing 110 to 120 fathoms—"no bottom." I myself found 200 fathoms of water not far from the Negros coast. I believe that this deep channel is indicative of a long-standing separation between the two islands. It would, it seems to me, be more reasonable to unite the chain of islands which extends from Luzon to Basilan into a single group than to include Cebu with Panay, Guimaras, Masbate, and Negros.

BOHOL.

The relationship of the birds of Bohol is difficult to determine, as the last trace of virgin forest seems to have long since been swept from the island, and with its disappearance a considerable part of the record of Bohol's past, as furnished by its birds, has been forever blotted out.

Of the 54 species of birds known to inhabit the island but 13 are Philippine species, and most of these are wide-ranging forms which afford us no evidence of value.

The three exceptions to this rule, *Loriculus apicalis*, *Orthotomus frontalis*, and *Phabotreron brevirostris*, all point unequivocally to a relationship between the birds of Bohol and those of the eastern and southern islands rather than with Cebu or the central Philippines. This view of the position of Bohol is made the more probable by the occurrence of *Galeopithecus*, a mammal which ranges through the southern and eastern islands from Basilan to Luzon, but is unknown in the central group.

Although the distance from Bohol to Leyte is slightly greater than that to Cebu, the water between Bohol and Leyte is very shallow, the deepest sounding being but 22 fathoms, while soundings varying from 91 to 105 fathoms have been made in the channel between Bohol and Cebu without getting bottom.

If a bit of forest remains on this island it would richly repay a visit. From the evidence at hand I can only conclude that the island should be grouped with Leyte rather than with Cebu.

SQUIJOR.

Siquijor is a small island, with an area of about 90 square miles. It lies some 12 miles southeast of the southern extremity of Negros. There is a tradition among the natives to the effect that the island has been thrown up from beneath the sea within a comparatively short time, and there is abundant geological evidence that this tradition is founded on fact. Every stone cracked open by the hammer shows evident signs of its coral origin. The tops of the highest hills, which rise a thousand feet above sea level, are strewn with the shells of the very same mollusks which to-day live along the shores. The hills themselves are mere masses of coral rag, to which a few trees cling with difficulty, as the soil washes down into the valleys almost as fast as it is formed. The fresh-water streams are without fish.

The birds of Siquijor form a somewhat miscellaneous assemblage. Ten or 12 miles of water may seem a small matter to us here in America, where our change of seasons drives many of our birds from north to south and back again, but in the Tropics, where birds may be born, grow old, and die within the limits of a single grove, and never suffer want of food or shelter, the effect of a barrier of these dimensions is far more noteworthy. In the present instance numerous species of birds have either utterly failed to cross from the neighboring islands, or having reached the island have been unable to live and multiply there.

So far as I know the only work ever done on the birds of Siquijor has been that of Mateo Francisco, Bourns, and myself. By diligent search, carried on for weeks on two different occasions, we were able to raise the total number of species of birds recorded to 86. But 34 of these are Philippine species, and, as was perhaps to be anticipated, nearly all of the 34 are species which range widely throughout the archipelago.

Not a single one of the species characteristic of the central islands was found in Siquijor. *Phaboteron brevirostris*, *Ceyx bournsi*, *Haleyon vinchelli*, and *Hyloterpe philippinensis* have probably come in from Mindanao, though they might possibly have worked through from Leyte by way of Bohol.

To me, however, the most interesting feature of the avifauna of this little island is the occurrence of three well-marked representative species of birds. These are *Dicaeum besti*, *Loriculus siquijorensis*, and *Iole siquijorensis*.

The occurrence of these three peculiar species on an island which has recently been heaved up from beneath the sea would present an interesting problem to nonbelievers in evolution. How did these species get into Siquijor? There are but two possible theories: They are the modified descendants of species that have straggled into the island, or a special creative act has recently been necessary, in order to populate Siquijor with birds.

It is interesting to note that no *Megapodiidae*, *Turnicidae*, *Bucerotidae*, *Capitonidae*, *Picidae*, *Dicruridae*, *Sittidae*, *Paridae*, or *Timeliidae* are known from the island, although each of these families is represented in the islands immediately adjacent.

TABLAS, ROMBLON, AND SIBUYAN.

So far as I am aware, the only collections of birds ever obtained from these islands are those made there by myself in 1892. I had hoped for much from Sibuyan, knowing that it was surrounded by water of considerable depth, but I fully expected to find old friends in the birds of Tablas. The results of my work show very conclusively the folly of attempting to draw *a priori* conclusions as to the avifauna of adjacent islands from their geographical relationship as shown on a chart which does not give accurately the depth of the water between them. Tablas is a well-wooded island some 30 miles in length, by 8 to 10 in width. A range of high hills runs from north to south near the east coast.

During my stay in the island I was in such poor health as not once to be able to set foot in the forest. I was fortunate in having with me as a hunter, however, Mateo Francisco, a Philippine native, who was brought to this country as a boy by Steere in 1874, returned to the Philippines with us in 1887 and shot the greater part of the birds brought back by Steere in 1888. He remained at his old home in Mindanao when we left the islands, and we picked him up there in 1891. His familiarity with the birds and their ways was so great that I could easily direct his work, sending him for anything I desired, and I felt great confidence in his statements as to the occurrence or nonoccurrence of the commoner forms.

Fully expecting to find the birds of Tablas identical with those of Panay, I was pleasantly surprised when Mateo brought in on the first day an *Iole* larger than any previously discovered in the Philippines, and a fine new *Chibia*. During my stay in the island he brought me specimens of 71 species of birds, of which 4 were new.

Thirty-six Philippine species were obtained. The following have probably come in from Panay:

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| 1. <i>Phabotreron nigrorum</i> . | 5. <i>Anthreptes chlorigaster</i> . |
| 2. <i>Prioniturus discurus</i> . | 6. <i>Hyloterpe winchelli</i> . |
| 3. <i>Loriculus regulus</i> . | 7. <i>Pycnonotus goiavier</i> . |
| 4. <i>Aethopyga magnifica</i> . | 8. <i>Pitta atricapilla</i> . |

Ceyx bournsi and *Haleyon winchelli* may have followed the same route. The former was obtained in Negros by us, and while the latter has

never been secured in the central islands I do not consider its occurrence there improbable. The finding of such very common species as *Pycnonotus goiavier* and *Pitta atricapilla* is worthy of note merely because we failed to obtain either in Romblon and Sibuyan.

The occurrence of *Chibia menagei* in Tablas is an ornithological puzzle. The only other species of the genus known from the Philippines, *Chibia borneënsis*, has straggled into the extreme southwestern islands from Borneo. The only explanation I can suggest for the occurrence of this well-differentiated form in Tablas is that it is derived from wind-driven stragglers of the Palawan species (*C. palawanensis*), from the northern islands of the Palawan group. The numerous islets and shoals intervening would afford occasional stopping places, and are, perhaps, indicative of a former closer connection between these islands, though why *Chibia* should have reached Tablas and be absent in Mindoro and Panay, if it came by this route, I can not see.

A second oddity is *Rhipidura sauli*, which has a close ally in *Rhipidura cyaniceps* of Luzon.

Iole cinereiceps is strikingly different from *Iole philippinensis*, the central Philippine form. It most nearly resembles *Iole monticola* of Cebu. Some intermediate form between the two may yet be discovered in the highlands of the central islands.

The occurrence of these three species, as well as that of *Dicaeum intermedium* in the place of *D. dorsale*, presents an obstacle to grouping this island with the central Philippines, which is greatly augmented by the negative characteristics of its bird fauna.

Of the 29 species previously listed as especially characteristic of the central islands, but four were found in Tablas; and I ought to state here that in the large series of *Loriculus regulus* obtained in Tablas, Romblon, and Sibuyan not a single male was found with as much orange on the head as is shown by Panay specimens in good plumage.

Alyone is almost certainly absent. We searched the banks of the small streams for it in vain. The *Bucerotidae*, *Capitonidae*, and *Picidae* have not a single species, while *Dicrurus* is replaced by *Chibia*. *Dicaeum haematostictum* does not occur, and the absence of tailor-birds (*Orthotomus*) is especially striking. The *Timeliidae* are without a representative. *Rhipidura albiventris* is replaced by *R. sauli* and *Artamides panayensis* by *A. mindorensis*.

These facts, together with the entire absence of deer, lead me to the conclusion that Tablas has not been connected with Panay, at least since the latter island received its present fauna.

Romblon is a small island but 4 or 5 miles from Tablas. At present it is almost entirely under cultivation. But two small patches of forest remain on the island. Of the 47 species of birds which I found there, 25 are Philippine. With the exception of *Baza leucopais*, these have all been found in Tablas also, and *B. leucopais*, originally discovered in Palawan and since found in Samar by us, may be looked for almost anywhere in the Philippines.

It is not surprising that we should not have found such deep-woods forms as *Chibia menagei* and *Rhipidura sauli* in Romblon, as the few acres of forest remaining do not afford them a suitable habitat. The presence of *Iole cinereiceps* and *Dicaeum intermedium* will perhaps serve, however, to indicate the relationship of the now rapidly diminishing avifauna of the island. Romblon belongs, I believe, with Tablas, and the two islands must, like Siquijor, be given a place by themselves.

Sibuyan is a much more attractive field for the ornithologist than Romblon. It is separated from the latter island by a channel some 6 miles wide and about 100 fathoms deep. In its center the fine peak of Giting-giting rises to a height of 6,500 feet. To the south of Giting-giting is a deep canyon, with the soil and vegetation on its opposite sides quite distinct. Conifers grow at sea level—a most unusual sight in the Philippines.

Giting-giting was a perpetual temptation to me, and I twice climbed it to a height of 4,000 feet only to be driven back by the storms which hardly ceased to rage about the mountain during my stay. It is perhaps worthy of note that *Aethopyga magnifica* and *Hyloterpe winchelli* were obtained at the highest point reached, while *Ceyx bournsi* was abundant at a height of 2,000 feet.

The lowlands of Sibuyan were in many places abundantly clothed with forest, and the weather there was comparatively favorable for collecting during my stay, so that a good collection of the lowland birds was secured in a short time. Of the 65 species obtained, 36 were Philippine forms.

Not one of the four new species discovered in Tablas and Romblon was found in Sibuyan. *Tyngipicus menagei* and *Dicaeum sibuyanicum* were the only novelties obtained, although the discovery of *Cyanomyias coelestis*, hitherto known only from Basilan, Mindanao, and Dinagat, was quite as interesting to me as would have been the finding of a new species. *C. coelestis* is comparatively common on the island. Three specimens were secured and others seen.

Of the remaining species, *Phabotreron nigrorum*, *Aleyone cyanipectus*, *Prioniturus discurus*, *Loriculus regulus*, *Aethopyga magnifica*, *Anthothreptes chlorigaster*, and *Hyloterpe winchelli* are the only ones of interest. All of these are central Philippine forms, and have perhaps found their way into Sibuyan along the route indicated by the line of shoals which connects Sibuyan with Masbate. I can not believe that there has been actual connection here, however, for we are once more confronted with the absence of whole families like the *Bucerotidae*, *Capitonidae*, *Dicruroidae*, and *Timeliidae*. No *Paridae*, *Cethiidae*, or *Pycnonotidae* were obtained, although the ground collected over was well suited to them. Representatives of the two former families may have been overlooked, however.

These facts, as well as the absence of deer, lead me to doubt the existence of any connection between Sibuyan and the islands to the south and east since the latter obtained their present characteristic fauna,

and the absence of the forms peculiar to Tablas and Romblon render it improbable that there has been any recent connection between them and Sibuyan.

I venture to prophesy that the first ornithologist who successfully attempts to collect at a high altitude on Giting-giting will make some interesting finds.

MINDORO.

The avifauna of Mindoro has not as yet received the attention which it deserves. The island is of good size, measuring 90 miles in greatest length by 50 in greatest width. Its interior is abundantly clothed with the densest of tropical forests. In the north center rises the magnificent Mount Halcon, the height of which, as obtained by triangulation, is 8,865 feet. A fine chain of mountains stretches away from Halcon to the south. Open grassy plains of large extent are to be found in the southern and western portions of the island, and there is excellent collecting ground for aquatic birds about Lake Naujan.

Unfortunately there are numerous drawbacks to offset these attractions. The climate is intolerably bad, rain falling in torrents much of the time during nine months of the twelve, and not infrequently during the other three. The coasts of the island, especially the western and southern, are populated by organized bands of thieves and cutthroats ("tulsanes"), who use Mindoro as a base of operations, and make piratical expeditions against the peaceable natives and Spanish planters on the neighboring islands. Several most fiendish deeds were perpetrated by these brutes during our stay in the island.

The interior of Mindoro is sparingly peopled by a race of almost naked savages, the "Mangyans," or "Manguyanes," who were represented to us as head hunters, cannibals, and what not, but proved to be harmless as children so long as they were decently treated.

One may scare the "tulsanes" without much exertion, for they are most desperate cowards, and very superstitious at that; he may easily make friends with the savages, but there is one dangerous enemy in Mindoro from which there is no escape—the pestiferous fevers bred by the decaying vegetation in the dense lowland forests—and the man who collects there can make up his mind beforehand to be ill. Mindoro has been not inaptly dubbed by the natives "the white man's grave."

During the comparatively short stay of the Steere expedition in Mindoro in 1888, most of our time was given to hunting the "timarau" (*Bubalus mindorensis*, Heude), and comparatively little work was done on the birds, yet several interesting new species were discovered. Not long after our departure Schmacker made a collection of birds in the vicinity of Mount Halcon, but most of his discoveries had been anticipated by the Steere expedition.

When Bourns and I returned to the island in 1891 we found that the well-known German collector, Doctor Platen, aided by his wife and a force of native hunters, had been in the island for more than a year

and had shipped extensive collections home. Knowing the thoroughness with which Platen's work is usually done, it did not seem to us worth while, under the circumstances, to give much time to the birds, and during that and our subsequent visit to the island we devoted ourselves chiefly to collecting mammals, reptiles, and land mollusca.

For some unexplained cause no account of Platen's collections has ever appeared, a fact which is greatly to be regretted.

Quite recently Everett undertook an expedition to the island, which he was unfortunately compelled to abandon before it was fairly begun.

Finally, Whitehead has attempted to work the highlands of Mindoro. Unfortunately he chose the worst possible months for visiting an island which has a sufficiently abominable climate at best, and in comparison with what he has accomplished in several other localities his results are disappointing.

As a result of all this collecting but 134 species are known from this large, well watered, and magnificently wooded island, and it is certainly true that much remains to be done in Mindoro.

Sixty-four of the known species are strictly Philippine forms. The following species are peculiar to the island so far as we at present know, though they may be discovered in the at present unknown islands Ylin and Lubang, or in smaller islands near Mindoro.

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| 1. <i>Carpophaga mindorensis</i> . | 7. <i>Loriculus mindorensis</i> . |
| 2. <i>Phlogoenas mindorensis</i> . | 8. <i>Thriponax mindorensis</i> . |
| 3. <i>Penelopides mindorensis</i> . | 9. <i>Turdus mindorensis</i> . |
| 4. <i>Centropus mindorensis</i> . | 10. <i>Geocichla cinerea</i> . |
| 5. <i>Centropus sterrii</i> . | 11. <i>Iole mindorensis</i> . |
| 6. <i>Prioniturus mindorensis</i> . | |

Upon comparing the remaining species with the corresponding Luzon forms, we note that the Mindoro species *Phlogoenas platenae*, *Penelopides mindorensis*, *Loriculus mindorensis*, *Thriponax mindorensis*, and *Ceyx enerythra* are replaced in Luzon by *Phlogoenas luzonica*, *Penelopides manillae*, *Loriculus philippensis*, *Thriponax javensis*, and *Ceyx melanura*, respectively.

On the other hand, the following species are common to Luzon and Mindoro, most of them being confined to these islands and the smaller ones immediately adjacent:

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| 1. <i>Phabotreron leucotis</i> . | 10. <i>Dicaeum xanthopygium</i> . |
| 2. <i>Carpophaga carola</i> . | 11. <i>Prionochilus inexpectatus</i> . |
| 3. <i>Porphyrio pulverulentus</i> . | 12. <i>Zosterops aureiloris</i> . |
| 4. <i>Alygon cyanipectus</i> . | 13. <i>Brachypteryx polioyyna</i> . |
| 5. <i>Iyngipicus validirostris</i> . | 14. <i>Hyloterpe albiventris</i> . |
| 6. <i>Dicurus baliassius</i> . | 15. <i>Lanius validirostris</i> . |
| 7. <i>Chlorura brunneiventris</i> . | 16. <i>Lalage melanoleuca</i> . |
| 8. <i>Aethopyga flavipectus</i> . | 17. <i>Stoparola nigrimentalis</i> . |
| 9. <i>Dicaeum retrocinctum</i> . | |

Turning now to the negative differences between the two islands, I propose to confine myself to cases in regard to which there can be no doubt, omitting mention of a number of genera which have not been

found in Mindoro, and which I believe will not be found there, though they may have been thus far overlooked.

Hydrocorax does not occur in Mindoro, although the island is seemingly remarkably well adapted to it. So of *Harpactes*, and of the three peculiar Luzon cookoos, *Centropus unirufus*, *Dasylophus superciliosus*, and *Lepidogrammus cumingi*. *Bolbopsittacus* is lacking and so are *Chrysocolaptes* and *Microstictus*. There seems to be no *Oriolus* of the *O. steerii* type. No *Anthothreptes* has as yet been found, though I spent a number of days collecting in cocoanut groves. Tailor birds (*Orthotomus*) are certainly absent, and *Cittocincla* is probably so. *Irena* is certainly, and *Zosterornis* probably, lacking.

The facts above enumerated, as well as the absence of the characteristic Luzon mammals in Mindoro, and that of *Bubalus mindorensis* in Luzon, have forced me to the conclusion that the faunae of the two islands were originally fundamentally distinct.

It certainly requires no stretch of the imagination to suppose that the Luzon birds found in Mindoro may have crossed at Puerto Gallera by way of Isla Verde.

LUZON, MARINDUQUE, AND CATANDUANES.

The avifauna of Luzon is better known than that of any other island of the Philippine group. Nearly every ornithological collector who has visited the archipelago has been forced to go there whether he would or not, and most of the collectors who have visited Manila have improved the opportunity to do more or less work, although their operations have been for the most part confined to the immediate vicinity of that city.

Luzon is the largest of the Philippine Islands, and with its extensive fresh-water lake, great rivers, and lofty forest-clad mountains it offers splendid collecting ground.

My personal familiarity with the island is slight. During our first visit to the Archipelago neither Bourns nor I fired a gun there. At the beginning of our second visit we went to the Laguna de Bay for three weeks, to "break in," but were unfortunate in the locality we selected, which was too far from the forest, and were hindered by torrents of rain which fell almost without interruption during our stay.

My last trip in the islands was to have been to North Luzon and the Batanes and Babuyanes groups. To my everlasting regret, an attack of typhoid fever made it necessary for me to abandon this long-cherished plan and leave the Philippines once for all.

In spite of bad collecting ground and worse weather, the results of our three weeks' work in Luzon were such as to convince us that much remained to be done there, and it was with genuine satisfaction that we learned of the intended visit to the island of Mr. John Whitehead, so well known from his remarkable work on Mount Kina Balu, in Borneo.

The splendid results of Whitehead's work in Luzon have been made known to the readers of the *Ibis* through the interesting papers of Mr. W. R. Ogilvie Grant.

Whitehead not only collected in various parts of the island remote from the capital, but pushed into the highlands, reaching ground where no collector had ever set foot before. Just what it means to get to the places which he reached, and to stay there and collect after getting there, no one can realize who has not had experience with Spanish officialdom and the Philippine native, his country, and its climate.

Of the 286 species of birds recorded from Luzon, no less than 136 are Philippine species. The following seem to be peculiar to this island and the smaller ones immediately adjacent to it:

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| 1. <i>Turnix ocellata</i> . | 27. <i>Eudrepanis jefferyi</i> . |
| 2. <i>Phabotreron leucotis</i> . | 28. <i>Cinnyris flagrans</i> . |
| 3. <i>Ptilopus marchei</i> . | 29. <i>Cinnyris whiteheadi</i> . |
| 4. <i>Phlogoenas luzonica</i> . | 30. <i>Cinnyris excellens</i> . |
| 5. <i>Scops megalotus</i> . | 31. <i>Dicaeum obscurum</i> . |
| 6. <i>Scops longicornis</i> . | 32. <i>Zosterops meyeri</i> . |
| 7. <i>Scops whiteheadi</i> . | 33. <i>Zosterops luzonica</i> . |
| 8. <i>Batrachostomus microrhynchus</i> . | 34. <i>Lusciniola seebohmi</i> . |
| 9. <i>Halecyon lindsayi</i> . | 35. <i>Cettia seebohmi</i> . |
| 10. <i>Penelopides manillae</i> . | 36. <i>Chimarrhornis bicolor</i> . |
| 11. <i>Centropus uirufus</i> . | 37. <i>Orthotomus derbianus</i> . |
| 12. <i>Dasylophus superciliosus</i> . | 38. <i>Orthotomus chloronotus</i> . |
| 13. <i>Lepidogrammus cumingi</i> . | 39. <i>Cittociocla luzoniensis</i> . |
| 14. <i>Prioniturus luconensis</i> . | 40. <i>Zosterornis striatus</i> . |
| 15. <i>Prioniturus montanus</i> . | 41. <i>Zosterornis whiteheadi</i> . |
| 16. <i>Bolbopsittacus lunulatus</i> . | 42. <i>Zosterornis dennistouni</i> . |
| 17. <i>Loriculus philippensis</i> . | 43. <i>Pseudotharrhaleus caudatus</i> . |
| 18. <i>Chrysocolaptes haematribon</i> . | 44. <i>Irena cyanogastra</i> . |
| 19. <i>Microstictus funebris</i> . | 45. <i>Artamides striatus</i> . |
| 20. <i>Oriolus albiloris</i> . | 46. <i>Rhipidura cyaniceps</i> . |
| 21. <i>Oriolus isabellae</i> . | 47. <i>Rhinomyias insignis</i> . |
| 22. <i>Loxia luzoniensis</i> . | 48. <i>Siphia enganensis</i> . |
| 23. <i>Pyrrhula leucogenys</i> . | 49. <i>Siphia herioti</i> . |
| 24. <i>Mirafra philippinensis</i> . | 50. <i>Callaeops periopthalmica</i> . |
| 25. <i>Rhabdornis mystacalis</i> . | 51. <i>Pitta kochi</i> . |
| 26. <i>Dendrophila mesoleuca</i> . | |

We have, then, 51 species not known from the Philippines outside of Luzon, Marinduque, and Catanduanes. Eleven of the genera represented are peculiar, and no one can object to Steere's assigning Luzon and its small neighbors to a place of their own. It should be remembered, however, that of the above-enumerated species 33, including all but 3 of the peculiar genera, were discovered by Whitehead. Just how many of them are highland forms we are not informed, but certainly a considerable number. Until the highlands of the remaining islands have been worked as thoroughly as have those of Luzon, there is, therefore, danger of exaggerating the distinctness of the Luzon avifauna.

Marinduque is an island nearly round in outline, and about 40 miles in diameter. It lies some 20 miles from the coast of Luzon, but the intervening space is partially bridged by several islets, and the water is shallow.

The birds of this island are known chiefly through the collections of the Steere expedition, made in 1888. Our headquarters were at Boac, and there was no really good collecting ground within reach. We obtained 74 species of birds, however. Every one of the Philippine species obtained in Marinduque is also recorded from Luzon, while the occurrence of such species as *Hydrocorax hydrocorax*, *Penelopides manillae*, *Dasylophus superciliosus*, *Lepidogrammus cumingi*, *Prioniturus luconensis*, *Loriculus philippensis*, *Chrysocolaptes haematribon*, *Microstictus funebris*, and *Cittocincla luzoniensis* is proof positive that Marinduque is to be considered a fragment of Luzon.

Catanduanes is a larger island than Marinduque. It lies east of the southern portion of Luzon, and is distant about 6 miles from that island. I know nothing of it personally, but my friend, Sör. José Quadras, the well-known conchologist, who has gathered land mollusca on the island, informed me that it was mountainous and abundantly wooded.

Its birds are known to us only through the collections of Whitehead, the first ornithologist to visit it.

As in the case of Marinduque, all the Philippine species recorded are also known from Luzon, while the occurrence of the following characteristic Luzon species makes it safe for us to class it as another detached fragment of that island:

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| 1. <i>Phabotreron leucotis</i> . | 5. <i>Microstictus funebris</i> . |
| 2. <i>Dasylophus superciliosus</i> . | 6. <i>Cinnyris excellens</i> . |
| 3. <i>Loriculus philippensis</i> . | 7. <i>Orthotomus derbianus</i> . |
| 4. <i>Iynpipicus validirostris</i> . | 8. <i>Cittocincla luzoniensis</i> . |

FUGA.

Fuga is one of the Babuyanes islands. It lies some 15 miles off the north coast of Luzon. Mr. Whitehead made a brief enforced stay there, being driven off shore while attempting to make Cape Engaño.

One of the seven species of birds obtained makes us wish that he had tarried long enough to make a more complete collection. In *Hypsipetes fugensis* we have the only known Philippine representative of this genus. The remaining forms give us no clew as to whether or not there is a close relationship between the Fuga and Luzon birds. The collector who is plucky enough to face the strong winds and dangerous currents which make navigation among the Batanes and Babuyanes islands so dangerous that the mail steamers make the run but twice a year, "weather permitting," will make valuable discoveries, provided he can reach the more important islands of the chain and contrive to live on them after he gets there.

SAMAR, LEYTE, AND PANAON.

For the purposes of this paper Samar and Leyte may be considered to form a continuous area, for the channel which separates them is very narrow and is dotted with numerous islets, so that it does not form an appreciable barrier. The first collections of importance in Samar were those made by the Steere expedition. Bourns and I made a second trip to the island upon our return to the Philippines, and more recently Whitehead has visited it twice, his first collection having unfortunately been destroyed.

The first collector to visit Leyte was Everett, who worked at the southern extremity of the island. Steere made a short collecting trip in the vicinity of Tacloban in 1888, and Whitehead concluded his Philippine work at the northern end of the island after an ineffectual attempt to reach Biliran.

Whitehead was unable to reach good collecting ground in the highlands of either Samar or Leyte.

One hundred and fifty species are known from Samar, against 119 from Leyte. The only differences worth mentioning that are brought out by comparing the species known from the two islands are due to the occurrence in southern Leyte of a few Mindanao species, which apparently do not range northward into Samar.

The following peculiar species are sufficient to give to the avifauna of these islands a good deal of individuality:

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| 1. <i>Alcyon fluminicola.</i> | 12. <i>Oriolus samarensis.</i> |
| 2. <i>Ceyx samarensis.</i> | 13. <i>Orthotomus samarensis.</i> |
| 3. <i>Hydrocorax semigaleatus.</i> | 14. <i>Zosterornis pygmaeus.</i> |
| 4. <i>Penelopides samarensis.</i> | 15. <i>Zosterornis nigrocapitatus.</i> |
| 5. <i>Bolbopsittacus intermedius.</i> | 16. <i>Rhabdornis inornatus.</i> |
| 6. <i>Loriculus worcesteri.</i> | 17. <i>Ptilocichla minuta.</i> |
| 7. <i>Iyugipicus leytensis.</i> | 18. <i>Irena ellae.</i> |
| 8. <i>Chrysocolaptes rufopunctatus.</i> | 19. <i>Pericrocotus leytensis.</i> |
| 9. <i>Thriponax pectoralis.</i> | 20. <i>Muscicapula samarensis.</i> |
| 10. <i>Sarcophanops samarensis.</i> | 21. <i>Hypothymis samarensis.</i> |
| 11. <i>Corvus samarensis.</i> | 22. <i>Cyanomyias helenae.</i> |

Panaon is known to us only through the collections of Everett. Of the 20 species of birds which he obtained, only *Chrysocolaptes rufopunctatus*, *Thriponax pectoralis*, and *Hydrocorax semigaleatus* afford evidence as to the zoological position of the island. These all point to a close relationship with Leyte, of which Panaon probably at one time formed a southern projection.

THE RELATIONSHIP BETWEEN LUZON, SAMAR, AND LEYTE.

I have already given a list of 51 species not recorded outside of Luzon and the small islands immediately adjacent to it. In comparing the birds of Luzon with those of Samar and Leyte we must add to this list

the following species common to Luzon and Mindoro, but not known to range to the south:

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| 1. <i>Carpophaga carola</i> . | 7. <i>Dicaeum retrocinctum</i> . |
| 2. <i>Porphyrion pulverulentus</i> . | 8. <i>Dicaeum xanthopygium</i> . |
| 3. <i>Iyngipicus validirostris</i> . | 9. <i>Lanius validirostris</i> . |
| 4. <i>Dicrurus balicassius</i> . | 10. <i>Hyloterpe albiventris</i> . |
| 5. <i>Chlorura brunneiventris</i> . | 11. <i>Lalage dominica</i> . |
| 6. <i>Aethopyga flavipectus</i> . | 12. <i>Brachypteryx poliogyua</i> . |

This gives us the rather imposing total of 63 Luzon forms not found in Samar as yet, and if we add the 22 Samar species not recorded from Luzon the total difference between the two regions is great. I wish, however, to call attention to certain common features in the avifaunae of the two islands. The only families of land birds of which representatives have been found in Luzon, but not in Samar or Leyte, are the *Strigidae*, *Caprimulgidae*, *Fringillidae*, *Alaudidae*, and *Paridae*. It can hardly be doubted that, with the possible exception of the *Fringillidae*, representatives of all these families will eventually be found in Samar and Leyte, and in the case of the *Fringillidae* we must remember that the highlands of these islands are yet to be heard from.

Apart from the practical agreement of the families represented, several of which are confined in the Philippines to the eastern and southern islands, we find the following genera ranging from Mindanao to Luzon, in some cases even from Tawi Tawi to Luzon, but not recorded from the central Philippines:

- | | |
|-----------------------------------|---------------------------|
| 1. <i>Phlogoenas</i> . | 10. <i>Microstictus</i> . |
| 2. <i>Microhierax</i> . | 11. <i>Eudrepanis</i> . |
| 3. <i>Pitheophaga</i> (probably). | 12. <i>Zosterornis</i> . |
| 4. <i>Bubo</i> . | 13. <i>Poliolophus</i> . |
| 5. <i>Scops</i> . | 14. <i>Irena</i> . |
| 6. <i>Hydrocorax</i> . | 15. <i>Muscicapula</i> . |
| 7. <i>Lyncornis</i> . | 16. <i>Pericrocotus</i> . |
| 8. <i>Harpactes</i> . | 17. <i>Surniculus</i> . |
| 9. <i>Bolbopsittacus</i> . | |

It would seem, then, that there is a general relationship between the chain of islands forming the eastern and southern Philippines, and as a further evidence of the closeness of this relationship it will be found that at each of the natural barriers in this chain there is more or less overlapping of species. *Harpactes ardens*, *Surniculus relutinus*, *Prioniturus discurus*, *Anthothreptes griseigularis*, *Dicaeum rubriventer*, *Dicaeum luzoniense*, *Hyloterpe philippinensis*, *Lalage minor*, and *Poliolophus urostictus* are species which illustrate the partial overlapping of the avifaunae of Samar and Luzon.

Such a large number of genera are known to have different representative species in Samar and Luzon as to warrant the supposition that a considerable amount of difference will remain in the avifaunae of the two islands when our knowledge of Samar and Leyte becomes as complete as is our knowledge of Luzon at present, but when we remember that the apparent differences are due in

no small degree to the fact that the highlands of the more southern islands are still quite unknown, it seems probable that further work will tend to decrease rather than to increase them.

It is perhaps worth while to note in passing that Samar seems to be the northern limit in the Philippines of the genera *Macronus*, *Ptilo-cichla*, and *Sarcophanops*. Some of these genera may yet be discovered in Luzon, but it seems to me improbable that they should have been overlooked by Whitehead, who spent upward of two years in the island.

One Samar-Leyte form has always puzzled me. Why should *Thriponax javensis* give way in Samar and Leyte to so well-marked a species as *Thriponax pectoralis*, and then reappear in Luzon?

THE RELATIONSHIP BETWEEN SAMAR, LEYTE, AND MINDANAO.

With the single exception of *Pericrocotus leytensis* every one of the peculiar Samar-Leyte species is known to have an ally in Mindanao, and most of them have very close allies. I believe that *Pericrocotus*, which reappears in Sulu, will eventually be found in Mindanao and the other intervening islands.

A still further indication of the closeness of the relationship between the birds of Samar, Leyte, and Mindanao is found in the following species which are common to the three islands, but are lacking in the central and western islands. Species that range northward to Luzon or Mindoro are prefaced by an *, those that range westward to Cebu Bohol, or Siquijor by a †:

* 1. *Phabotreron amethystina*.

† 2. *Phabotreron brevirostris*.

3. *Phlogoenas crinigera*.

4. *Scops everetti*.

† 5. *Microhierax meridionalis*.

6. *Pithecophaga jefferyi*.

* 7. *Harpactes ardens*.

8. *Surniculus velutinus*.

9. *Centropus melanops*.

10. *Microstictus fuliginosus*.

11. *Dicrurus striatus*.

12. *Eudrepanis pulcherrima*.

13. *Aethopyga bella*.

14. *Arachnothera flammifera*.

15. *Arachnothera philippinensis*.

* 16. *Anthothreptes griseigularis*.

17. *Dicaeum cinereigulare*.

18. *Dicaeum everetti*.

19. *Prionochilus olivaceus*.

† 20. *Hyloterpe philippinensis*.

21. *Orthotomus frontalis*.

22. *Zosterornis capitalis* (Leyte only).

23. *Macronus mindanensis*.

24. *Iole everetti*.

* 25. *Poliolophus urostictus*.

26. *Artamides kochii*.

* 27. *Lalage minor*.

28. *Pitta steerii*.

29. *Rhinomyias ruficauda*.

The relationship between the "Eastern Philippines" (Samar and Leyte) and Mindanao is, in my judgment, closer than that between any other two areas which Steere has separated. I am tempted to say that the resemblances outweigh the differences. Remembering that 4 species of *Centropus*, 4 of *Carpophaga*, 2 of *Cettia*, 2 of *Ninox*, 6 of *Cinnyris*, 6 of *Dicaeum*, 4 of *Halecyon*, 2 of *Hierococcyx*, 2 of *Hyloterpe*, 2 of *Lyncornis*, 3 of *Oriolus*, 2 of *Orthotomus*, 3 of *Scops*, 3 of *Zosterops*, 3 of *Zosterornis*, 2 of *Muscicapula*, and 3 of *Siphia* have been found in Luzon alone, one can not but wonder whether, if there were actual land con-

nection between Luzon and Mindanao, the differences between the birds in the various localities where collections have been made might not be nearly as great as under existing conditions.

At all events, the practical identity of the families represented in the eastern chain of islands, the occurrence in it of the genera above enumerated, which in the Philippines are nearly or quite confined to it, as well as the overlapping of species at each of the breaks in it, seem to me to be indicative of a much closer relationship between the islands composing it than exists between any of them and other islands of the Philippine group.

MINDANAO AND BASILAN.

Mindanao is, next to Luzon, the largest island in the Philippines. It extends 250 miles north and south by 270 east and west. Its rivers, lakes, forests, and mountains are quite equal to those of Luzon, and afford the most tempting collecting grounds remaining in the Philippines. There is, however, a decided drawback to ornithological investigation in this island in the fanatically hostile Mohammedan tribes which populate its interior.

Neither the Steere nor the Menage expeditions attempted any serious ornithological work here, our time in each instance being chiefly given to the collection of coral, while native hunters were sent to the woods for birds. The best work in Mindanao has been done by Everett. Platen and his wife were for a long time at Davao, but with a single exception all their novelties were described by Steere from specimens obtained by the Steere Expedition before Blasius, into whose hands Platen's material fell, was ready to publish.

Although 207 species of birds are known from Mindanao, it is certain that many interesting forms remain undiscovered, especially in the highlands, which are as yet entirely unknown. Mount Apo is so conveniently near Davao that it is to be hoped some adventurous collector will soon give us some knowledge of the upland avifauna of this great island.

Basilan is a small island distant about 8 miles from the peninsula in which Mindanao extends to the southwest. It is connected with this peninsula by a line of soundings so shallow as to suggest a former actual land connection. Basilan is well watered and well wooded. Its surface is broken, but it has no very high mountains. Hunting is safe enough near Isabella, the capital, but it is dangerous in the interior on account of the hostility of the natives.

The first collections on the island were made by Steere, who was followed by Everett. Later the Steere and Menage expeditions worked there. The total number of species of birds recorded is 119. One hundred and nine of the Mindanao and 80 of the Basilan species are Philippine, and they afford an interesting study.

Steere has classed Mindanao and Basilan together, making them constitute a subprovince, the "Southern Philippines," and their bird

faunae certainly have much in common. The following species are, so far as we at present know, peculiar to these two islands and the smaller ones immediately adjacent to them:

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|---------------------------------------|---------------------------------------|
| 1. <i>Phabotreron occipitalis</i> . | 10. <i>Sarcophanops steerii</i> . |
| 2. <i>Ninox spilocephala</i> . | 11. <i>Oriolus steerii</i> . |
| 3. <i>Batrachostomus septimus</i> . | 12. <i>Orthotomus cinereiceps</i> . |
| 4. <i>Ceyx mindanensis</i> . | 13. <i>Iole rufigularis</i> . |
| 5. <i>Alcyon argentata</i> . | 14. <i>Irena melanochlamys</i> . |
| 6. <i>Hydrocorax mindanensis</i> . | 15. <i>Edoliisoma mindanensis</i> . |
| 7. <i>Loriculus apicalis</i> . | 16. <i>Muscicapula mindanensis</i> . |
| 8. <i>Tyngipicus fulvifasciatus</i> . | 17. <i>Hypothymis superciliosus</i> . |
| 9. <i>Chrysocolaptes lucidus</i> . | |

The following additional species are common to the two islands and range to the north, but seem to reach their southwestern limit in Basilan.

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|-------------------------------------|--------------------------------------|
| 1. <i>Phlogoenas erinigera</i> . | 8. <i>Dicaeum rubriventer</i> . |
| 2. <i>Harpactes ardens</i> . | 9. <i>Hyloterpe philippinensis</i> . |
| 3. <i>Centropus melanops</i> . | 10. <i>Megalurus ruficeps</i> . |
| 4. <i>Haleyon gularis</i> . | 11. <i>Orthotomus frontalis</i> . |
| 5. <i>Dicrurus striatus</i> . | 12. <i>Zosterornis capitalis</i> . |
| 6. <i>Eudrepanis pulcherrima</i> . | 13. <i>Artamides kochii</i> . |
| 7. <i>Arachnothera flammifera</i> . | |

Cinnyris juliae, *Dicaeum hypoleucum*, *Dicaeum mindanense*, and *Zocephus cinnamomeus* on the other hand, are common to Mindanao and Basilan, and range to the westward, but do not get farther north than Mindanao.

So much for the resemblances between the two islands. There are, however, a number of more or less important differences. Eight species are, so far as we at present know, peculiar to Mindanao. They are:

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|--|-------------------------------------|
| 1. <i>Bubo gurneyi</i> . | 5. <i>Prionochilus bicolor</i> . |
| 2. <i>Penelopides affinis</i> . | 6. <i>Parus nehrkornae</i> . |
| 3. <i>Cranorrhinus leucocephalus</i> . | 7. <i>Orthotomus nigriceps</i> . |
| 4. <i>Bolbopsittacus mindanensis</i> . | 8. <i>Ptilocichla mindanensis</i> . |

Some of these apparent differences will doubtless disappear as we learn more of the birds of Basilan, which are much less well known than those of Mindanao, but that island also has its peculiar species, and there is little probability that more than one of them exists in Mindanao. They are as follows:

- | | |
|-------------------------------------|--------------------------------------|
| 1. <i>Phabotreron brunneiceps</i> . | 4. <i>Ptilocichla basilanica</i> . |
| 2. <i>Penelopides basilanicus</i> . | 5. <i>Dendrobiastes basilanica</i> . |
| 3. <i>Macronus striaticeps</i> . | |

We may admit that such Mindanao forms as *Bubo gurneyi*, *Prionochilus bicolor* and *Parus nehrkornae* may have been overlooked in Basilan, and that *Dendrobiastes basilanica* may have escaped detection in Mindanao, but it is decidedly improbable that genera like *Cranorrhinus* and *Bolbopsittacus* should have escaped all the collectors who have visited Basilan.

When we note further that *Phabotreron brevirostris* is replaced in Basilan by *P. occipitalis*, *Phabotreron amethystina* by *P. brunneiceps*, *Penelopides affinis* by *P. basilanica*, *Macronus mindanensis* by *M. striaticeps*, and *Ptilocichla mindanensis* by *P. basilanica*, as well as that *Arachnothera philippinensis*, *Anthothreptes griseigularis*, *Chloropsis flavipennis*, *Iole everetti*, and *Zosterornis plateni* all apparently reach their southern limit in Mindanao, it becomes evident that the relationship between the birds of Mindanao and Basilan does not by any means amount to identity.

The facts may be explained by supposing that Basilan was once a part of Mindanao, or at all events was more closely connected with that island than it is at present; that it has been cut off long enough to allow of the differentiation of its representative species allied to Mindanao forms, and that in the meantime a connection has come into existence between Leyte and Mindanao sufficiently good to allow of the entrance of those Samar-Leyte forms which are common in Mindanao, but wanting in Basilan.

Possible confirmation of such a theory might be found in the ranging of *Zosterornis capitalis* into southern Leyte, and that of *Iole philippinensis* into northern Mindanao. Each of these forms might be considered to have recently crossed, the one going north, the other south. Manifestly, however, the absence of *Zosterornis capitalis* in northern Leyte and Samar, and that of *Iole philippinensis* in southern Mindanao admits of other explanation than the mere lack of time to spread there.

At present the gap between Basilan and Mindanao is slightly smaller than that between Mindanao and Panaon, which island may be regarded as a southern prolongation of Leyte. A single sounding "80 fathoms, no bottom," is shown on the chart about the middle of the passage. In the absence of any information as to the depth of water between Dinagat and Leyte, it is perhaps useless to attempt to theorize further as to possible past land connections at this point.

DINAGAT, CAMIGUIN, NIPAH, BAZOL, SAKUYOK, AND MALANIPA.

Dinagat is the largest and best known of these islands. Mr. Everett obtained 39 species of birds there, and no collector has since visited the locality. The occurrence of *Aleyone argentata*, *Loriculus apicalis*, and especially that of *Sarcophanops steerii* marks the island as belonging with Mindanao.

Camiguin is a volcanic island of small size lying a short distance from the north shore of Mindanao. Nipah, Bazol, and Sakuyok are, according to Lord Tweeddale, "situated to the north of the shores of Mindanao, and are only separated from that island by narrow channels." They are too small to be named in any of my charts. But 13 species of birds were obtained from the three localities by Mr. Everett, the only collector who has visited them. The species procured are all common Mindanao forms.

The occurrence of *Cranorrhinus leucocephalus* in Camiguin serves to indicate the relationship with Mindanao which might have been expected.

Malanipa is a tiny island lying to the east of the southwest extremity of Mindanao. Half a day's work was done on it by a party from the "Challenger." *Eudynamis mindanensis*, *Myristicivora bicolor*, *Haliastur intermedius*, *Tanygnathus luconensis*, *Pelargopsis gigantea*, *Numenius phaeopus*, *Cinnyris juliae*, *Heteractitis brevipes*, and *Hypothymis azurea* were the only species obtained, and all of them are known from Mindanao.

SULU, TAWI TAWI, AND BONGAO.

Sulu and Tawi Tawi lie to the southwest of Basilan, and are connected with that island by a line of shallow soundings hardly anywhere exceeding 100 fathoms. Sulu has long been the home of the Sultans who have ruled the piratical Mohammedan population of the southern Philippines, and is a veritable hornet's nest. When we were there with the Steere expedition in 1887 collecting was absolutely out of the question, a pitched battle having just been fought between the Spanish garrison and the natives. In 1891 we managed to collect, though at serious personal risk.

The native forest in the part of the island near the town of Sulu was cleared away to a large extent by the slaves of the "Moros" in the days before the advent of steam gunboats and Gatling guns, when piracy was a more profitable vocation than it is at present. In place of the original forest enormous numbers of fruit trees were planted, so that most of the wooded district near the town is artificial and does not afford the best of collecting. There are several well-wooded hills in the interior of the island, but it was out of the question to attempt to reach them at the time of our visit.

Guillemard was the first to make important collections in Sulu, although a few specimens had previously been obtained there by Burbridge. Platen afterwards visited the island, and Bourns and I spent some six weeks there in 1891. The total number of species recorded up to date is 108.

Tawi Tawi is almost entirely covered by forest. There are several piratical settlements on its southern coast, but its northern side is uninhabited except for a few native huts near the Spanish blockhouse at Tatañin, where reside the governor, captain of the port, postmaster, etc. (all combined in one man), also a Spanish lieutenant and thirty to fifty native soldiers.

Guillemard touched at Tawi Tawi, but did not collect there. The first collections ever made on the island were those of Bourns and myself. Everett has since visited Sibutu and Bongao, and has sent his collectors to Tawi Tawi. The total number of species recorded is 97.

We touched at Bangao on our way to Tawi Tawi, but did not collect

there. Bongao is so small, and is separated from Tawi Tawi by so narrow a stretch of water, that it is almost a pity to give it the dignity of a separate island. Since it has appeared as such, in Sharpe's table in the *Ibis*, I shall retain it to avoid confusion.

In this connection I may remark that I have discarded Malamaui from the list of islands. I doubt if the channel which separates it from Basilan is 500 yards wide, and I have treated it as a part of that island.

There is nothing in the results of Everett's work to indicate that Bongao is anything more zoologically than a part of Tawi Tawi, and I shall so consider it in this paper.

Of the Sulu birds, 53 are Philippine species, of the Tawi Tawi birds, 51.

An analysis of these species will, I think, prove that Sulu and Tawi Tawi should be classed together, and that they can not be added to the Basilan-Mindanao group, but must stand by themselves.

The following species are peculiar to the Sulu-Tawi Tawi group, at most ranging to Sibutu:

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|-----------------------------------|------------------------------------|
| 1. <i>Anthracoseros montani</i> . | 7. <i>Hyloterpe homeyeri</i> . |
| 2. <i>Tanygnathus burbidgei</i> . | 8. <i>Macronus kettlewelli</i> . |
| 3. <i>Loriculus bonapartei</i> . | 9. <i>Iole haynaldi</i> . |
| 4. <i>Iyngipicus ramsayi</i> . | 10. <i>Artamides guillemardi</i> . |
| 5. <i>Aethopyga arolasi</i> . | 11. <i>Edolisoma everetti</i> . |
| 6. <i>Dicaeum assimilis</i> . | 12. <i>Rhinomyias ocellaris</i> . |

In addition to these 12 exceptionally well-marked species common to the two islands we have *Ninox reyi* and *Pericrocotus marchesae* recorded from Sulu alone, and *Phabotreron cinnereiceps*, *Phlogoenas menagei*, *Prioniturus verticalis*, and *Oriolus cinereogenys* recorded from Tawi Tawi alone.

In the case of *Prioniturus* we are in all probability dealing with a real difference, for *Prioniturus discurus* is certainly abundant enough in Sulu, and just as certainly not obtainable near Tataän, in Tawi Tawi. There is a bare possibility that *P. verticalis* has been overlooked in Sulu, and *P. discurus* in Tawi Tawi, which would give us here two species of the genus in each island, but this is improbable.

The other apparent differences will, I think, disappear as the birds of the two islands become better known.

The line of demarcation between Basilan and Sulu is on the whole quite sharp. A few forms, like *Cinnyris juliae*, range westward through the chain, but the absence of such genera as *Hydrocorax*, *Penelopides*, *Harpactes*, *Chrysocolaptes*, *Sarcophanops*, *Dicrurus*, *Eudrepanis*, *Arachnothera*, *Orthotomus*, *Zosterornis*, *Ptilocichla*, *Poliolophus*, *Irena*, *Muscicapula*, and *Cyanomyias*, together with the occurrence of *Anthracoseros* and *Chibia*, indicate a greater degree of distinctness in the avifaunae of the two areas than I had anticipated.

LAPAC AND SIASSI.

Lapac and Siassi lie midway between Sulu and Tawi Tawi. Guillemard is the only collector who has visited them. The only one of the few species of birds obtained there by him which throws any light on their zoological position is *Artamides guillemardi*, but we have no cause for doubting that in this case the geographical and zoological relationships correspond, and the islands belong to the Sulu-Tawi Tawi group.

SIBUTU.

Much interest attaches to Mr. Everett's recent work in Sibutu, which had been up to that time held, even by himself, to be a Bornean island. The opinion advanced by Guillemard, and reiterated by Everett, that the Sibutu Passage marked the western boundary of the Philippines, zoologically speaking, has now been shown to be erroneous.

The old ideas were based not so much on the avifauna of Sibutu, which was almost unknown, as on the supposed conformation of the sea bottom, the charts indicating "500 fathoms, no bottom," in the middle of the Sibutu Passage, as well as at a point nearer the Tawi Tawi shore. Recent soundings have failed to establish any such depth of water in the positions indicated, and it has also been shown that Sibutu lies barely within the hundred fathom line of Borneo.

Thanks to Mr. Everett's efforts, the number of birds known from Sibutu has been raised to 36, and, although the island is apparently poor in species, the presence of such forms as *Macropygia tenuirostris*, *Pelargopsis gigantea*, *Eudynamis mindanensis*, *Prioniturus verticalis*, *Tanygnathus luconensis*, *Corvus philippinus*, *Sarcops calvus*, *Calornis panayensis*, *Oriolus chinensis*, *Cinnyris jugularis*, *Hyloterpe homeyeri*, *Iole haywardi*, *Artamides guillemardi*, *Siphia philippinensis*, and *Pitta erythrogastra* leaves no room for doubt that Sibutu is zoologically as well as politically one of the Philippine Islands.

Pitta muelleri is the only strictly Bornean form yet obtained there.

The island has two peculiar species, *Scops sicutensis* and *Dicaeum sicutense*, but on the whole may probably be held to belong with the Sulu-Tawi Tawi group.

SUMMARY.

I will now briefly restate the conclusions thus far reached.

1. The Philippines zoological and the Philippines political are not identical areas.
2. Cagayan Sulu, Balabac, Palawan, and the Calamianes islands are Bornean.
3. The line of demarcation between the Philippine and Bornean islands passes between Sibutu and the coast of Borneo, and thence northward through the Sulu Sea and Mindoro Strait.

It remains to be determined whether it runs to the east or the west of the Cujos Islands.

4. The line between the Philippine and Formosan islands also remains to be determined.

5. The Philippines can not be divided into a number of zoologically equivalent groups, but do naturally fall into groups, some of which are much less sharply differentiated than others.

A close relationship exists between the degree of difference in the avifaunæ of any two groups and their present and past geographical relationship, those islands which have been longest and most completely cut off from their neighbors showing the highest degree of differentiation. In this connection it is needless to remark that the depth of channels is much more important than their width in estimating the probable duration of isolation.

6. The Central Philippines, comprising the islands Negros, Panay, Guimaras, and Masbate, form a well-defined natural group, though in the case of Masbate there are indications of immigration from Luzon.

7. Cebu can not be regarded as one of the central group. It is separated from Negros by a very deep though narrow channel, and must be given a place by itself. It shows a slight admixture of eastern and southern forms.

8. Siquijor is an island of very recent origin. It has been populated by stragglers from other islands, and its three peculiar species have been developed from allied forms under the influence of changed environment.

9. Tablas, Romblon, and Sibuyan show no evidence of having been connected with any of the larger islands. Tablas and Romblon should probably be classed together.

10. There are abundant evidences of the original distinctness of the faunæ of Luzon and Mindoro, which may be expected to increase as our knowledge of Mindoro birds increases.

11. Bongao, Tawi Tawi, Lapac, Siassi, and Sulu form another natural group, to which Sibutu must probably be added. The differences between the birds of this group and those of Mindanao and Basilan are great.

12. Stretching from Basilan to Luzon we have a chain of islands between which the zoological relationship is very close. This is proven by the mammals as well as by the birds, such genera as *Sciurus*, *Galopithecus*, and *Tarsius* extending throughout the chain, although not found in the central and western islands.

13. Basilan probably at one time formed a part of Mindanao. It has been separated long enough to allow of the development of a number of representative forms from Mindanao species. A considerable number of species have apparently entered Mindanao since Basilan was cut off, and have hence failed to gain a foothold in the latter island.

14. The relationship between the birds of Mindanao and those of Samar and Leyte is very close, though possibly less so than that between those of Mindanao and Basilan.

15. The widest gap in the chain is that between Samar and Luzon. No final conclusions can be reached as to the precise relationship of the islands in this chain, however, until the highland avifaunae of the southern islands are better known.

I have not sufficient familiarity with the birds of the larger land masses adjacent to the Philippines to intelligently discuss the relationships of the Philippine birds as a whole, and, leaving this interesting question to wiser heads than mine, I pass to the consideration of some of the more general problems of distribution and development raised by the known distribution of the birds within the limits of the archipelago.

STEERE'S LAW OF DISTRIBUTION.

While the question of the relationships between the birds of the various islands is not without its interest, other and more important problems, which can not be so readily disposed of, are presented by the facts of distribution of the resident birds. So far as I know, Steere has been the only one to attempt to discuss these more general questions on the strength of the data furnished by Philippine species.

In his paper on "The Distribution of Genera and Species of Non-migratory Land Birds in the Philippines" he makes a somewhat detailed examination of the birds obtained by the Steere expedition, as the result of which he arrives at the conclusion that "the genus is represented by but a single species in a place." He believes that Philippine species and varieties are geographical or local groups depending on local causes for their existence, and that they show isolation to be the first and necessary step in the formation of species. It is evident that when he speaks of isolation he refers to geographical isolation, for in describing the species which he holds confirm his law he says: "In 53 genera, with 153 species, each genus is represented in the Philippines by two or more species, each of which exists in a limited area of its own, sharply separated by sea channels from the similar areas occupied by the other species of the same genus."

In the paragraph which precedes the one in which he states his law he says that "there results 145 genera out of 150, and 302 species out of 312, or 29 from every 30 of the genera, and over 30 from every 31 of the species, so distributed in the islands that no two species nearly enough allied to be put in the same section or subgenus are found existing in the same island." This statement, as well as the one above quoted, shows that by "place" he means island.

Steere confined himself to an examination of his own birds and those collected by Moseley, Bourns, and myself in 1887-88, in the belief that "these collections, while not comprising all species known from the islands, are so nearly complete that any just conclusions drawn from them must be accepted as truth, which further exploration will only strengthen."

He divides the genera discussed into five lists, A, B, C, D, and E.

In List A he includes 6 genera, with 12 species, which are left out of consideration because some or all of the species are migratory.

In List B he places 75 genera, each of which, he says, was found represented in the Philippines by a single species.

List C includes 53 genera, with 153 species, which he holds to be distributed in strict conformity with his law: i. e., with but one species of a genus in an island.

Of List D he says: "In 17 genera, with 74 species, each genus is represented in the islands by several species, two or more of which may be found inhabiting the same island; but the species thus found together with the same generic name differ greatly in size or coloring or other structures, and belong to different natural sections or subgenera." He adds that "these sections or subgenera themselves may each be represented in the archipelago by several species; but where this occurs each species is found isolated and separated from all the other species of the same subgenus, just as are the species of the genera given in List C."

Finally, List E includes "5 genera and 10 species, in which 2 species of the same genus were found existing together in the same islands, these not differing enough to appear to warrant placing them in distinct sections of the genus."

Adding the genera with but one Philippine species (List B), those with several species, no two of which occur in the same area (List C), and the 17 genera of List D, which he implies should really be further subdivided, and would then come under his law, he obtains a total of 145 genera out of 150, and 302 species out of 312, distributed in conformity with his law.

These conclusions, if true, would be of far-reaching importance, and I can not close this paper without a reexamination of the facts, first because the data of which Steere chose to avail himself were very incomplete, and, second, because I dissent from some of the conclusions which he drew from the data of which he made use.

In order that the comparison may be the more direct, I shall confine myself to a consideration of the resident land birds, and shall include the birds of the Palawan group of islands with those of the Philippines proper. I shall also retain in the main Steere's method of grouping the genera, changing slightly the order in which the groups are taken up.

Considering first the genera which so far as we at present know have but one species each in the Philippines, we have:

LIST B.

<i>Acridotheres.</i>	<i>Artamus.</i>	<i>Caloenas.</i>
<i>Acrocephalus.</i>	<i>Buchanga.</i>	<i>Calornis.</i>
<i>Aegithina.</i>	<i>Butastur.</i>	<i>Cerchneis.</i>
<i>Alauda.</i>	<i>Cacatua.</i>	<i>Chalcophaps.</i>
<i>Alseonar.</i>	<i>Cacomantis.</i>	<i>Chalcostetha.</i>
<i>Anthuraceros.</i>	<i>Callacops.</i>	<i>Chimarhornis.</i>
<i>Anuropsis.</i>	<i>Calliope.</i>	<i>Chlorura.</i>

LIST B—Continued.

<i>Coccyzus.</i>	<i>Harpactes.</i>	<i>Pernis.</i>
<i>Columba.</i>	<i>Hemilophus.</i>	<i>Phyllergates.</i>
<i>Corone.</i>	<i>Hypsipetes.</i>	<i>Piprisoma.</i>
<i>Copsychus.</i>	<i>Lepidogrammus.</i>	<i>Polioaetus.</i>
<i>Cotile.</i>	<i>Limoniidromus.</i>	<i>Poliolophus.</i>
<i>Dasyrotopha.</i>	<i>Lophotriorchis.</i>	<i>Polyplectron.</i>
<i>Dasylophus.</i>	<i>Loxia.</i>	<i>Pratincola.</i>
<i>Dendrobiaastes.</i>	<i>Lusciniola.</i>	<i>Pseudotharrhaleus.</i>
<i>Dryococcyx.</i>	<i>Macropteryx.</i>	<i>Pyrrhula.</i>
<i>Elanus.</i>	<i>Mainatus.</i>	<i>Sarcops.</i>
<i>Eurystomus.</i>	<i>Megapodius.</i>	<i>Strix.</i>
<i>Excalfactoria.</i>	<i>Micropus.</i>	<i>Sturna.</i>
<i>Gallus.</i>	<i>Mirafra.</i>	<i>Syrnium.</i>
<i>Geopelia.</i>	<i>Mixornis.</i>	<i>Terpsiphone.</i>
<i>Gerygone.</i>	<i>Monticola.</i>	<i>Tiga.</i>
<i>Gymnolaemus.</i>	<i>Muscicapa.</i>	<i>Treron.</i>
<i>Haliastur.</i>	<i>Myristicivora.</i>	<i>Turdinus.</i>
<i>Haliaetus.</i>	<i>Passer.</i>	<i>Uroloncha.</i>

On comparison with Steere's List B it will be noted that although the number of genera remains the same, numerous changes have been made in the list. Recent work has made it necessary to add a number of genera, and, on the other hand, I have excluded *Accipiter*, *Alcedo*, *Batrachostomus*, *Bubo*, *Chaetura*, *Carpophaga* (*Carpophaga*, *Hemiphaga* and *Ptilocolpa* of Steere), *Chalcococcyx*, *Columba*, (*Ianthoenas* Steere), *Culicicapa*, *Cryptolopha* (*Abrornis* and *Cryptolopha* Steere), *Geocichla*, *Hierococcyx*, *Lalage* (*Lalage* and *Pseudolalage* Steere), *Merula*, *Munia* (*Munia* and *Padda* Steere), *Rhipidura*, *Stoparola*, and *Xanthopygia*, because each of these eighteen genera has been shown to have more than one species in the islands. I do not consider it necessary to go into the details of the evidence which justifies these changes. It is based on records which Steere overlooked, or which have been made since his paper was written. Reference to the general distribution list will show whether it stands upon the authority of Bourns and myself alone, or upon our authority supported by that of others, or upon that of others alone. I will take this opportunity, however, to reiterate the statement that with very few exceptions no species has been included in the distribution list for which definite locality and collector can not be assigned.

Anticipating to some extent the likelihood of important changes in this table, Steere has said "it is probable that a few genera of this list, among them *Scops*, *Batrachostomus*, and *Megapodius*, will be found to have more than one species in the islands. In this case they will fall into List C (i. e., the list of genera distributed in strict conformity with his law), and will in no sense weaken the conclusions of this paper." It is difficult to see how one could safely attempt to foretell into what list the discovery of additional species of these genera would bring them. As a matter of fact, some of the genera removed from this list

because represented by more than one species in the archipelago fall into Steere's List C, and others decidedly do not.

The revised List B contains a somewhat miscellaneous aggregation of forms. Some of the genera are represented by species with wide range outside of the Philippines, others by species which range widely within the group, but extend little if at all beyond its confines, while a few genera are represented by species which are confined to a single island or small group of islands.

What bearing have the genera included in this list on the question in hand? Steere has unhesitatingly assumed that they all afford confirmations of his law, but I am unable to follow him in this. Where genera happen to have but a single species in the Philippines, but have additional species in other countries, with their ranges overlapping, they manifestly can not be held to afford confirmation of the law. On the other hand, the evidence afforded by the forms peculiar to the Philippines is by no means in every case unequivocal. The presence of but single species of the peculiar genera *Dasylophus* and *Lepidogrammus* in Luzon and the neighboring small islands, for instance, can hardly be explained as due to their being limited by geographical barriers to an area so small and little diversified as to prevent the formation of additional species, for in this same area we find six species of *Dicaeum* and five of *Cinnyris*, while six genera are represented by four species each, eleven by three, and no less than twenty-one by two each. In the case of genera like *Dasylophus* and *Lepidogrammus*, then, I believe that the explanation of the occurrence of but a single species is to be sought in the organisms themselves. It may be that they are generalized forms, capable of existing under a variety of conditions, and hence comparatively independent of their environment

But, apart from their miscellaneous character, there is another reason for excluding the species of this list from further consideration. If a genus is represented by but a single species in a group of islands, it manifestly can not have more than one species on any island of the group, hence can afford no evidence on the question as to whether or not two or more species belonging to the same genus or section of a genus may exist in the same place.

I follow Steere in excluding from consideration genera some or all the species of which are migratory, and under this head I place the following:

LIST A.

<i>Anthus.</i>	<i>Merula.</i>	<i>Phylloscopus.</i>
<i>Cuculus.</i>	<i>Motacilla.</i>	<i>Xanthopygia.</i>
<i>Hemichelidon.</i>	<i>Pandion.</i>	
<i>Locustella.</i>	<i>Pericrocotus.</i>	

Lanius I exclude from this list, believing that all the species recorded from the Philippines are resident there.

This brings us to Steere's List C, or the list of genera with two or more species which have but one species in a place. Of the genera

placed here by Steere, *Caprimulgus*, *Falco*, *Phillentoma*, *Prioniturus*, *Setaria* (*Rhinomyias* of my lists), and *Siphia* must be excluded, because each has been shown to have more than one species in one or more of the islands.

Actenoides I unite with *Haleyon*, *Centrococyx* with *Centropus*, *Pseudolalage* with *Lalage*, *Broderipus* with *Oriolus*, and *Erythropitta* with *Pitta*.

As already indicated, I exclude *Pericrocotus*, since *P. cinereus* is a winter migrant; but if included at all the genus must be removed to the list of genera with two or more species in a place, as the range of *P. cinereus* overlaps that of *P. igneus* in Palawan, and that of *P. novus* in Luzon.

Recent work has made it necessary to add several genera to List C. With these additions, after making the changes above mentioned, the list will include 41 genera, with 129 species.

In view of the importance of the forms included in this list and the one which follows it, it seems to me advisable to arrange them in tabulated form so as to show not only the exact distribution of each genus in the archipelago, so far as at present known, but the number of its species in each island as well. By this method of treatment certain facts are brought out which would be likely to escape attention were we to consider only total numbers of genera and species, without examining their distribution in detail.

Genera which would fall under Steere's List C, then, I give in Table A. A glance at this table will show that 41 genera, with 129 species, are, so far as we at present know, distributed in accordance with Steere's law.

In his next list (List D) Steere includes 17 genera, with 74 species, and although he admits that in each case two or more species have been found to inhabit one or more of the islands, he holds that the classification is in reality at fault and that the genera should be further subdivided.

It would, perhaps, be not unreasonable to expect a somewhat detailed discussion of the genera in question, with reasons why each should be further subdivided, but he contents himself with the very general statement that "the species thus found together, with the same generic name, differ greatly in size or coloring or other structures and belong to different natural sections or subgenera."

He does attempt to show that where representatives of two or more of these subgenera inhabit an island it is under distinct conditions. My own observations are at variance with his in regard to so many of these species that it seems to me advisable to discuss each of the examples which he has instanced.

He first mentions *Merops bicolor* and *M. philippinus*, which he admits probably exist together in every island of the group. The former species he says is social, hundreds sometimes feeding together at a height of fifty to a hundred or more feet from the ground. He adds that *M.*

philippinus is solitary in habit, feeding near the ground in open country. Its food he states consists of wasps and dragon flies, so far as observed, whereas *M. bicolor* appears to be limited closely to honeybees.

I have repeatedly seen *M. philippinus* feeding in flocks upon honeybees, frequently in company with *M. bicolor*. I have also met with *M. bicolor* feeding singly or in pairs near the ground in open country. The matter is a very simple one. Both species often feed singly, but a swarm of bees is apt to draw a flock of bee birds.

It is remarkable that Steere should dismiss the genus *Ceyx* with five lines, especially in view of the fact that he himself described two species of the blue woodland type from Basilan. If his theory were correct, ought he not to have placed these two species in different subgenera, and shown the distinct conditions under which they existed? Bourns and I have shown by a large series of specimens that in reality the types of these supposed species were representatives of one form which displays an unusually large amount of individual variation. This form, however, does exist in Mindanao and Basilan together with *C. mindanensis*, a little red woodland species. The two species are found side by side in the same thickets, their habits are seemingly identical, and a careful examination of the stomachs of a large series of specimens has failed to show any differences in their food.

The blue riparian forms formerly classed in this genus have been shown by Grant to belong to the genus *Acyone*. Steere is right in saying that they are invariably found along streams; but if he recognizes an ally of *C. melanura* in *C. eurythra*, his statement that the former species and its allies are always found away from streams and in the forest is certainly incorrect.

Speaking of *Halcyon gularis*, *H. coromanda*, and *H. chloris*, he says that none of them frequent the water, "*H. gularis* being found in open plains, feeding from the ground, or perched in low trees; *H. coromanda* in low, thick undergrowth in forests, and *H. chloris* quite generally near the sea beach, and often in open cocoa groves about the coast villages."

It is my observation that every one of these species frequents the water at times. I have never seen *H. gularis* so abundant as over the waters of Lake Naujan in Mindoro, and it is commonly met with along the banks of fresh-water streams, as is *H. chloris*. The latter species is especially abundant about tide water, in mangrove swamps. I have twice shot *H. coromanda* over water in mangrove swamps, but nearly all our specimens were obtained in the forest, along fresh-water streams. In Sibuyan two specimens were obtained in my own yard, where they had come to feed on the bodies of land snails which were thrown out as we cleaned the shells. These birds were far away from both forest and water.

I am unable to agree with the statement that *Osmotreron vernans* feeds from bushes or on the ground, as distinguished from *O. axillaris*, which feeds from trees. Both species certainly feed together in fruit trees, for

I have more than once killed individuals of both at a single shot, in trees of considerable height.

Apropos of *Megalurus palustris* and *M. ruficeps*, the ranges of the two species overlap not in Marinduque alone, but in Mindoro, Luzon, and Samar. I am unable to agree with Steere's statement that there is a sharp distinction of habitat here, *M. ruficeps* being found in waste places inland, which had grown up to high, coarse grass, while *M. palustris* was found close along the beach in open grassy places. The two species are certainly to be found side by side in the same fields, although *M. palustris* is the bolder of the two, and hence more likely to be collected.

In estimating the value of observations on habits the "personal equation" must, of course, be taken into account. I can only say that the above statements are based on nearly three years and a half of actual field work in the Philippines, and that I believe they will be found to be correct so far as they go.

In speaking of the general distribution of the genera represented by two or more species in one or more of the islands, Steere states that "whenever the birds of the two sections of one of the genera named above differ greatly in size, the species of the section of larger longer-winged birds will be more widely distributed than the smaller birds of the other." His first illustration of this rule, *Ninox lugubris*, is certainly well chosen. His second, *Phabotreron amethystina*, is unfortunate. He says that it apparently extends over the areas of the five smaller species. In reality it is confined to the eastern Philippines (Luzon to Mindanao), and its place is occupied elsewhere by *P. maculipectus*, *P. frontalis*, *P. cinereiceps*, and *P. brunneiceps*, species which had not been described at the time he wrote.

Dicaeum pygmaeum is the most widely distributed Philippine representative of its genus, overlapping the ranges of four other species, yet is the smallest of the Philippine Dicaeidae.

I conclude, therefore, that the rule of distribution above quoted does not invariably hold, and that other factors than size and length of wing play a part in determining whether the range of a species shall be wide or restricted.

Steere's next and final list (List E) includes five genera with ten species, in which two species of the same genus were found existing together in the same islands, these not appearing to him to differ enough to warrant placing them in different sections of the genus. In this list he placed *Melanopitta* (*Pitta*), *Criniger*, *Megalurus*, *Cisticola*, and *Tanygnathus*, each of these genera being credited with two species.

I find it difficult to understand why, having swallowed the camel, he should have difficulty with the tail. The differences between the two species of *Pitta* with which he begins this list are very decided, and if *Dicaeum everetti* and *D. hypoleucum* are to be placed in List D and referred to different subgenera, why not these two species also? *Crini-*

ger. frater and *C. palawanensis*, of List E, are certainly quite as unlike as are *Orthotomus frontalis* and *O. cinereiceps*, of List D. *Megalurus palustris* and *M. ruficeps* again seem to me to differ more structurally than do *Merops philippinus* and *M. bicolor*, yet he would leave the former genus undivided and separate the latter, while *Tanygnathus*, of List E, which is represented in the Philippines by three species, might quite as well be divided into subgenera as might *Halecyon* or *Collocalia*, of List D.

In short, if we can accept Steere's List D, I see no reason for not including in it the genera referred by him to List E. This would simplify matters by bringing *all* resident Philippine land birds under his law.

In disposing of the genera which would fall under Steere's Lists D and E, I shall take the classification as the best authorities have left it, and shall unite them under a single distribution table showing the number of species of each genus for every island where it is represented. This table I shall call Table B.

A comparison of Tables A and B will show that, if we accept the classification as it stands, 41 genera, with 129 species, make for Steere's law, and 55 genera, with 264 species, against it. Admitting, as I am quite ready to do, that further subdivision of several of the genera of Table B is advisable and will, doubtless, be made in time, it would, in my judgment, be preposterous to maintain that such division was necessary wherever the ranges of two species of a genus happen to overlap.

To illustrate: Whether or not we admit that *Broderipus* should be included under *Oriolus*, no one will deny that the habits of *O. (Broderipus) chinensis* on the one hand and those of various representatives of the *O. steerii* type on the other are so distinct that competition between these forms would be almost out of the question. Their occurrence side by side, then, is no argument against the spirit of Steere's law, although it may infringe the letter. But what of the occurrence of *O. albiloris* and *O. isabellae*, both of the *O. steerii* type, in Luzon?

Prioniturus has always been one of Steere's favorite genera for illustrating his law, but Grant has shown that *P. luconensis*, *P. discurus*, and *P. montanus* all occur in Luzon. Admitting that the last mentioned species may properly be assigned to a separate section of the genus, what shall we do with the other two?

Shall we divide *Cinnyris* into five sections to accommodate its Luzon representatives, add another for *C. guimarasensis* in the central Philippines, and still another for *C. juliae* in the south?

On the strength of what shall we place *Iole ruficularis* and *Iole philippinensis* or the different species of *Zosterops* in different subgenera?

Finally, is it by any means certain that competition may not be quite as keen between birds that are quite differently colored as between those that are very similar in this particular? Take the Phil-

ippine Dicaeidae for instance; most of the larger islands have a representative of the *D. dorsale* type, and one of the *D. haematostictum* type. The prevailing colors of the former group of species are slate blue, orange, and scarlet; those of the latter black, white, and red, or scarlet, yet nothing is commoner than to find representatives of the two groups feeding side by side from the same flowers.

With six representatives in Luzon, five in Samar, four in Leyte, three each in Mindoro, Masbate, Negros, Mindanao, Basilan, and Sulu, and two in Siquijor, Cebu, Guimaras, Panay, Sibuyan, Catanduanes, Dinagat, and Tawi Tawi, the genus *Dicaeum* would be somewhat disfigured if Steere's law were to be strictly enforced upon it.

Numerous other instances of the singular conclusions into which this law would lead us might be given, but I think that those already mentioned will suffice.

In formulating his law, Steere offers the following as an alternative for the statement of it already given: "No two species near enough alike structurally to be adapted to the same conditions will occupy the same area." This statement seems to me to be self-contradictory. Individuals of any given species are certainly adapted structurally to about the same conditions, yet they manage to exist together. If two species structurally adapted to the same conditions were brought into competition in a given area, each would continue to exist in the area in question in numbers proportionate to the number of each at the time competition began.

I find no satisfactory line of argument in Steere's paper leading up to his conclusion that isolation is the first and necessary step in the formation of species. This conclusion necessarily raises the whole question of the way in which environment acts. No one will deny that it has its effect, but does it act directly, stimulating the production of variations, or indirectly by favoring some of the variations spontaneously presented to it?

Manifestly there can be no progressive development without variation, and in saying that isolation is the first and necessary step in species formation Steere commits himself to the former view. His position does not differ essentially from that of Moritz Wagner and his followers, nor can I see that he has added anything new to the evidence bearing on the subject. The mere fact that there are numerous geographical races of birds in the Philippines does not afford an explanation of the part played by geographical isolation in producing them.

FACTORS IN THE ORIGIN AND DISTRIBUTION OF THE GENERA AND SPECIES OF RESIDENT PHILIPPINE LAND BIRDS.

I have thought it worth while to examine with a good deal of care the facts brought out in Tables A and B, in order to ascertain whether they afford foundation for any general principles of species formation and distribution, and have first endeavored to ascertain whether there

is any relationship between the size of an island and the number of species of a genus likely to be found upon it.

A glance at Table B will at once show that the actual number of genera with two or more species in an island is far higher in Luzon, Mindanao, Palawan, and Samar than in the smaller islands of the archipelago, but it will be objected that more species of all kinds, including those distributed according to Steere's law, are known from these islands. Manifestly, then, the error arising from the fact that the birds of some islands are much better known than those of others must be eliminated as far as possible if we are to arrive at any conclusive results.

I have first compared the possible with the actual exceptions to Steere's law in each island on the basis of our actual knowledge.

If a genus which anywhere in the archipelago has more than one species in a place occurs in a given island, we have the possibility of its being represented there by more than one species. If, then, we take all the genera of Table B which occur in any given island, compare the number represented by single species with that having two or more species, and reduce our results to percentages, we shall have a tolerably satisfactory basis for comparing the relative tendencies toward differentiation of genera into several species in islands of different size, and shall have eliminated as far as practicable the error arising from the incompleteness of our knowledge in regard to many of the islands, for in each case the comparison is between the total genera known from the place in question and the factors which go to make up that total.

The percentages of possible to actual exceptions to Steere's law obtained by this method are given as one of the footings of Table B, but in order that the facts brought out may be more readily grasped I have embodied them in a curve, which I shall refer to as Curve 1. It is constructed as follows: The percentage of genera represented by two or more species in an island is in each case indicated by units arranged in vertical series, 1 unit being allowed for 1 per cent. The relative areas of the several islands are shown by units arranged horizontally. In order to keep the curve within reasonable limits, and still make plain its relationships, I have found it necessary to vary the scale used in indicating the areas of islands.

In comparing very small islands like Sibutu and Lapac with Mindanao and Luzon it is obvious that the first part of the curve must be expanded and the last contracted or we should lose the relationships at the beginning, and the curve would stretch out at its end to inconvenient length. Up to 900 square kilometers, therefore, I have made 1 unit correspond to 10 square kilometers. From 900 to 14,900, 1 unit corresponds to 100 square kilometers, while from 14,900 to 114,900 I have allowed 1 unit to each thousand square kilometers.

The relative sizes of the islands determine their positions in the base line, while a dot at the proper height over each shows the percentage of genera with two or more species found in it. If the dots thus

located are joined, we have a curve which brings out the relationship between these percentages and areas.

Upon examining the curve thus constructed it becomes immediately evident that there is a general relationship between the size of the islands, and the percentage of genera represented by two or more species, for the curve begins at zero for the smallest islands, and its general trend is upward until it finally reaches the 80 per cent mark in the largest island—Luzon. Numerous irregularities are noticeable, however, and the more conspicuous of these are of decided interest.

It is self-evident that only a general correspondence between area and amount of differentiation could be expected. Size is no doubt directly important, since room is afforded for numerous individuals of the species represented, and the probability of the occurrence of opportune and important individual variations is correspondingly increased; but for our present purpose I believe that the size of islands is chiefly important in that it serves as a rough index of the probable diversity of conditions existing upon them. The occurrence of extensive highlands, of undisturbed forest and of fresh-water lakes and streams, as well as of extensive open lowlands, must be taken into consideration if we are to get to the bottom of the matter. Were it possible to give each of these factors its due value in constructing our curve, and to introduce, as well, another important factor, namely, the completeness and length of duration of separation from neighboring islands, I believe that the irregularities would disappear.

For instance, Bohol, though an island of 850 square kilometers, has no highlands and its forest has seemingly been wiped out. The very low level of the curve at this point, then, finds its explanation in a uniformity of conditions unfavorable to the differentiation of numerous species, or to their continued existence after they have become differentiated.

It will be noted that the curve is much broken at its origin, although it runs low on the whole. This irregularity is largely due to our scanty knowledge of the islands in question. For Lapac our conclusions are drawn from but two genera, for Fuga from four, for Cagayan Sulu from five, and for Camiguin from three. Manifestly, in dealing with such small numbers the addition or subtraction of a single genus even makes a great variation in the percentage. No collections approaching completeness have ever been made on these islands, and the irregularity of the curve is exactly what would be expected from the scanty haphazard collecting on which it is based.

We are indebted to Mr. Everett for nearly all that we know of Sibutu, and he tells us little about its surface. It would be interesting to know whether the conspicuous rise in the curve for this island is correlated with a comparatively great diversity of conditions. Tawi Tawi, at any rate, is well wooded and well watered; the curve rises. Siquijor is not well wooded nor well watered, and is of comparatively recent origin; the curve falls. The surfaces of Guimaras and Sulu are diversified, and

both islands are fairly well known; the curve rises for these islands. Marinduque marks the lowest remaining point. The island is known only from the collections of the Steere Expedition, and in making them we had to tramp miles from the village where we had headquarters in order to get into scattering forest hardly worthy of the name.

It will be noted that the latter part of our curve, where we are dealing with large islands, each of which has some virgin forest remaining, is comparatively regular.

Attention should be called to another important fact. By reference to the footings of Table B it will be seen that not only does the number of genera showing two or more species reach its maximum in the largest islands, but the number of species into which genera are differentiated reaches its maximum as well. Luzon leads with six species of *Dicaeum* and five of *Cinnyris*, while we have six genera with four species each, and eleven with three. Mindanao follows, having one genus with five species and eight with three. I know of no simple means by which this factor could be introduced into the curve, but its significance should not be lost sight of.

It seems to me that the facts above stated justify the conclusion that in the Philippines the larger the island and the greater the diversity of its surface, the larger the percentage of genera represented by more than one species, and the larger the average number of species into which they are differentiated.

It may be objected that we also find the largest number of genera distributed in accordance with Steere's law, i. e., with but one species in a place, in the largest islands. This is true, Mindanao leading with 32, followed by Luzon with 28, Samar with 27, and so on. It should be remembered, however, that we are dealing here with relative, not absolute quantities, and the real question is not whether the absolute number of confirmations of Steere's law is higher for these islands, but whether it is proportionately higher. It can be readily shown to be proportionately lower.

In constructing Curve II, to illustrate this point, I have used the same abscissa and ordinate as for Curve I, vertical units indicating percentages, and horizontal units areas. In computing percentages for each island I have taken the total number of confirmations of Steere's law from Table A, and added it to the total number of exceptions shown in Table B. This gives the total number of genera affording evidence in each case, and it is an easy matter to ascertain what percentage of this total is distributed in the one way, and what in the other.

In Curve II, as in the curves that follow it, a solid line is used to represent confirmations of Steere's law, and a broken line to indicate exceptions to it.

For reasons already stated the curve is irregular for the smaller and less well-known islands, but its general features are apparent even here. The solid line shows a constant tendency to return to the 100 per cent mark, the broken line to fall to zero.

The islands from which the smallest number of genera is known, then, afford the strongest confirmation of Steere's law.

As we pass to the larger and better known islands, the broken line takes permanent leave of the zero level, and the solid line of the 100 per cent mark. It will be noted, however, that on the average the solid line keeps well above the 50 per cent mark. The first thing that calls for special attention is its sudden drop to 27 per cent for Siquijor, and the corresponding rise in the broken line. Reference to the tables will show that this result is due not so much to a larger number of exceptions to Steere's law from Table B, as to an unusually small number of confirmations (only three) from Table A.

I have already stated my reasons for believing that Siquijor is an island of very recent origin, and has not been connected with any of the adjacent islands since it received its present bird fauna. I believe it can be shown that the birds distributed according to Steere's law are, as a rule, possessed of comparatively weak power of flight, and this probably accounts for their not having reached Siquijor in larger numbers. The divergence of the two lines for Marinduque, and their approximation for Bohol find their explanation in the facts already stated in regard to these islands. Again, it will be noted that the curve becomes more regular as we pass to the larger and better known islands, the broken line steadily rising as the solid one falls.

The evidence furnished by Curve II, then, confirms that obtained from Curve I. On the strength of it we may make the statement that the larger and more diversified the island, the larger will be the average number of species into which the genera of Table D are differentiated, and the larger will be the percentage of genera represented by two or more species as compared with those represented by but a single species.

I have shown that a majority both of genera and species are distributed in opposition to Steere's law. How then are we to explain the fact that the solid line in Curve II, indicating the percentage of genera in each island distributed according to this law, is well above the 50 per cent mark?

The answer to this question is found in part in the fact that two species of a genus may, and not infrequently do, have ranges that are distinct for the most part, but overlap along their line of contact, so that the species in question afford exceptions to Steere's law in only a part of the islands in which they occur. An additional and very important reason for this apparent contradiction will readily suggest itself.

To find ten exceptions to Steere's law we must collect at the very least twenty species of birds, while ten species may suffice to afford ten confirmations of it. If, then, genera distributed in the two ways were equally abundant upon an island, we should at first find at least two confirmations of Steere's law for every exception. Really, however,

the percentage of exceptions found would at first be very much smaller than this, from the fact that to afford evidence the species must be collected at least in pairs, i. e., two to a genus.

To take a very simple illustration, suppose that three figure ones were shaken up in a hat, together with two twos, two threes, and two fours, and one were then to draw out the figures at random, placing the ones in one pile and the pairs of twos, threes, and fours in another; at what rate would the two piles grow?

On the first draw there would be three chances in nine of getting a one, but only two in nine of getting a two, three, or four, and no chance whatever of getting a pair of either of the last three numerals. On the second draw there would be three chances in eight of getting a one, but only two in nine plus two in eight divided by two (the number in a pair) multiplied by three (the number of pairs), or seventeen in two hundred and sixteen, of getting a pair. Three in eight are equivalent to eighty-one in two hundred and sixteen, and the chances of getting a one on the second draw would be to those of getting a pair of twos, threes, or fours as eighty-one is to seventeen. As the drawing continued, the chances of getting a pair would improve each time, but would equal those of getting a one only at the very close of the drawing.

Returning now to our birds, the matter may be reduced to a formula. We may, for convenience, divide them into genera with one species in a place, and those with two species in a place, for in genera with more than two species in an island the recording of two is enough to establish an exception, while the increased probability of recording two species, arising from the fact that there are more than two to draw from, will be counterbalanced by the fact that three or four species belonging to but one genus constitute but a single exception.

Let a = number of genera with but one species in an island.

Let b = number of genera with two species in an island.

Then $a + 2b$ = whole number of species in the island.

Let z = number of species known.

Were a collector to take up the work at this point his chance of making an addition to the list of genera represented by single species would be $\frac{a}{a + 2b - z}$, while his chance of making an addition to the

list of genera with two species each would be but $\frac{2}{a + 2b - z}$, or

$\frac{1}{a + 2b^2 - bz}$. Since z is the variable factor here, and increases one with every addition of a species, it is evident that as the number of species of birds known from an island approximates the number actually existing there the chances of recording exceptions to Steere's law will steadily increase.

It is not too much to say, then, that as there is probably not a single island all of the resident land birds of which are known the broken line in our curves is everywhere too low; that the error is smallest for those islands that are best known and greatest for those that are least known.

Unfortunately the number of genera recorded from an island is not exactly indicative of the completeness of our knowledge of it, since some islands doubtless have more genera than others. It seems, however, to be the most satisfactory index available, and in Curve III the islands are arranged not according to size, but on the number of genera having two or more species in the Philippines known from each. The number of genera is indicated by units arranged in horizontal series, 4 units being allowed for each genus. On this basis I have compared the percentages of genera distributed in the two ways for each island, reckoning percentages as before.

Irregularities in our curve are not lacking, but the more important of them have already been discussed, and the curve establishes beyond a doubt the fact that Steere's law receives its strongest confirmation in the islands from which the smallest number of genera is at present known, and that as our knowledge increases the percentage of genera represented by a single species steadily falls.

It may be objected that my treatment of this subject has been unfair, in that I have omitted from consideration, in reckoning percentages for Curves II and III, the genera of Table B wherever they happened to be represented by but a single species. It may be said that I ought to consider each instance where a single species of one of these genera is recorded from an island as a confirmation of Steere's law, rather than as a bit of evidence incomplete, and therefore to be ignored.

I might well reply that in view of the heavy chances against the discovery of exceptions to the law, it is no more than fair to leave the genera of Table B out of account in islands where but one species happens to have been recorded, and as a further offset might add that in plotting the curves no more importance has been given to an exception where six species of a genus occur in an island than to one based upon the occurrence of but two. On the whole, then, I believe my treatment has been fair; but in order to test further the general correctness of my results I have constructed two more curves, in which I have given Steere's law the benefit of every doubt, and have counted every case where a genus of Table B is recorded with but one species as a confirmation of it. In Curves IV and V the percentages of *species* distributed in the two ways are shown.

Arranging the islands in order of their size we get Curve IV, which does not differ in any essential particular from those already obtained, and enforces the same conclusion stated in terms of species that Curve II enforces stated in terms of genera. We see that in the smaller islands nearly or quite all the recorded species belong to different gen-

era, but as the islands grow larger it becomes increasingly common to find two or more species of a genus in a place.

Although this curve does not rise quite so high for Luzon as did Curve II, its general level is well up, owing to the fact that due importance is given to the number of species affording exceptions to the law, which has not been done in the other curves.

Perhaps the most conclusive of all the curves is Curve V, where the islands are arranged according to the number of species in Tables A and B recorded from each.

These last two curves make it evident that even when Steere's law is given the benefit of the doubt in every case, which is most illogical, there still remains for all but the very smallest and least known islands a mass of exceptions altogether too formidable to be overlooked; that the percentage of exceptions steadily increases with increase in the number of species recorded, and that finally in the largest and best known islands it is no less than 73 per cent of the whole number of species considered.

It remains to be ascertained whether the genera of Tables A and B group themselves into separate families, or whether we shall find that in the majority of cases some genera of a family are distributed in the one way, others in the other.

In Curve VI, I have endeavored to bring out the facts. Families are arranged in horizontal series, space being given to each proportionate to the number of genera that it includes, 4 units being allowed to each genus. It will be seen that in fourteen families there is not a single genus of resident land birds with but one species in an island. Seven more families have less than half their genera distributed according to Steere's law; three have their genera equally divided as regards the method of their distribution; four have more than 50 per cent distributed according to the law, while eight have all their species so distributed.

With few exceptions, the species included in these eight families are possessed of comparatively weak power of flight, hence are unable to surmount geographical barriers of any importance. I do not doubt that they are in many instances to be regarded as geographical races, and that isolation has had much to do with bringing them into existence, but I feel indisposed to make the same admission for all the species belonging to the fourteen families which do not offer a single confirmation of Steere's law.

I believe, then, that in formulating his law Steere has given altogether too much importance to a really important factor in the development of species. He has assigned undue prominence to geographical barriers, especially sea channels, and has not given sufficient consideration to the fact that within the confines of the larger islands, especially when they are mountainous and well wooded, there is abundant room for life zones which may be quite as sharply defined as those marked out by salt water.

My own conclusions in regard to the whole matter are as follows:

1. There are in the Philippines a number of closely allied species of birds, each of which has a definite range that in many instances at least does not overlap the range of any other species of the same genus. The general correspondence between the ranges of these species and the positions of geographical barriers to their free migration lends probability to the conclusion that we are here dealing with a case of cause and effect, especially when we remember the fact that the phenomenon is not an isolated one, but has been observed in the Galapagos and other island groups.¹

2. On the other hand, cases where two or more closely allied species of the same genus occur within the limits of a single island are too numerous to be overlooked. While it does not necessarily follow from the fact that two species occupy the same island that they occupy the same life zone, there are enough well ascertained cases where two allied species do occur side by side to effectually negative Steere's conclusion that the genus is represented by but a single species in a place.

3. We are more likely to find genera represented by several species in large islands with diversified surfaces than in small islands in which comparatively uniform conditions prevail, and in islands that are well known than in those that are little known.

4. Among the facts at our disposal there is nothing to justify the statement that isolation is the first and necessary factor in species formation, since we have no proof that environment is the direct cause of variation, without which there can be no development.

5. In studying island avifaunae it should be remembered that geographical barriers, in the ordinary sense, are not the only barriers which are effective in bringing about localization of birds. Temperature, distribution of food supply, direction of prevailing winds, character and duration of seasons, and especially the nature and distribution of enemies are of importance in limiting the ranges of species, and must be taken into consideration before we can arrive at any final conclusions.

6. If two closely allied species were thrown together in an island one of three things would happen. They would continue to live together, preserving their relative numbers, or they would fuse with each other, forming a hybrid race, or one species would tend to exterminate the other.

7. I do not at present know of any positive evidence in favor of Steere's theory that they would fuse. Similarity in coloring, or in the food, would by no means serve to offset the well-known tendency to sterility between different species, and especially among the hybrid

¹See Wallace's "Island Life." Also Moritz Wagner, *Die Darwinische Theorie und das Migrationgesetz der Organismen.*, Leipzig, 1868; Baur, *Ein Besuch der Galapagos-Inseln.* *Biol. Centralbl.*, XII, p. 221, 1892; Ridgway, *Birds of the Galapagos Archipelago.*, *Proc. U. S. Nat. Mus.*, XIX, p. 459, 1897.

offspring of different species, in balancing the probabilities in such a case.

8. The actual result would probably depend, then, on the relative completeness of the adaptation of the two species to the common environment under which they were placed. If equally well adapted to their surroundings, both would continue to exist. If not, one species would tend to exterminate the other.

POSSIBILITIES OF FUTURE ORNITHOLOGICAL WORK IN THE PHILIPPINES.

Before we gain much additional light on the value of the several factors in the origin and distribution of the genera and species of resident Philippine land birds, work of a very different character from most of that which has as yet been attempted must be carried on.

Conclusive proof of the result of bringing together two closely allied species might be obtained by introducing two of the species of *Loriculus* into Palawan or the Calamianes islands, where the genus is at present lacking, and noting the result. Would both forms hold their own, would they fuse, or would one tend to exterminate the other? These questions have no little theoretical interest, and they are entirely capable of practical solution.

Individuals of a single species of some genus with a marked tendency to develop local forms, such as *Chrysocolaptes*, *Iyngipicus*, or *Penelopides*, might be introduced into Siquijor or some other similarly isolated island, and their offspring watched, to see if a new species would in time develop, under the influence of changed environment. True, the experimenter would probably not live to see the result of his work, but future generations of ornithologists might be indebted to him.

Within the limits of an ordinary lifetime, however, one might make a detailed examination of the facts of individual variation in those species which show a marked tendency to develop local forms as compared with those that seem to lack such a tendency. He might also learn an immense amount in regard to the habits of birds, their foods, and especially their relationships with each other, with other organisms, in short, with their environment in general. We know very little about this subject at present, and without information bearing on it we can not arrive at satisfactory conclusions.

To take a single illustration, *Pycnonotus goiavier* is almost certainly lacking in Siquijor. Why should this commonest of Philippine birds not occur there? Certainly not because it could not have reached the island. Apparently not from lack of a supply of suitable food. Probably from the presence of some enemy, at present entirely unknown to us.

I am led by the results of our work in Siquijor, Tablas, and Sibuyan

to believe that a careful study of the smaller and more isolated islands would be productive of important results.

The study of the relationship between species formation and environment is in its infancy. Much is to be hoped from it, and it is comforting to reflect that sooner or later the supply of "new species" will be exhausted, and ornithologists will have time to learn more about old ones.

Were some competent naturalist to go to the Philippines with an abundance of time before him and sufficient funds behind him to allow of his carrying on his work upon a broad scale; were he free from the necessity of turning out about so many bird skins a month, and of discovering his quota of new species each year, he might in due time make a contribution of far-reaching importance to scientific ornithology, and to our knowledge of island life in general.

LIST OF PAPERS REFERRED TO IN COMPILING THE DISTRIBUTION LIST.

1888. BLASIUS, WILH.—Die Vögel von Palawan.
Ornis, 1888, p. 301.
1888. BLASIUS, WILH.—Letter concerning Doctor Sharpe's Nomenclature of Palawan birds.
Ibis, 1888, p. 372.
1890. BLASIUS, WILH.—Die wichtigsten Ergebnisse von Doctor Platen's ornithologischen Forschungen auf den Sulu-Inseln.
Journ. für Ornith., 1890, p. 139.
1890. BLASIUS, WILH.—Die von Herrn Doctor Platen und dessen Gemahlin im Sommer 1889 bei Davao auf Mindanao gesammelten Vögel.
Journ. für Ornith., p. 144.
1894. BOURNS, FRANK S., and WORCESTER, DEAN C.—Preliminary Notes on the Birds and Mammals collected by the Menage Expedition to the Philippine Islands.
Occasional Papers, Minnesota Academy of Natural Sciences, I, No. 1. December, 1894.
1894. CLARKE, WM. EAGLE.—On some Birds from the Island of Negros, Philippines.
Ibis, 1894, p. 531.
1895. CLARKE, WM. EAGLE.—On some Birds from the Island of Negros, Philippines. (Second Contribution.)
Ibis, 1895, p. 472.
1889. EVERETT, A. H.—Remarks on the Zoo-geographical Relationships of the Island of Palawan and some adjacent Islands.
Proc. Zool. Soc., 1889, p. 220.
1889. EVERETT, A. H.—A List of the Birds of the Bornean Group of Islands.
1895. EVERETT, A. H.—A List of the Birds of the Island of Balabac, with some Notes on and Additions to the Avifauna of Palawan.
Ibis, 1895, p. 21.
1888. GORGOZA Y GONZÁLEZ, JOSÉ.—Datos para la Fauna Filipina.
Aves. Anales de la Sociedad Española de Historia Natural. October, 1888, p. 258.
1894. GRANT, W. R. OGILVIE.—On the Birds of the Philippine Islands. Pt. I. Mount Arayat, Central Luzon.
Ibis, 1894, p. 406.

1894. GRANT, W. R. OGILVIE.—On the Birds of the Philippine Islands. Pt. II. The Highlands of North Luzon, 5,000 feet.
Ibis, 1894, p. 501.
1895. GRANT, W. R. OGILVIE.—On the Birds of the Philippine Islands. Pt. III. The Mountains of the Province of Isabela, in the Extreme Northeast of Luzon.
Ibis, 1895, p. 106.
1895. GRANT, W. R. OGILVIE.—On the Birds of the Philippine Islands. Pt. IV. The Province of Albay, Southeast Luzon, and the adjacent Island of Catanduanes.
Ibis, 1895, p. 249.
1895. GRANT, W. R. OGILVIE.—On the Birds of the Philippine Islands. Pt. V. The Highlands of the Province of Lepanto, North Luzon.
Ibis, 1895, p. 433.
1896. GRANT, W. R. OGILVIE.—On the Birds of the Philippine Islands. Pt. VI. The Vicinity of Cape Engaño, Northeast Luzon, Manila Bay, and Fuga Island, Babuyan Group.
Ibis, 1896, p. 191.
1896. GRANT, W. R. OGILVIE.—On the Birds of the Philippine Islands. Pt. VII. The Highlands of Mindoro.
Ibis, 1896, p. 457.
1896. GRANT, W. R. OGILVIE.—On the Birds of the Philippine Islands. Pt. VIII. The Highlands of Negros.
Ibis, 1896, p. 525.
1897. GRANT, W. R. OGILVIE.—On the Birds of the Philippine Islands. Pt. IX. The Islands of Samar and Leyte.
Ibis, 1897, p. 209.
1885. GUILLEMARD, F. H. H.—A Provisional List of the Birds Inhabiting the Sulu Archipelago.
Proc. Zool. Soc., 1885, p. 247.
1885. GUILLEMARD, F. H. H.—Borneo and the Island of Cagayan Sulu.
Proc. Zool. Soc., 1885, p. 404.
1891. HARTERT, ERNST.—Die bisher bekannten Vögel von Mindoro.
Journ. für Ornith., 1891, pp. 199-206, 292-302.
1891. HARTERT, ERNST.—Katalog der Vögelsammlung im Museum der Senckenbergischen naturforschenden Gesellschaft in Frankfurt am Main. January, 1891. Frankfurt a. M. Druck von Gebrüder Knauer.
1895. HARTERT, ERNST.—A New *Prionochilus* from the Philippines and Note on an *Anthreptes*.
Novitates Zoologicae, II, p. 64.
1895. HARTERT, ERNST.—On a small Collection of Birds from Mindoro.
Novitates Zoologicae, II, p. 486.
1883. KUTTER, J. F.—Beitrag zur Ornithologie der Philippinen.
Journ. für Ornith., 1883, p. 291.
1891. MEYER, A. B.—Über einige Tauben von Borneo und den Philippinen.
Journ. für Ornith., 1891, p. 67.
1891. MOSELEY, E. L.—Descriptions of two new Species of Flycatchers from the Island of Negros, Philippines.
Ibis, 1891, p. 46.

1880. OUSTALET, E.—Description des Oiseaux nouvelles des Isles Souloo.
Bull. hebdom. Assoc. Sc. France, 1880, p. 205.
1881. RAMSAY, R. G. WARDLAW.—Appendix, Tweeddale's Ornithological Works.
1884. RAMSAY, R. G. WARDLAW.—Contributions to the Ornithology of the Philippine Islands. No. 1. On two Collections of Birds from the Vicinity of Manila.
Ibis, 1884, p. 330.
1886. RAMSAY, R. G. WARDLAW.—Contributions to the Ornithology of the Philippine Islands. No. 2. On additional Collections of Birds.
Ibis, 1886, p. 155.
1891. SALVADORI, T.—On a rare Species of Lorikeet in the Rothschild Collection.
Ibis, 1891, p. 48.
1886. SALVADORI, T.—On some Papuan, Moluccan, and Sulu Birds.
Ibis, 1886, p. 151.
1876. SHARPE, R. BOWDLER.—On the Birds collected by Professor J. B. Steere in the Philippine Archipelago.
Trans. Linn. Soc., 2d ser., I, p. 307.
1879. SHARPE, R. BOWDLER.—A Contribution to the Avifauna of the Sulu Islands.
Proc. Zool. Soc., 1879, p. 311.
1888. SHARPE, R. BOWDLER.—On a Collection of Birds from the Island of Palawan.
Ibis, 1888, p. 193.
1894. SHARPE, R. BOWDLER.—On a Collection of Birds sent by Mr. Alfred H. Everett from the Sulu Archipelago.
Ibis, 1894, p. 238.
1890. STEERE, J. B.—A List of the Birds and Mammals collected by the Steere Expedition to the Philippines.
Ann Arbor, Mich. Courier Print, July 14, 1894.
1891. STEERE, J. B.—Ornithological Results of an Expedition to the Philippine Islands.
Ibis, 1894, p. 301.
1894. STEERE, J. B.—The Distribution of Genera and Species of nonmigratory Land Birds in the Philippines.
Auk, 1894, p. 231. Also *Ibis*, 1894, p. 411.
1877. TWEEDDALE, ARTHUR, MARQUIS OF.—Reports on the Collections of Birds made during the Voyage of H. M. S. *Challenger*. No. II. On the Birds of the Philippine Islands.
Proc. Zool. Soc., 1877, p. 535.
1877. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. I. On the Collection made by Mr. A. H. Everett in the Island of Luzon.
Proc. Zool. Soc., 1877, p. 686.
1877. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. II. On the Collection made by Mr. A. H. Everett in the Island of Cebu.
Proc. Zool. Soc., 1877, p. 686.
1877. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. III. On the Collection made by Mr. A. H. Everett in the Island of Mindanao.
Proc. Zool. Soc., 1877, p. 816.

1878. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. IV. On the Collection made by Mr. A. H. Everett in the Islands of Dinagat, Bazol, Nipah, and Sakuyok.
Proc. Zool. Soc., 1878, p. 106.
1878. TWEEDDALE, ARTHUR, MARQUIS OF.—On a New Philippine Genus and Species of Bird.
Proc. Zool. Soc., 1878, p. 114.
1878. TWEEDDALE, ARTHUR, MARQUIS OF.—On a New Species of the Genus Buceros.
Proc. Zool. Soc., 1878, p. 277.
1878. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. V. On the Collection made by Mr. A. H. Everett in the Island of Negros.
Proc. Zool. Soc., 1878, p. 280.
1878. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. VI. On the Collection made by Mr. A. H. Everett in the Island of Leyte.
Proc. Zool. Soc., 1878, p. 339.
1878. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. VII. On the Collection made by Mr. A. H. Everett in the Island of Panaon.
Proc. Zool. Soc., 1878, p. 379.
1878. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. IX. On the Collection made by Mr. A. H. Everett in the Island of Palawan.
Proc. Zool. Soc., 1878, p. 611.
1878. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. X. On the Collection made by Mr. A. H. Everett in the Island of Bohol.
Proc. Zool. Soc., 1878, p. 708.
1878. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. XI. On the Collection made by Mr. A. H. Everett at Zamboanga, in the Island of Mindanao.
Proc. Zool. Soc., 1878, p. 936.
1879. TWEEDDALE, ARTHUR, MARQUIS OF.—Contributions to the Ornithology of the Philippines. No. XII. On the Collection made by Mr. A. H. Everett in the Island of Basilan.
Proc. Zool. Soc., 1879, p. 68.
1881. TWEEDDALE, ARTHUR, MARQUIS OF.—Ornithological works. London: 1881, 4to.
1875. WALDEN, ARTHUR, VISCOUNT.—A List of the Birds known to inhabit the Philippine Archipelago.
Trans. Zool. Soc. Lond., IX, p. 125.
1890. WHITEHEAD, JOHN.—Notes on the Birds of Palawan.
Ibis, 1890, p. 38.
1893. WHITEHEAD, JOHN.—*Cryptolopha xanthopygia* described.
Ibis, 1893, p. 263.
1891. WIGGLESWORTH, L. W.—On the Polynesian Members of the Genus *Ptilopus*.
Ibis, 1891, p. 566.

TABLE A.

Names of genera.	Number of species.	Cagayan Sulu.						
		Cuyo.	Balabac.	Palawan.	Calamianes.	Bohol.	Siquijor.	
1. Accipiter.....	2			1				
2. Alcyon.....	4							
3. Artamides.....	7		1		1			
4. Baza.....	2			1				
5. Brachypteryx.....	2							
6. Bolbopsittacus.....	3							
7. Bubo.....	2							
8. Chaetura.....	3			1				
9. Chalcococcyx.....	2		1					
10. Chibia.....	3		1	1	1			
11. Chrysocolaptes.....	5		1	1	1			
12. Chloropsis.....	2		1	1				
13. Citrocicla.....	5		1	1	1			
14. Corvus.....	2		1	1				
15. Cranorrhinus.....	2							
16. Cyanomyias.....	2							
17. Dendrophila.....	3		1	1				
18. Edoliisoma.....	5							
19. Endrepanis.....	2							
20. Dierurus.....	3							
21. Hydrocorax.....	3							
22. Irena.....	4			1	1			
23. Iyngipicus.....	6			1	1			
24. Loriculus.....	2					1	1	
25. Geocichla.....	2						1	
26. Macromus.....	3							
27. Microstictus.....	2							
28. Microhierax.....	2							
29. Mixornis.....	1	1						
30. Pelargopsis.....	2		1	1				
31. Phlogoenas.....	4		1	1	1			
32. Penelopides.....	6							
33. Ptiloecichla.....	4			1	1			
34. Pycnonotus.....	2			1	1			
35. Sarcophanops.....	2			1	1	1	1	
36. Spilornis.....	3			1	1	1		
37. Stoparola.....	3			1	1		1	
38. Surniculus.....	2			1	1			
39. Thriponax.....	4				1			
40. Xantholaema.....	2							
41. Zeecephus.....	3				1	1		
Total.....	129	1	0	14	20	11	2	3

TABLE B.

Names of genera.	Number of species.	Cagayan Sulu.						
		Cuyo.	Balabac.	Palawan.	Calamianes.	Bohol.	Siquijor.	
1. Aethopyga.....	6			1	1	1		
2. Alcedo.....	2		2		2			
3. Anthothreptes.....	4	1		1	2	1	1	
4. Arachnothera.....	3			1				
5. Batrachostomus.....	5							
6. Centropus.....	7			1	2	1	2	2
7. Caprimulgus.....	4			3	1			
8. Carpophaga.....	6	1		1	1	1	1	1
9. Cettia.....	2							
10. Ceyx.....	5			1	1	1		1
11. Cinnyris.....	2			1	2	2	1	2
12. Circus.....	3							
13. Cisticola.....	2			1	1	1	1	
14. Collocalia.....	7				4	1		1
15. Criniger.....	2			1	2	1		
16. Cryptolopha.....	4				1			
17. Dicaeum.....	18			1	1			2
18. Emberiza.....	2							
19. Endynamis.....	2				2			1

TABLE B—Continued.

Names of genera.	Number of species.	Number of species in islands.												
		Cagayan Sulu.	Cuyo.	Balabac.	Palawan.	Calamianes.	Bohol.	Siquijor.	Cebu.	Masbate.	Negros.	Guimaras.	Panay.	Tablas.
20. Falco	5													
21. Halcyon	3	1		1										
22. Hemilechidon	2													
23. Hierococcyx	2													
24. Hirundo	3	1												
25. Hyloterpe	5													
26. Hypothymis	3													
27. Iole	9													
28. Lalage	3													
29. Lanius	4			1	1									
30. Lyncornis	2													
31. Megalurus	2													
32. Merops	2													
33. Muscipula	4													
34. Munia	5			1	2	1	1	1						
35. Ninox	8			1	1	1	1	1						
36. Oriolus	9			1	1	1	1	1						
37. Orthotomus	9	1		1	1	1	1	1						
38. Osmotreron	2													
39. Parus	4													
40. Phaboteron	9													
41. Pitta	6													
42. Prioniturus	6													
43. Prionochilus	7			1	1	1	1							
44. Ptilopus	5													
45. Rhabdornis	3													
46. Rhinomyias	4													
47. Rhipidura	4													
48. Scops	6													
49. Siphia	6			1	3	1								
50. Spizaetus	2													
51. Tanygnathus	3													
52. Turnix	2													
53. Turtur	3			1	1	1	1	1						
54. Zosterornis	7													
55. Zosterops	7													
	264													

SUMMARY OF EXCEPTIONS.

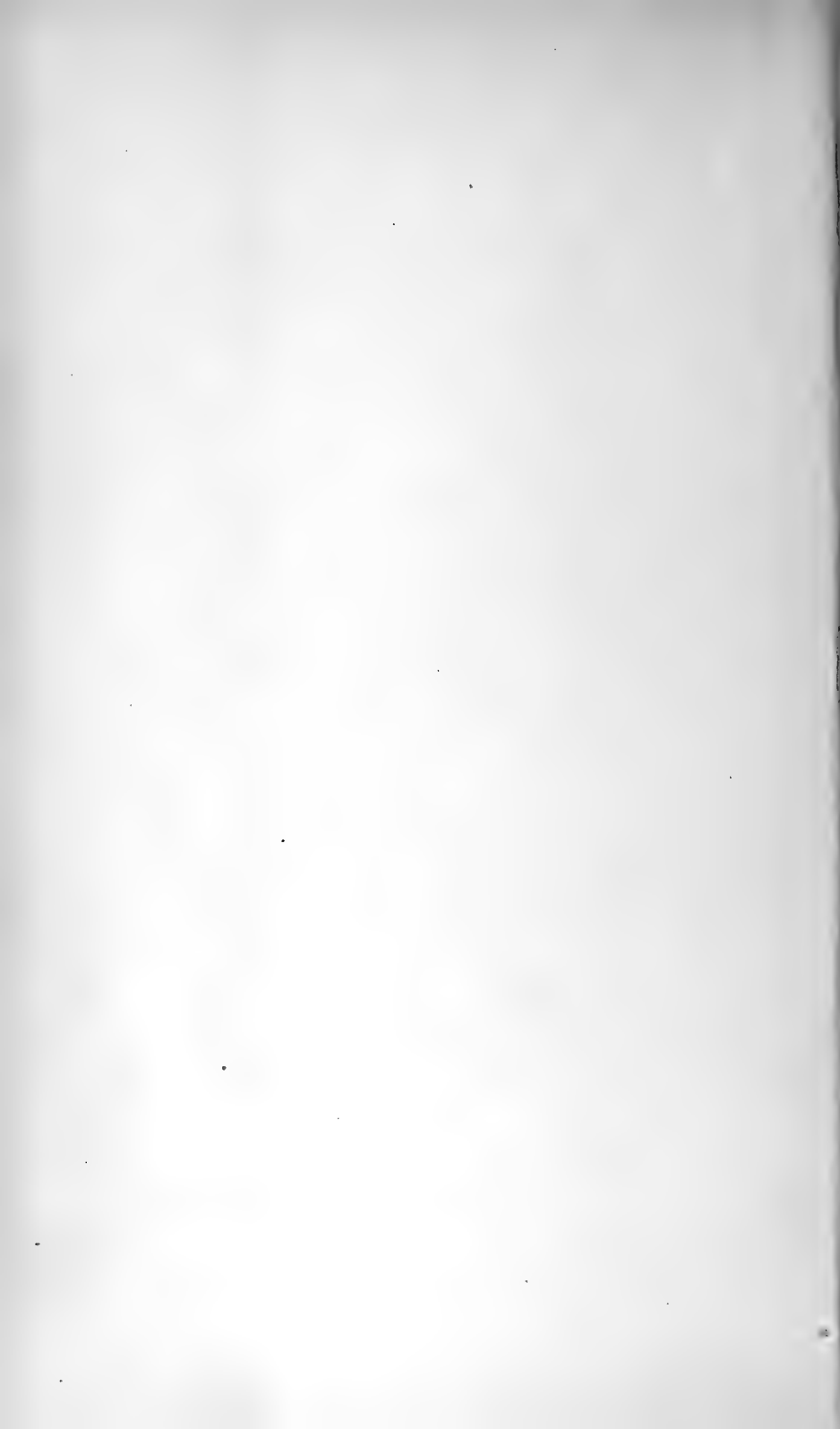
	Cagayan Sulu.	Cuyo.	Balabac.	Palawan.	Calamianes.	Bohol.	Siquijor.	Cebu.	Masbate.	Negros.	Guimaras.	Panay.	Tablas.
Two Species in Island			2	15	5	2	7	15	9	14	8	11	3
Three Species in Island				4			1	1	2	6	2	3	1
Four Species in Island				1									
Five Species in Island													
Six Species in Island													
Total Exceptions	0	0	2	20	5	2	8	16	11	20	10	14	4
Number of Genera reported	5	0	20	43	32	20	31	40	34	45	31	34	29
Percentage of Exceptions	0	0	10	47	16	10	26	40	32	44	32	41	12
One Species in Island	5	0	18	23	27	18	23	24	23	25	21	20	25

TABLE B—Continued.

Cebu.	Masbate.	Negros.	Guimaras.	Panay.	Tablas.	Romblon.	Sibuyan.	Mindoro.	Luzon.	Marinduque.	Catanduanes.	Fuga.	Samar.	Leyte.	Dinagat.	Panaon.	Nipal.	Camiguin.	Bazol.	Sakujok.	Mindanao.	Basilan.	Sulu.	Lapac.	Siassi.	Tawi Tawi.	Bongao.	Sibutu.	Malaniya.
1	3	3	3	3	3	1	1	3	4	2	1		3	2	1		1				5	4	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		
1	1	1	1	1	1	1	1	1	1	1	1			1	1						1	1	1			1	1		

SUMMARY OF EXCEPTIONS.

Romblon.	Sibuyan.	Mindoro.	Luzon.	Marinduque.	Catanduanes.	Fuga.	Samar.	Leyte.	Dinagat.	Panaon.	Nipal.	Camiguin.	Bazol.	Sakujok.	Mindanao.	Basilan.	Sulu.	Lapac.	Siassi.	Tawi Tawi.	Bongao.	Sibutu.	Total.
1	2	10	21	4	2		20	11	4	1					19	14	10			9	6	3	228
	1	4	11				3	2							8	1	3						52
		1	6					1							1						1		11
			1				1																3
			1																				1
1	3	15	40	4	2	0	23	14	4	1	0	0	0	0	28	16	13	0	0	10	6	3	295
22	29	40	52	21	22	4	43	33	19	9	2	3	1	1	49	43	37	2	3	32	24	21
4	10	37	80	5	10	0	53	42	21	11	0	0	0	0	57	36	35	0	0	31	21	13
21	26	25	12	17	20	4	20	19	15	8	2	3	1	1	21	27	26	2	3	22	18	18



EXPLANATION OF MAP.

One hundred fathoms line.
Figures on land show height above sea level in feet
Figures in water show depth in fathoms
The names of places where collections of birds have
been made are underlined

MAP OF THE PHILIPPINE ISLANDS

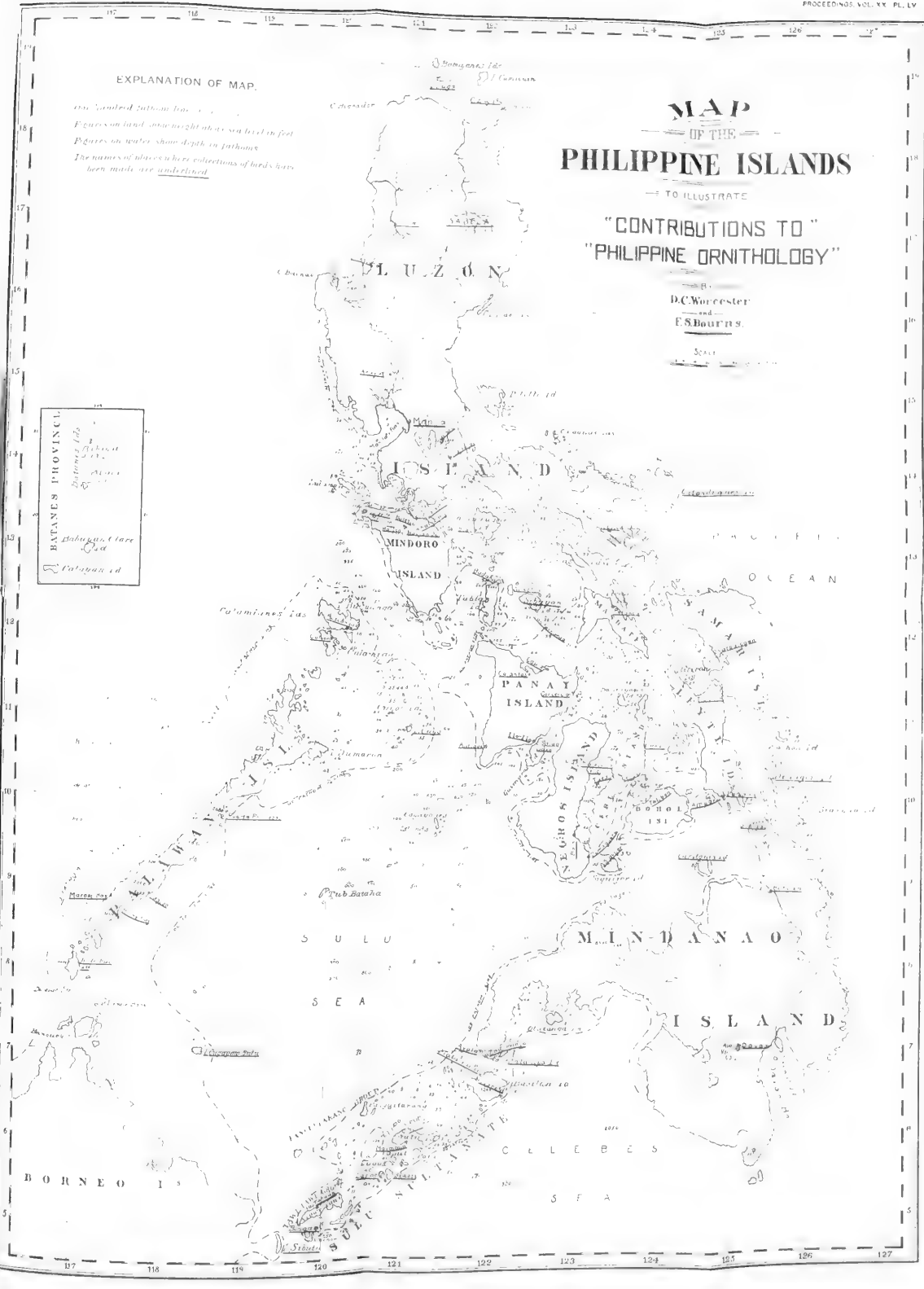
TO ILLUSTRATE

"CONTRIBUTIONS TO" "PHILIPPINE ORNITHOLOGY"

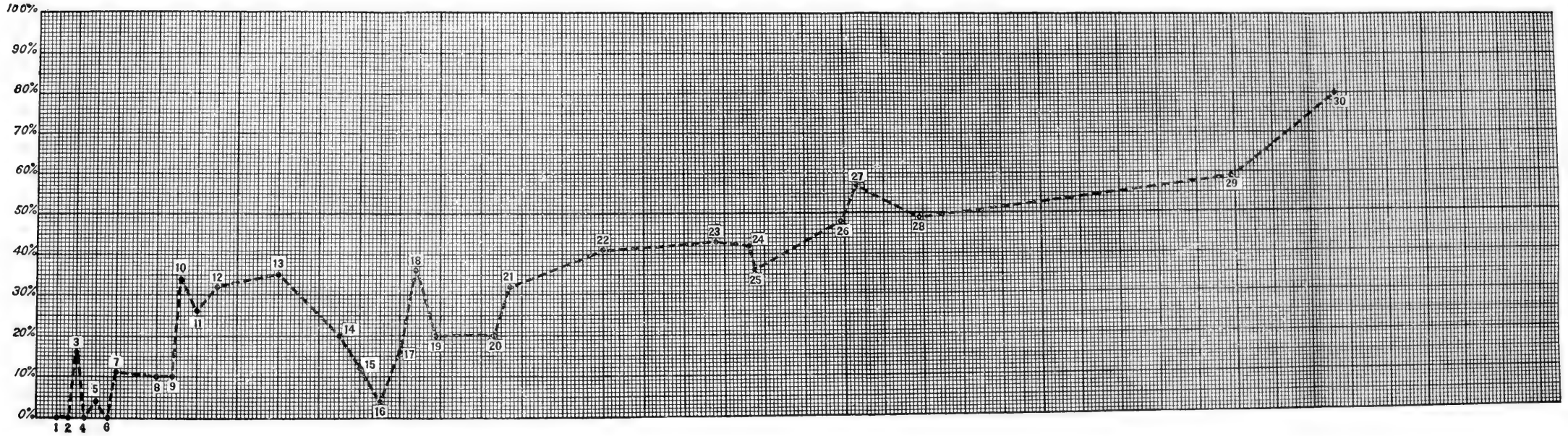
BY
D. C. WORCESTER
and
E. S. BURRILL

SCALE

BATAVIA PROVINCE
Batavia Is. Manila
Batavia Is. Manila
Batavia Is. Manila
Batavia Is. Manila







CURVE I.

DISTRIBUTION CHART SHOWING WHAT PERCENTAGE OF THE GENERA OF TABLE D KNOWN TO OCCUR IN EACH ISLAND ARE REPRESENTED BY TWO OR MORE SPECIES. THE ISLANDS ARE ARRANGED ACCORDING TO THEIR AREAS.

- 1. Lapac
- 2. Fuga.
- 3. Sibutu.
- 4. Cagayan Sulu.
- 5. Romblon.

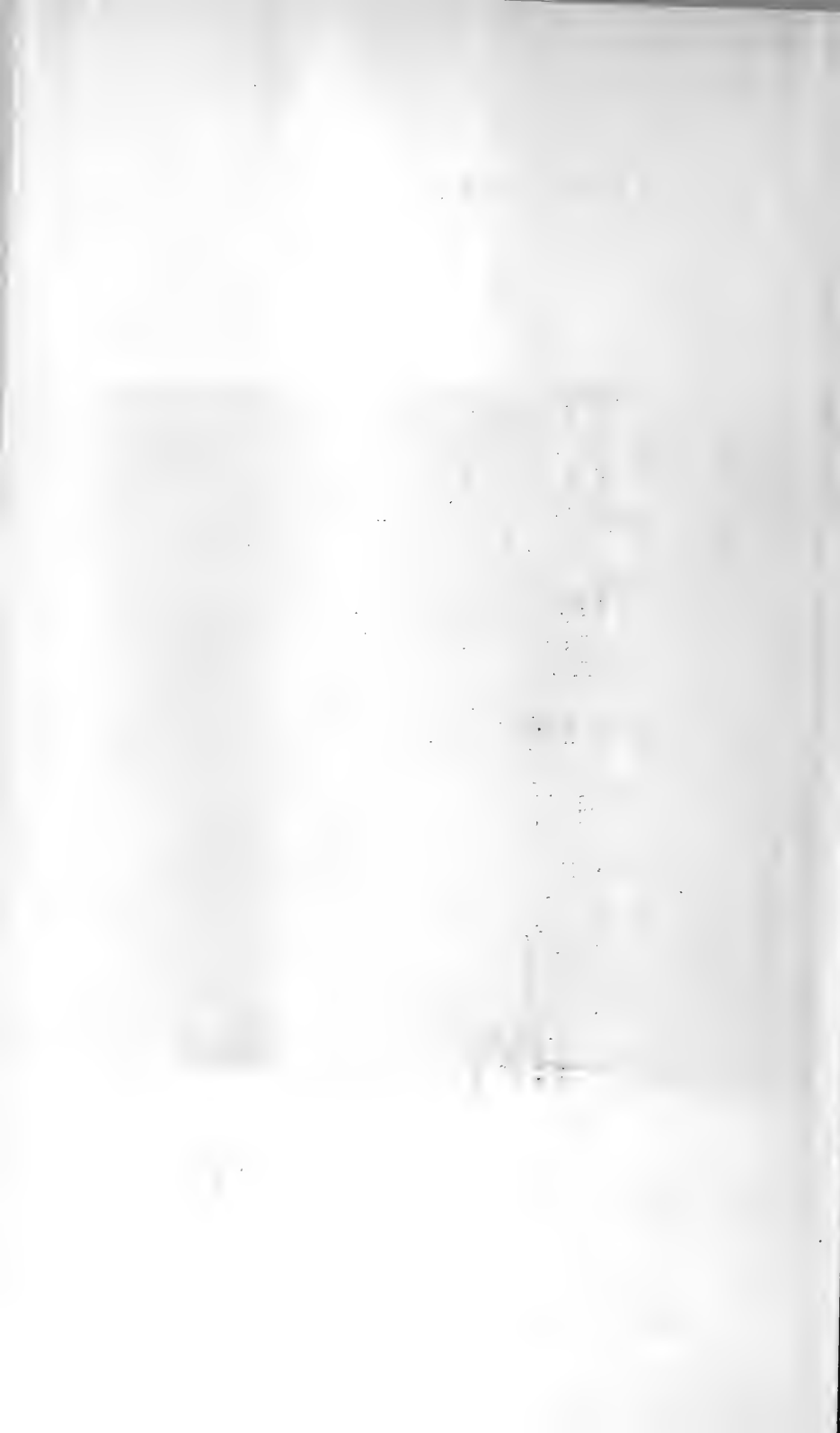
- 6. Camiguin.
- 7. Pavaon.
- 8. Sibuyan.
- 9. Balabac.
- 10. Tawi Tawi.

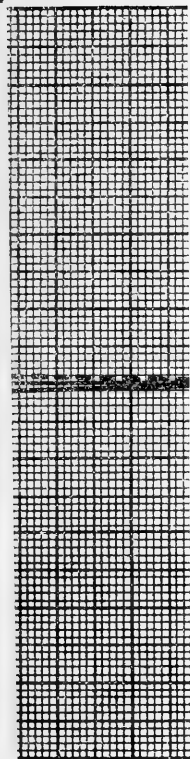
- 11. Siquijor.
- 12. Guimaras.
- 13. Sulu.
- 14. Dinagat.
- 15. Tablas.

- 16. Marinduque.
- 17. Calamianes.
- 18. Basilan.
- 19. Catanduanes.
- 20. Bohol.

- 21. Masbate.
- 22. Cebu.
- 23. Negros.
- 24. Leyte.
- 25. Mindoro.

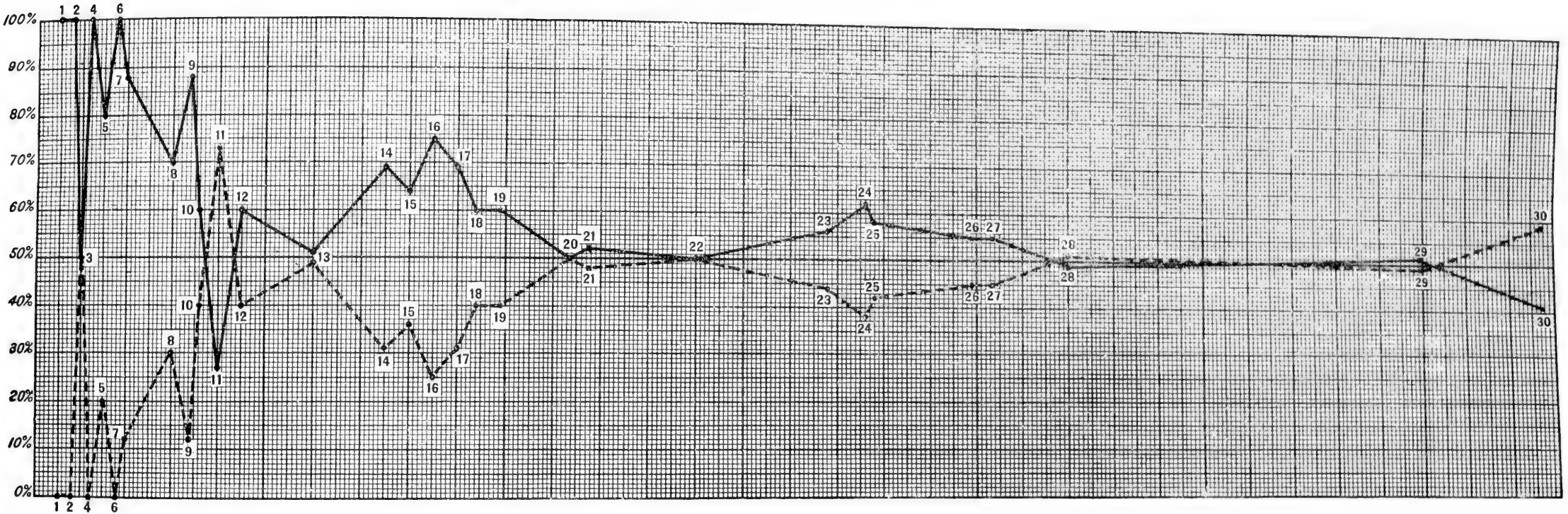
- 26. Panay.
- 27. Samar.
- 28. Palawan.
- 29. Mindanao.
- 30. Luzon.





UTED IN OPPOSITIO

21. Masba
22. Cebu.
23. Negro:
24. Leyte.
25. Mindo



CURVE II.

DISTRIBUTION CHART SHOWING RELATIONSHIP BETWEEN NUMBER OF GENERA, WITH SPECIES DISTRIBUTED IN ACCORDANCE WITH STEERE'S LAW, AND THOSE WITH SPECIES DISTRIBUTED IN OPPOSITION TO IT WHEN COMPARED ON THE BASIS OF THE RELATIVE SIZE OF THE SEVERAL ISLANDS.

- 1. Lapac.
- 2. Fuga.
- 3. Sibutu.
- 4. Cagayan Sulu.
- 5. Romblon.

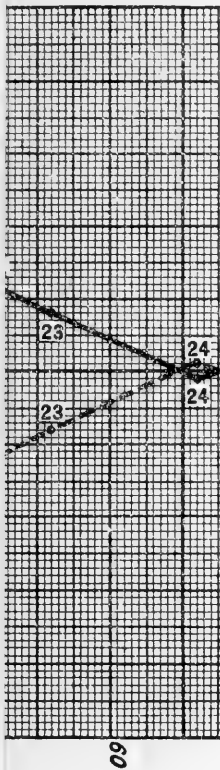
- 6. Camiguin.
- 7. Panaon.
- 8. Sibuyan.
- 9. Balabac.
- 10. Tawi Tawi.

- 11. Siquijor.
- 12. Guimaras.
- 13. Sulu.
- 14. Dinagat.
- 15. Tablas.

- 16. Marinduque.
- 17. Calamianes.
- 18. Basilan.
- 19. Catanduanes.
- 20. Bohol.

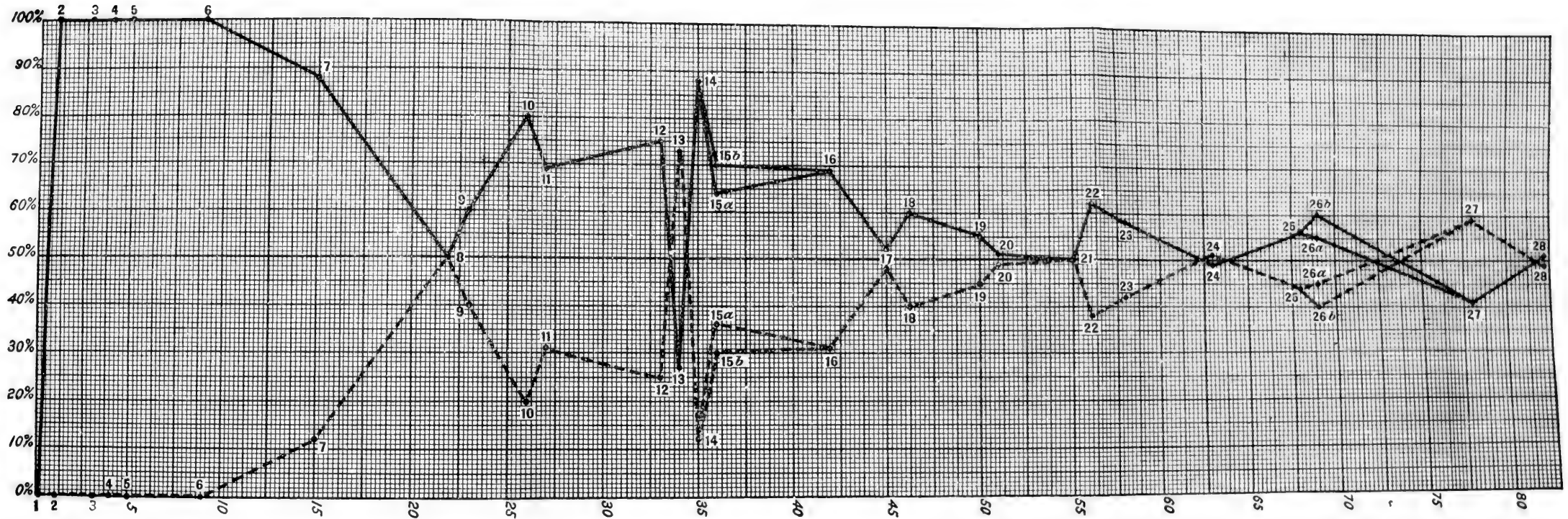
- 21. Masbate.
- 22. Cebu.
- 23. Negros.
- 24. Leyte.
- 25. Mindoro.

- 26. Pansy.
- 27. Samar.
- 28. Palawan.
- 29. Mindanao.
- 30. Luzon.



CORDANCE WITH, AND I





CURVE III.

DISTRIBUTION CHART SHOWING RELATIONSHIP BETWEEN NUMBER OF GENERA OF NON-MIGRATORY LAND BIRDS KNOWN FROM EACH ISLAND AND PERCENTAGES DISTRIBUTED IN ACCORDANCE WITH, AND IN OPPOSITION TO, STEERE'S LAW. FOUR UNITS OF HORIZONTAL SPACE ARE GIVEN TO EACH GENUS.

- 1. Cuyo and Bazol.
- 2. Sakujok.
- 3. Siasi.
- 4. Fuga and Lapac.
- 5. Camiguin.
- 6. Cagayan Sulu.
- 7. Panaon.

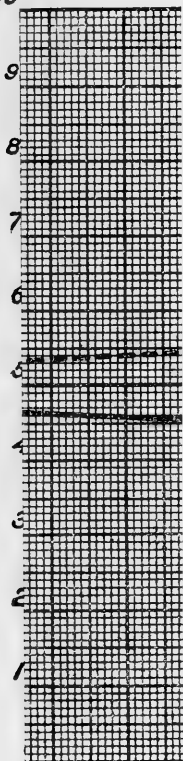
- 8. Bohol and Sibutu.
- 9. Catanduanes.
- 10. Romblon.
- 11. Dinagat.
- 12. Marinduque.
- 13. Siquijor.
- 14. Balabac.

- 15. Sibuyan (a) and Tablas (b).
- 16. Calamianes.
- 17. Masbate.
- 18. Tawi Tawi and Guimaras.
- 19. Panay.
- 20. Sulu.
- 21. Cebu.

- 22. Leyte.
- 23. Mindoro.
- 24. Palawan.
- 25. Negros.
- 26. Samar (a) and Basilan (b).
- 27. Luzon.
- 28. Mindanao.

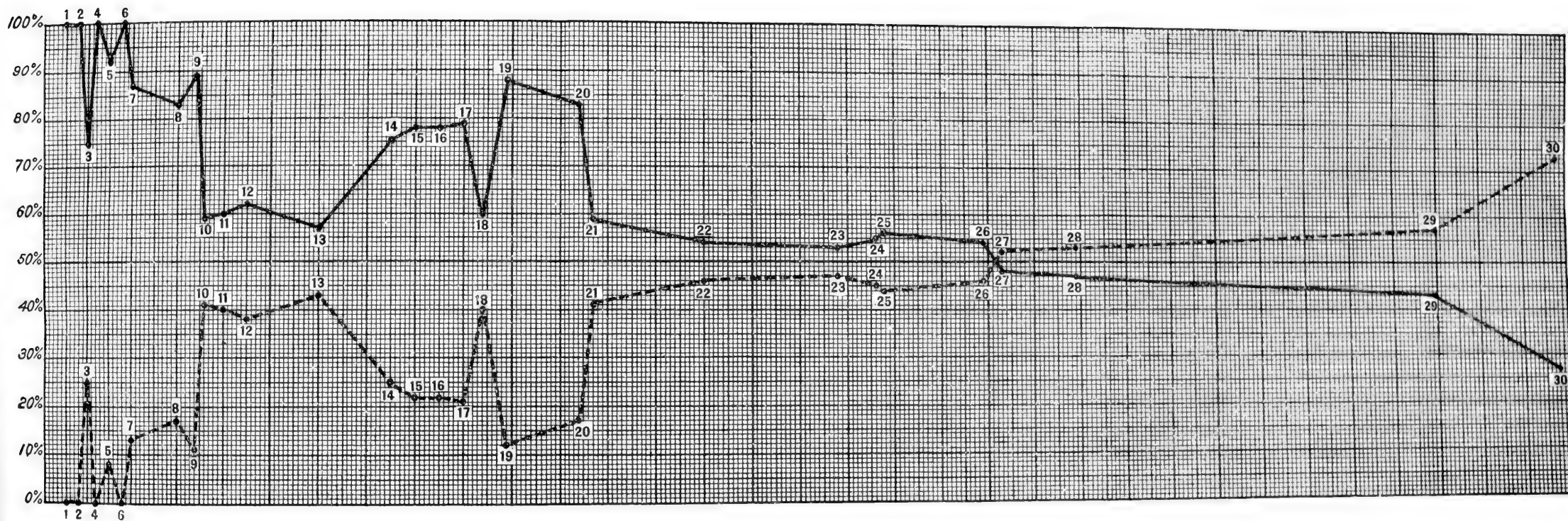


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ON THE BASIS O

- 21. Mas
- 22. Cebi
- 23. Neg
- 24. Ley
- 25. Min



CURVE IV.

DISTRIBUTION CHART SHOWING RELATIONSHIP BETWEEN SPECIES CONFIRMING STEERE'S LAW OF DISTRIBUTION AND THOSE AFFORDING EXCEPTIONS TO IT, WHEN COMPARED ON THE BASIS OF THE RELATIVE SIZE OF THE DIFFERENT ISLANDS.

- 1. Lapac.
- 2. Fuga.
- 3. Sibutu.
- 4. Cagayan Sulu.
- 5. Rombon.

- 6. Camiguin.
- 7. Panason.
- 8. Sibuyan.
- 9. Balabac.
- 10. Tawi Tawi.

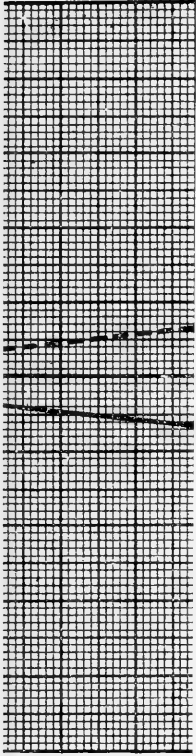
- 11. Siquijor.
- 12. Guimaras.
- 13. Sulu.
- 14. Dinagat.
- 15. Tablas.

- 16. Marinduque.
- 17. Calamianes.
- 18. Basilan.
- 19. Catanduanes.
- 20. Bohol.

- 21. Masbate.
- 22. Cebu.
- 23. Negros.
- 24. Leyte.
- 25. Mindoro.

- 26. Panay.
- 27. Samar.
- 28. Palawan.
- 29. Mindanao.
- 30. Luzon.

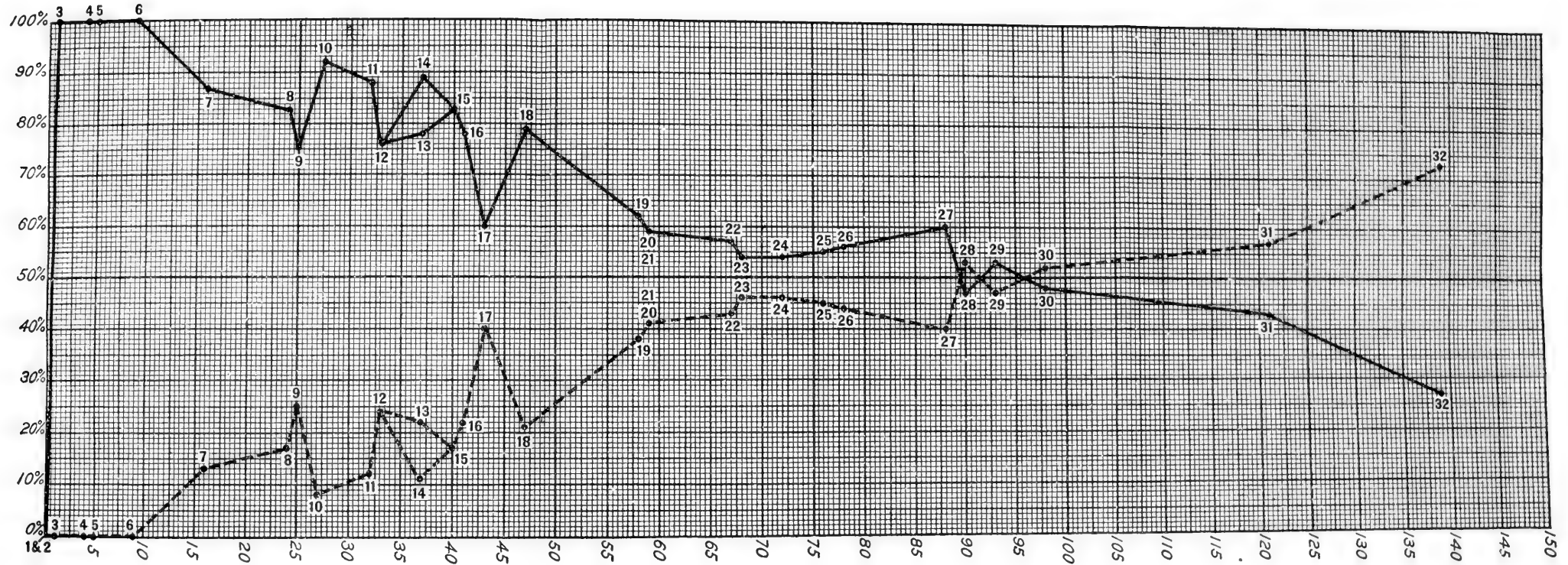




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CURVE V.

DISTRIBUTION CHART SHOWING RELATIONSHIP BETWEEN PERCENTAGE OF SPECIES DISTRIBUTED IN ACCORDANCE WITH, AND THOSE DISTRIBUTED IN OPPOSITION TO, STEERE'S LAW, AND NUMBER OF SPECIES OF NON-MIGRATORY LAND BIRDS KNOWN FROM EACH ISLAND. TWO UNITS OF HORIZONTAL SPACE ARE GIVEN TO EACH SPECIES.

- 1. Bazol.
- 2. Cuyo.
- 3. Sakujok.
- 4. Camiguin.
- 5. Fuga and Lapac.
- 6. Cagayan Sulu.
- 7. Panaon.
- 8. Bohol.

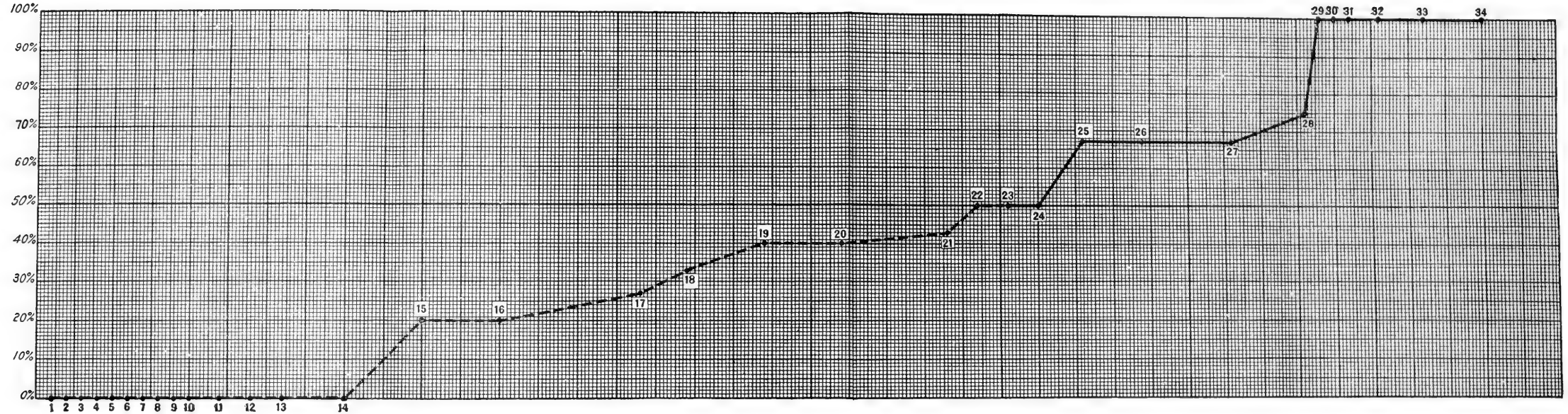
- 9. Sibutu.
- 10. Romblon.
- 11. Catanduanes.
- 12. Dinagat.
- 13. Marinduque.
- 14. Balabac.
- 15. Sibuyan.
- 16. Tablas.

- 17. Siquijor.
- 18. Calamianes.
- 19. Guimaras.
- 20. Masbate.
- 21. Tawi Tawi.
- 22. Sulu.
- 23. Panay.
- 24. Cebu.

- 25. Leyte.
- 26. Mindoro.
- 27. Basilan.
- 28. Palawan.
- 29. Negros.
- 30. Samar.
- 31. Mindanao.
- 32. Luzon.







CURVE VI.

DISTRIBUTION CHART SHOWING PERCENTAGE OF GENERA DISTRIBUTED ACCORDING TO STEERE'S LAW, IN EACH FAMILY OF PHILIPPINE LAND BIRDS. FOUR UNITS OF HORIZONTAL SPACE ARE GIVEN TO EACH GENUS OF A FAMILY.

- 1. Podargidae.
- 2. Meropidae.
- 3. Pringillidae.
- 4. Hirundinidae.
- 5. Oriolidae.

- 6. Paridae.
- 7. Pittidae.
- 8. Ploceidae.
- 9. Turnicidae.
- 10. Zosteropidae.

- 11. Caprimulgidae.
- 12. Diacridae.
- 13. Laniidae.
- 14. Trogonidae.
- 15. Sylviidae.

- 16. Nectariniidae.
- 17. Muscipapidae.
- 18. Bubonidae.
- 19. Alcedinidae.
- 20. Cuculidae.

- 21. Falconidae.
- 22. Certhiidae.
- 23. Peristeridae.
- 24. Cypselidae.
- 25. Campophagidae.

- 26. Timeliidae.
- 27. Pycnonotidae.
- 28. Psittacidae.
- 29. Corvidae.
- 30. Eurylemidae.

- 31. Capitonidae.
- 32. Dicaeidae.
- 33. Bucerotidae.
- 34. Picidae.



SUPPLEMENT TO THE ANNOTATED CATALOGUE OF THE
PUBLISHED WRITINGS OF CHARLES ABIATHAR WHITE,
1886-1897.

By TIMOTHY W. STANTON.

IN 1885 Mr. J. B. Marcou published in Bulletin 30 of the United States National Museum,¹ an "Annotated catalogue of the published writings of Charles Abiathar White," covering the period from 1860 to 1885, inclusive. The present list is a continuation of that catalogue, the entries being numbered consecutively through both lists, bringing Doctor White's personal bibliography down to the close of 1897. The first five entries were inadvertently omitted from the earlier catalogue, and are, therefore, not in their regular chronological order.

Charles A. White was born in North Dighton, Bristol County, Massachusetts, on January 26, 1826. In 1838 he removed with his father's family to Iowa, where he resided until 1873. For thirty-seven years his writings and his labors have related chiefly to scientific subjects, especially geology and paleontology, and during that time he has held many official positions and received many academic and professional honors.

He received the degree of M. D. from Rush Medical College, Chicago, in 1863 and the degree of A. M. in 1866 from Iowa State College. He was State geologist of Iowa, by legislative appointment, from 1866 to 1869, inclusive; professor of natural history in the Iowa State University from 1867 to 1873; professor of natural history in Bowdoin College from 1873 to 1875; paleontologist to the geographical and geological surveys west of the one hundredth meridian in charge of Lieutenant George M. Wheeler, in 1874; geologist and paleontologist to the United States Geological Survey of the Territories, in charge of Major J. W. Powell, in 1875; geologist and paleontologist to the United States Geological Survey of the Territories, in charge of Doctor F. V. Hayden, from 1876 to 1879; curator in charge of the paleontological collections of the United States National Museum from 1879 to 1882; detailed in 1881 to act as chief of the Artesian Wells Commission under the auspices of the United States Department of Agriculture; geologist and paleontologist to the United States Geological Survey from 1883 to 1892, and he now holds the relation to the Smithsonian Institution of associate in paleontology.

¹Pages 113-181.

He was president of the Washington Biological Society for the years 1883 and 1884; vice-president of the American Association for the Advancement of Science in 1889, and in the same year he was elected a member of the United States National Academy of Sciences. The degree of LL. D. was conferred upon him in 1893 by the Iowa State University, and in the same year he was elected to corresponding membership in the following foreign academies and scientific societies: The Geological Society of London; Isis Gesellschaft für Naturkunde, Dresden; R. Accademia Valdarnese del Poggio, Montevarchi; K. K. Geologische Reichsanstalt, Vienna, and in the Kaiserliche Leopoldinisch-Carolinische Deutsche Akademie der Naturforscher, Halle an der Saale.

152.

WHITE, C. A. The Permian Formation in North America. <Bull. Philos. Soc. Washington, vol. iii, pp. 104-105. Washington, 1880.

A brief review of those North American strata which had been recognized as of Permian age. It was inadvertently omitted from the preceding list.

153.

WHITE, C. A. Descripción de un gran Fossil Gasteropodo del estado de Puebla (México). <La Naturaleza, tomo vi, pp. 219-221, with two figures. City of Mexico, 1882.

This is a translation into Spanish and a republication, by Professor Mariano Barcena, of No. 89 of the preceding list, from which it was inadvertently omitted. The fossil described is *Tylostoma princeps* White.

154.

WHITE, C. A. [Administrative Report for the year 1883-84] <Fifth Annual Report of the Director of the U. S. Geological Survey, pp. 50-51. Washington, 1885.

Inadvertently omitted from the preceding list.

155.

WHITE, C. A. [Administrative Report for the year 1884-85] <Sixth Annual Report of the U. S. Geological Survey, pp. 42-44. Washington, 1885.

Inadvertently omitted from the preceding list.

156.

WHITE, C. A. Notes on the Mesozoic and Cenozoic paleontology of California. <Bulletin U. S. Geological Survey No. 15, pp. 1-33. Washington, 1885.

It is claimed that the Chico and Téton formations constitute a continuous series; that the Aucella-bearing Auriferous Slates are equivalent to the Knoxville division of the Shasta formation, and no species of Cretaceous fossils of the Pacific Coast region have been satisfactorily identified with any from either the interior or Atlantic Coast regions. It was inadvertently omitted from the preceding list.

157.

WHITE, C. A. On the Fresh Water Invertebrates of the North American Jurassic. Bulletin U. S. Geological Survey No. 29, pp. 1-41, pls. i-iv. Washington, 1886.

This bulletin contains a summary of all the known North American fresh water Jurassic invertebrates, and all are figured. They are:

	Page.
<i>T. felehi</i> , n. s.	16
<i>T. vridoides</i> , n. s.	17
<i>T. lapilloides</i> , n. s.	18
<i>T. macropisthus</i> , n. s.	17
<i>T. nucalis</i> Meek & Hayden	19

	Page.
<i>U. stewardi</i> White	19
<i>U. toxonotus</i> , n. s.	17
<i>Limnæa ativuncula</i> , n. s.	20
<i>L. consortis</i> , n. s.	20
<i>L. ? accelerata</i> , n. s.	20
<i>Planorbis veteris</i> M. & H. ?	21
<i>Vorticifex stearnsii</i> , n. s.	21
<i>Valvata scabrida</i> M. & H.	22
<i>Viviparus gilli</i> M. & H.	23
<i>Lioplacodes veteris</i> M. & H.	23
<i>Neritina nebrascensis</i> M. & H.	23
<i>Metacypriis forbesii</i> Jones	23

158.

WHITE, C. A. On the Relation of the Laramie Molluscan Fauna to that of the succeeding fresh-water Eocene, and other groups. < Bulletin of the U. S. Geological Survey, No. 34 (Vol. v), pp. 1-54 (388-442), pls. i-v. Washington, 1886.

The opinion is advanced that sedimentation was at no time wholly interrupted from the beginning of the deposition of the Colorado formation to the close of that of fresh-water Eocene formations of the interior region of North America. Five plates of figures of fossils are given, some of which are shown to have ranged from the Laramie into the fresh-water formations which overlie it. The following species are described and figured:

MOLLUSCA.

	Page.
<i>Unio mendax</i> White	20
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159.

WHITE, C. A. On New Generic Forms of Cretaceous Mollusca and their relation to other forms. < Proc. Acad. Nat. Sci. Phila. for 1887, pp. 32-37, and one plate. Philadelphia, 1887.

The genera Dalliconcha, Stearnsia, and Aguilera are proposed and type specimens of each are figured.

Same. Seventy extras printed without title-page, covers, or repaging.

160.

WHITE, C. A. On the Cretaceous Formations of Texas and their relations to those of other portions of North America. <Proc. Acad. Nat. Sci. Phila. for 1887, pp. 39-47. Philadelphia, 1887.

The order of superposition of the Cretaceous formations of Texas is given.

Same. Seventy extras printed without title-page, covers, or repaging.

161.

WHITE, C. A. On the age of the Coal found in the Region traversed by the Rio Grande. <American Journal of Science, 3d ser., vol. xxxiii, pp. 18-20. New Haven, 1887.

The coal is stated to be of Upper Cretaceous age, a part of which is in the Laramie formation.

Same. Twenty separates printed without title-page, covers, or repaging.

162.

WHITE, C. A. Remarks on the "Revision of the Palaeocrinoidea" of Wachsmuth and Springer. <American Journal of Science, 3d ser., vol. xxxiii, pp. 154-157. New Haven, 1887.

This article is a review of the publication named, and a summary of the views entertained by the authors.

Same. Seventy-five extras printed without covers, title-page, or repaging.

163.

WHITE, C. A. On the Inter-relation of Contemporaneous Fossil Faunas and Floras. <American Journal of Science, 3d ser., vol. xxxiii, pp. 364-374. New Haven, 1887.

The relative differences of time range of different species, genera, and families of animals and plants are pointed out, and special attention is called to the fact that it is seldom possible to determine the contemporaneity of non-marine with marine formations.

Same. Thirty extras printed with half-title, but without covers or repaging.

164.

WHITE, C. A. [Review of.] The summit plates in Blastoids, Crinoids, and Cystids, and their morphological relations; by Charles Wachsmuth and Frank Springer. <American Journal of Science, 3d ser., vol. xxxiv, p. 232. New Haven, 1887.

165.

WHITE, C. A. [Review of.] Charles D. Walcott: Second Contribution to the Studies on the Cambrian faunas of North America (Bulletin No. 30, U. S. Geological Survey, p. 225, 33 plates of wood cuts. Washington, 1886). <Neues Jahrbuch für Min., Geol. und Paläont. Jahrgang, 1887, II. Band, pp. 361-363. Stuttgart, 1887.

166.

WHITE, C. A. Contribuições á Paleontologia do Brazil (Com o original em Inglês), Por Charles A. White, M. D. Archivos do Museu Nacional do Rio de Janeiro, volume vii, pp. 1-273, pls. 1-27, 4°. Imprensa Nacional, Rio de Janeiro, 1887.

This work is devoted entirely to invertebrate fossils, all of which are referred to the Cretaceous. The following is a list of the species described and figured.

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(Marine species.)

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<i>C. dilabida</i> , n. s.	77
<i>Astarte agravia</i> , n. s.	77
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<i>I. coutinhoana</i> , n. s.	83
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<i>C. spiculatum</i> , n. s.	157
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<i>Ringinella pinguiscula</i> , n. s.	200
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<i>Pleurocera terebriformis</i> Morris.	236
<i>Melania nicolayana</i> Hartt.	238
<i>Neritina prolabiata</i> , n. s.	239
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<i>A. planulatus</i> Sow?	218
<i>A. offarcinatus</i> , n. s.	219
<i>A. folleatus</i> , n. s.	220
<i>A. sergipensis</i> , n. s.	221
<i>A. buarquianus</i> , n. s.	222
<i>A. maroimensis</i> , n. s.	224
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<i>A. (Buchiceras) hartii</i> Hyatt	226
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<i>Salenia sergipensis</i> , n. s.	252
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<i>Echinobrissus freitasii</i> , n. s.	259
<i>Catopygus æqualis</i> , n. s.	260
<i>Hemiasiter cristatus</i> Stoliczka	261
<i>Toxaster ulliusculus</i> , n. s.	262

167.

WHITE, C. A. Contributions to the Paleontology of Brazil.

This edition is identical with that of entry 166, except that it is furnished with an English title-page. No change is made in either the pagination or the numbering of the plates. Three hundred and fifty copies of this edition were issued from the Smithsonian Institution, Washington, 1888.

168.

WHITE, C. A. On the Occurrence of Later Cretaceous deposits in Iowa. <American Geologist, vol. i, pp. 221-227, one wood cut. Minneapolis, 1888.

The announcement is made of new discoveries of Cretaceous deposits in Iowa by Professor E. Haworth. *Lispodesthes? haworthi*, n. s., is described and figured.

Same. Thirty copies printed separately without title-page, covers, or repaging.

169.

WHITE, C. A. On *Hindeastræa*, a new generic form of Cretaceous *Astracæidæ*. <Geological Magazine, Dec. III, vol. v, No. 8, pp. 362, 363. London, 1888.

Hindeastræa discoidea is described and figured.

Same. Thirty separates printed with repaging, but without title-page or covers.

170.

WHITE, C. A. On the Relation of the Laramie Group to earlier and later formations. <Am. Jour. Sci., 3d ser., vol. xxxv, pp. 432-438. New Haven, 1888.

The relation of the Laramie to the Belly River series of Canada and to the Lignitic of the Gulf States is especially discussed.

Same. Twenty copies printed without title-page, covers, or repaging.

171.

WHITE, C. A. On the Puget Group of Washington Territory. <Amer. Jour. Sci., 3d ser., vol. xxxvi, pp. 143-150. New Haven, 1888.

The Puget Group is a nonmarine formation found in the State of Washington, and lies upon the confines of the Cretaceous and Tertiary. Its fauna is described and figured in entry 181.

Same. Twenty separates printed without title-page, covers, or repaging.

172.

WHITE, C. A. Mountain Upthrusts. <American Naturalist, vol. xxi, pp. 399-408. Philadelphia, 1888.

The character of the displacements which resulted in the production of Yampa and Junction mountains in Colorado, as well as those of some other mountains, is explained. The subject is more fully discussed in entry 177.

Same. Fifty copies printed separately without title-page, covers, or repaging.

173.

WHITE, C. A. A Probable Case of Instinct at Fault in Bees. <American Naturalist, vol. xxi, pp. 1029-1030. Philadelphia, 1888.

This case is one of extinction of bee swarms, evidently caused by the filling of all the cells with easily obtained honey, so that there were no empty cells in which the queen might deposit her eggs.

Same. Thirty copies printed separately without title-page, covers, or repaging.

174.

WHITE, C. A. Remarks on the Genus *Aucella*, with especial reference to its occurrence in California. <Monographs of the U. S. Geological Survey, vol. xiii; Geology of the Quicksilver Deposits of the Pacific Slope, pp. 226-232, and pls. iii and iv. Washington, 1888.

The figures, 41 in number, include copies of many of the forms of *Aucella* which have been published from various parts of the world.

Same. Fifty separates printed without title-page, covers, or repaging.

175.

WHITE, C. A. [Administrative Report for the year 1885-86.] <Seventh Annual Report of the U. S. Geological Survey, pp. 117-120. Washington, 1888.

176.

WHITE, C. A. On Certain Mesozoic Fossils from the Islands of St. Pauls and St. Peters in the Straits of Magellan. <Proc. U. S. National Museum, vol. xiii, pp. 13, 14, pls. 2 and 3. Washington, 1889.

Two species are described and figured—*Hamites elatior* Forbes? and *Lucina? townsendi*, n. s.

Same. Fifty copies printed separately with paper covers and title-page, but without repaging.

177.

WHITE, C. A. On the Geology and Physiography of a portion of Northwestern Colorado and adjacent parts of Utah and Wyoming. <Ninth Annual Report of the U. S. Geological Survey, pp. 677-712 and map. Washington, 1889.

This memoir covers substantially the same ground as that of entry No. 64, but the discussions are much extended and the subject more fully illustrated. The illustrations of the former report are corrected wherein they were erroneous.

Same. One hundred copies printed separately, with paper covers and title-page, but without repaging.

178.

WHITE, C. A. New Fossil Mollusca from the Chico-Téjon series of California. <Bulletin U. S. Geological Survey No. 51. On Invertebrate Fossils from the Pacific Coast, pp. 11-27, pls. i-v. Washington, 1889.

The following species are described and figured:

	Page.
<i>Ostrea (Alectryonia) dilleri</i> , n. s.	14
<i>Zirphæa plana</i> , n. s.	15
<i>Actæon inornatus</i> , n. s.	15
<i>Vasculum</i> , gen. nov.	16
<i>V. obliquum</i> , n. s.	16
<i>Lysis oppansus</i> , n. s.	17
<i>Trochus (Anadema) gemiferus</i> , n. s.	17
<i>Stomatia obstricta</i> , n. s.	18
<i>Gyrodès dowelli</i> , n. s.	19
<i>Rinella macilenta</i> , n. s.	19
<i>Mesalia obtusa</i> , n. s.	20
<i>Faunus marcidulus</i> , n. s.	20
<i>Ceratia nexilia</i> , n. s.	21
<i>Trophon condoni</i> , n. s.	21
<i>Cominella lecontei</i> , n. s.	22
<i>Fulgur hùlgardi</i> , n. s.	22
<i>Fulguraria gabbi</i> , n. s.	23
<i>Cancellaria turneri</i> , n. s.	25
<i>Scobinella dilleri</i> , n. s.	25
<i>Ammonites turneri</i> , n. s.	26

179.

WHITE, C. A. On Occurrence of Equivalents of the Chico-Téjon Series in Oregon and Washington Territory. <Bulletin U. S. Geological Survey No. 51. On Invertebrate Fossils from the Pacific Coast, pp. 28-32. Washington, 1889.

This brief article is devoted to notes concerning the northward extension of the Chico-Téjon series.

180.

WHITE, C. A. Cretaceous Fossils from Vancouver Island Region. <Bulletin U. S. Geological Survey No. 51. On Invertebrate Fossils from the Pacific Coast, pp. 33-48, pls. vi, vii. Washington, 1888.

This article of the bulletin contains an annotated list of 33 species collected by Professor J. S. Newberry upon Vancouver, and some of the smaller contiguous islands. The following species are described and figured:

	Page.
<i>Perna excavata</i> , n. s.	37
<i>Crassatella tuscana</i> Gabb	38
<i>Clisocolus dubius</i> Gabb	41
<i>C. cordatus</i> Whiteaves	41
<i>Anatina sulcatina</i> Shumard?	43
<i>Vanikoropsis suciensis</i> , n. s.	76
<i>Ammonites maclurei</i> , n. s.	48

181.

WHITE, C. A. The Molluscan Fauna of the Puget Group. <Bulletin U. S. Geological Survey No. 51. On Invertebrate Fossils from the Pacific Coast, pp. 49-63; pls. 8 and 9. Washington, 1889.

The Puget Group is a lately recognized non-marine, coal-bearing formation lying mainly upon the eastern side of Puget Basin in the State of Washington. The following species found in its strata are described and figured:

	Page.
<i>Cardium</i> (<i>Adacna</i> ?) — ?	58
<i>Cyrena brevidens</i> , n. s.	58
<i>Corbicula willisi</i> , n. s.	59
<i>C. pugetensis</i> , n. s.	60
<i>Batissa newberryi</i> , n. s.	60
<i>B. dobia</i> , n. s.	61
<i>Psammobia obscura</i> , n. s.	61
<i>Sanguinolaria</i> ? <i>caudata</i> , n. s.	61
<i>Teredo pugetensis</i> , n. s.	62
<i>Neritina</i> — ?	62
<i>Cerithium</i> — ?	62
Undetermined gastropod	62

182.

WHITE, C. A. Mesozoic Mollusca from the southern coast of the Alaskan Peninsula. <Bulletin U. S. Geological Survey No. 51. On Invertebrate Fossils from the Pacific Coast, pp. 64-70; pls. 12-14. Washington, 1889.

The collection upon which this article is based was sent to the office of the Survey from the western end of Kadiak Island. The following species are described and figured:

	Page.
<i>Cucullea increbescens</i> , n. s.	65
<i>Glycimeris dalli</i> , n. s.	66
<i>Belemnites</i> — ?	67
<i>B.</i> — ?	67
<i>Ammonites</i> (<i>Lillia</i>) <i>howelli</i> , n. s.	68
<i>A. (L.) kialagvikensis</i> , n. s.	69
<i>A. (Amaltheus) whitcavesii</i> , n. s.	69

183.

WHITE, C. A. The North American Mesozoic. Address as vice-president of Section E, of the American Association for the Advancement of Science, at Toronto, August, 1889. <Proc. A. A. S., vol. xxxviii, pp. 205-226. Salem, 1889.

The author gives a general review of the North American Mesozoic formations and shows their relation to one another. He is of the opinion that its subdivisions can not be closely correlated with those of the European Mesozoic.

Same. Two hundred copies in paper covers, with title-page and repagination.

Same. Published in full in *Science*, New York, vol. xiv, pp. 160-166.

184.

WHITE, C. A. Remarks on the Cretaceous of Northern Mexico. <Proc. Amer. Ass. Adv. Sci., vol. xxxviii, p. 252 (Abstract). Salem, 1889.

The subject of these remarks is more fully discussed in entry 186.

185.

WHITE, C. A. On the Permian Formation of Texas. <American Naturalist, vol. xxiii, pp. 109-128; pl. 1. Philadelphia, 1889.

The character and limitation of the Texan Permian are discussed and the three following species are described and figured as new:

	Page.
<i>Ptychites cumminsi</i> , n. s.	117
<i>Medlicottia copei</i> , n. s.	117
<i>Popanoceras walcottii</i> , n. s.	117

The subject is more fully discussed in entry No. 190.

Same. Fifty extra copies printed, without covers, title-page, or repagination.

186.

WHITE, C. A. The Lower Cretaceous of the Southwest, and its relation to underlying and overlying formations. <Ann. Jour. Science, 3d ser., vol. xxxviii, December, 1889, pp. 440-445. New Haven, 1889.

The Comanche series is mainly discussed in this article. Its extension into Western Texas and Northern Mexico is shown; and it is also shown that its thickness there is much greater than it was before known to possess.

Same. Twenty-two copies printed separately, with half-title, but without covers or repagination.

187.

WHITE, C. A. [Administrative] Report—Division of Mesozoic Paleontology. <Eighth Annual Report of the U. S. Geological Survey, pp. 178-181. Washington, 1889.

188.

WHITE, C. A. [Administrative] Report—Division of Mesozoic Invertebrates. <Ninth Annual Report of the U. S. Geological Survey, pp. 120-123. Washington, 1889.

189.

WHITE, C. A. A sketch of the scientific work of Professor A. H. Worthen [including bibliography] Geol. Surv. Illinois, vol. viii, Appendix, pp. 18-37. Springfield, 1890.

The bibliographical part of this sketch is republished, with some corrections, in entry No. 198.

190.

WHITE, C. A. [Remarks on Notes on the Early Cretaceous of California and Oregon, by George F. Becker.] Bull. Geol. Soc. America, vol. ii, p. 208, Rochester, 1891.

In these remarks Doctor White made reference to the coupling of types upon the confines of systems similar to those which he made with reference to entry No. 192.

191.

WHITE, C. A. Correlation Papers, Cretaceous: A Review of the Cretaceous formations of North America. <Bulletin U. S. Geological Survey No. 82, p. 273. Washington, 1891.

This memoir is a discussion of all the known Cretaceous formations of North America, and an exhibition of their stratigraphical relations to one another according to the views of the author.

192.

WHITE, C. A. The Texan Permian and its Mesozoic types of Fossils. <Bulletin U. S. Geological Survey No. 77, p. 51, pls. i-iv. Washington, 1891.

This bulletin embraces a much enlarged discussion of the subject of entry No. 185, and contains illustrations of all the invertebrate species which had, up to the time of its publication, been discovered in the Texan Permian. The following species are figured, and in part described:

	Page.
<i>Goniatites baylorensis</i> , n. s.	19
<i>Waagenoceras cumminsi</i> White	20
<i>Medlicottia copei</i> W	21
<i>Papanoceras walcotti</i> W	21
<i>Orthoceras rushensis</i> McChesney	22
<i>Nautilus winslowi</i> Meek & Worthen	23
<i>N. occidentalis</i> Swallow	23
<i>N. —?</i>	23
<i>N. —?</i>	24
<i>N. —?</i>	24
<i>N. (Endolobus) —?</i>	24

	Page.
<i>Naticopsis remex</i> W.....	24
<i>N. shumardii</i> Mc. C?.....	24
<i>Euomphalus subquadratus</i> M. & W.....	25
<i>E. —?</i>	25
<i>Murchisonia —?</i>	25
<i>Patella —?</i>	25
<i>Bellerophon crassus</i> M. & W.....	26
<i>B. montfortianus</i> Norwood & Pratten.....	26
<i>B. —?</i>	26
<i>Sedgwickia topekaensis</i> Shumard.....	26
<i>Pleurophorus —?</i>	27
<i>Clidophorus occidentalis</i> Geinitz.....	27
<i>Yoldia? subscitula</i> Meek & Hayden.....	27
<i>Myalina permiana</i> Swallow.....	28
<i>M. aviculoides</i> M. & H.....	28
<i>M. perattenuata</i> M. & H.....	28
<i>Gervillia longa</i> Geinitz.....	29
<i>Aviculopecten occidentalis</i> Shum.....	29
<i>Syringopora —?</i>	29
<i>Spirorbis —?</i>	30
<i>Cythere nebrascensis</i> Geinitz.....	30

193.

WHITE, C. A. On the biological and geological significance of closely similar fossil forms. <Proc. Amer. Assn. Adv. Sci., vol. xxxix, pp. 239-243. Salem, 1891.

The author thinks that for geological purposes it is often advisable to give separate names to fossil species, even though it should be impracticable to diagnose them as specifically different from forms which are members of other and different faunas.

Same. One hundred extras printed without covers and without repaging.

194.

WHITE, C. A. [Remarks upon On the Permian, Triassic, and Jurassic formations in the East Indian Archipelago (Timor and Rotti), by Doctor August Rothpletz.] Bull. Geol. Soc. Amer., vol. iii, p. 14. Rochester, 1891.

Doctor White spoke of this as one of several cases now known of the commingling of faunal types upon the confines of the Mesozoic and Paleozoic systems, and as indicating a condition which we always ought to expect.

195.

WHITE, C. A. [Remarks on A Geological Map of South America, by Professor Doctor Gustav Steinmann.] <Bull. Geol. Soc. Amer., vol. iii, p. 14. Rochester, 1891.

Doctor White referred especially to the Cretaceous fauna which he had published for the National Museum of Brazil. He said that he found that fauna to have much more affinity with the Cretaceous fauna of Southern India than with that of any portion of the North American Cretaceous.

196.

WHITE, C. A. [Remarks on The Comanche Series of the Texas-Arkansas Region, by Robert T. Hill.] Bull. Geol. Soc. Amer., vol. ii, pp. 525, 526. Rochester, 1891.

Doctor White agreed with the speaker as to the great difficulty of correlating American with European series of strata, and mentioned cases of such attempted correlation in which the true stratigraphical order was reversed.

197.

WHITE, C. A. [Remarks on Variations in the Cretaceous and Tertiary Strata of Alabama, by Daniel W. Langdon.] Bull. Geol. Soc. Amer., vol. iii, p. 606. Rochester, 1891.

Doctor White mentioned the difficulty of determining the limitations of the different recognized divisions of the Cretaceous of the Gulf States, either paleontologically or lithologically.

198.

WHITE, C. A. On the Bear River formation, a series of strata hitherto known as the Bear River Laramie. <Am. Jour. Sci., 3d ser., vol. xliii, pp. 91-97. New Haven, 1892.

This article gives a historical account of what has been published concerning the formation in question, and it is a companion article to one written by Mr. T. W. Stanton showing the true stratigraphic position of the formation.

Same. Two hundred extras, with paper covers and half-title, but without repaging.

199.

WHITE, C. A. Memoir of Amos Henry Worthen. <Biographical Memoirs of the National Academy of Sciences, vol. iii, pp. 339-362. Washington, 1893.

This memoir contains the bibliography of Mr. Worthen's writings which is contained by entry No. 187, but with slight corrections.

Same. One hundred extra copies printed with paper covers and title-page.

200.

WHITE, C. A. Memoir of Ferdinand Vandiveer Hayden. <Biographical Memoirs of the National Academy of Sciences, vol. iii, pp. 395-414. Washington, 1893.

Same. One hundred extra copies printed with paper covers, title page, and portrait.

201.

WHITE, C. A. The Relation of the Sounds of Fog Signals to other Sounds. <Science, vol. xxiii, pp. 56-62. New York, 1894.

Two kinds of areas of inaudibility of fog signals are differentiated under the names of montumbral and pseudumbral, and each is characterized. The author believes that other sounds than those of the neighboring fog signal may be projected from various directions into any of those areas of inaudibility of the sounds of the signal, and that echoes of the latter may also be projected into any of those areas. Possible danger to shipping in the latter cases is pointed out.

202.

WHITE, C. A. The Relation of Biology to Geological Investigation. A series of essays discussing the nature and scientific uses of fossil remains and the necessity for their systematic collection and permanent conservation in public museums. <Annual Report U. S. National Museum for 1892, pp. 245-368. Washington, 1894.

The special object of these essays is the defense of biology as an indispensable element of geological investigation.

Same. Five hundred extras printed with paper covers and title-page, but without repagination.

203.

WHITE, C. A. Notes on the Invertebrate Fauna of the Dakota Formation with descriptions of new molluscan forms. <Proc. U. S. Nat. Museum, vol. xvii, pp. 131-138 and pl. viii. Washington, 1894.

This article announces the discovery in Jefferson County, Nebraska, by Professor L. E. Hicks, of a fresh-water fauna in strata of the Dakota formation. The following species are described and figured.

	Page.
<i>Unio barbouri</i> , n. s.	133
<i>U.</i> —?	133
<i>Corbula hicksii</i> , n. s.	134
<i>Gonitobasis jersonensis</i> , n. s.	134
<i>G.</i> —?	135
<i>Viviparus hicksii</i> , n. s.	135
<i>Pargulifera meckii</i> , n. s.	135

204.

WHITE, C. A. Sobre la relación de los sonidos de las señales de niebla con otros sonidos; por Carlos A. White. <Revista General de Marina; tomo xxxv, pp. 17-25. Madrid, Julio, 1894.

This article is a Spanish translation of that which is entered under No. 201.

205.

WHITE, C. A. La manera de obar del aceite para suavizar las olas en la mar; por el Doctor Charles A. White. <Revista General de Marina; tomo xxxvi, pp. 174-177. Madrid, Febrero, 1895.

Some experiments are described, showing the effect of oil upon wind-moved water.

206.

WHITE, C. A. The Bear River Formation and its Characteristic Fauna. <Bulletin U. S. Geological Survey No. 128. Washington, Govt. Printing Office, 1895.

The whole subject of the Bear River Formation is reviewed, and the following species are described and figured:

	Page.
<i>Ostrea haydeni</i> , n. s.	32
<i>Modiola pealei</i> , n. s.	33
<i>Unio belliplicatus</i> Meek	34
<i>U. vetustus</i> M.	35
<i>Corbicula durkei</i> M.	36
<i>Corbula pyriformis</i> M.	38
<i>C. engelmanni</i> M.	40
<i>Corbulomya tauschii</i> , n. s.	40
<i>Auricula neumayri</i> , n. s.	41
<i>Melampus clarkii</i> , n. s.	42
<i>Rhytophorus priscus</i> M.	43
<i>R. meekii</i> White.	43
<i>Tortacella</i> , gen. nov.	44
<i>Tortacella haldemani</i> White.	44
<i>Linnaea nitidula</i> M.	45
<i>Planorbis praeursoris</i> , n. s.	46
<i>Physa usitata</i> , n. s.	47
<i>Helix</i> — ?	48
<i>Tornatellina? isocline</i> , n. s.	48
<i>Neritina naticiformis</i> W.	49
<i>N. stantoni</i> , n. s.	49
<i>Pachymelania</i> , gen. nov.	50
<i>P. cleburni</i> W.	51
<i>P. chrysalis</i> M.	51
<i>P. chrysalloidea</i> W.	52
<i>P. turricula</i> , n. s.	53
<i>P. ? macilenta</i> W.	54
<i>Pyrgulifera humerosa</i> M.	55
<i>P. stantoni</i> , n. s.	57
<i>Hydrobia occulta</i> , n. s.	57
<i>Bythinella latentis</i> , n. s.	58
<i>Charydrobia stachei</i> , n. s.	58
<i>Viviparus coesii</i> W.	59
<i>Campeloma macrospira</i> M.	60
<i>Lioplax? endlichi</i> W.	60
<i>Membranipora? — — ?</i>	61
<i>Chara stantoni</i> Knowlton	63

207.

WHITE, C. A. How a Mocking-bird Mocked Me. <Forest and Stream, vol. xlv, No. 14, p. 263. New York, April 6, 1895.

The mimicking of the note of a duck by a *Mimus polyglottus*, temporarily led the author to believe that he was really in the vicinity of water, while making a "dry camp."

Proc. N. M. vol. xx—41

208.

WHITE, C. A. Memoir of George Engelmann. <Biographical Memoirs of the National Academy of Sciences, vol. iv, pp. 1-21. Washington, 1896.

Same. Five hundred extra copies printed with paper covers, title-page, and portrait.

209.

WHITE, C. A. Biographical Sketch of Fielding Bradford Meek. <American Geologist, vol. xviii, pp. 337-350, with portrait. Minneapolis, 1896.

This sketch contains a full list of the published writings of Mr. Meek.

Same. Twenty-five extra copies printed with paper covers and half title-page.

210.

WHITE, C. A. Memoir of Fielding Bradford Meek. <Biographical Memoirs of the National Academy of Sciences, vol. iv, pp. 75-91.

This memoir contains a full list of the published writings of Mr. Meek.

Same. Twenty-five copies printed separately with paper covers and title-page.

211.

WHITE, C. A. The Relation of Sex to Mentality. <Medical Record, vol. lii, No. 19, pp. 661, 662. November 6, 1897, New York. Wm. Wood & Co.

The author shows the relation of sex to certain phases of mentality and discusses the probable effect of ovariectomy upon those phases.

OBSERVATIONS ON THE ASTACIDÆ IN THE UNITED STATES NATIONAL MUSEUM AND IN THE MUSEUM OF COMPARATIVE ZOOLOGY, WITH DESCRIPTIONS OF NEW SPECIES.

By WALTER FAXON,

*Assistant in charge of Mollusca and Crustacea, Museum of Comparative Zoology,
Cambridge, Massachusetts.*

SINCE the publication of my "Notes on North American Crayfishes" in 1890, a good deal of material has accumulated in the United States National Museum and in the Museum of Comparative Zoology. The first part of the present article embodies the results of an examination of this material.¹

The second part relates to the crayfishes of the Southern Hemisphere—the *Parastacinae*. After the publication of Part I of my "Revision of the Astacidae," which treated of the Northern Hemisphere genera, *Cambarus* and *Astacus*, I hoped to get together a collection of the Parastacine crayfishes that would enable me to issue the second part of the revision in a shape similar to the first part. Disappointed in this hope, I have decided to include in this paper such results as I could obtain from a study of the *Parastacinae* in the two museums above named. Thanks to Mr. Charles C. Chilton, of Christchurch, New Zealand, my series of New Zealand crayfishes is ample, but lack of adequate material from Australia, Tasmania, and South America precludes a satisfactory revision of the *Parastacinae* as a whole.

Six new species and three new subspecies of *Cambarus* are described and figured in this paper. Of these, five belong to the United States, four to Mexico. Five new species of *Parastacus* are also described and figured—two from Uruguay, two from Chile, and one ostensibly from Mexico.

¹Anyone who undertakes the perplexing study of the North American crayfishes should have at hand the following works: 1. Monograph of the North American Astacidae. By Hermann A. Hagen. Ill. Cat. Mus. Comp. Zool., No. 3 [Mem. Mus. Comp. Zool., II, No. 1], 1871. 2. A Revision of the Astacidae. Part I. The Genera *Cambarus* and *Astacus*. By Walter Faxon. Mem. Mus. Comp. Zool., X, No. 4, 1885. 3. Notes on North American Crayfishes—Family Astacidae. By Walter Faxon. Proc. U. S. Nat. Mus., XII, pp. 619-634, 1890. 4. The present article. In these works all the North American crayfishes are described and many of them figured.

Family ASTACIDÆ.

Subfamily ASTACINÆ.¹

Genus CAMBARUS Erichson.

Cambarus ERICHSON, Arch. f. Naturgesch., 12ter Jahrg., I, p. 88, 1846.

Type, *Astacus bartonii* Fabricius.

GROUP I. (Type, *Astacus blandingii* Harlan.)

Third segment of third and fourth pairs of legs of male hooked. Outer part of first pair of abdominal appendages of male truncate at the tip and furnished with one to three small recurved teeth; inner part ending in a short acute spine, which is commonly directed outward.

CAMBARUS BLANDINGII ACUTUS (Girard).

Specimens of this Southern and Western form of *C. blandingii* have been received through Professor S. E. Meek from Kainister and Good Land, Indian Territory, Mammoth Spring, Batesville, and Camden, Arkansas, and Arthur (Red River), Texas. There are specimens in the United States National Museum from Corpus Christi, Texas, and from Portage River, at Oak Harbor, Ohio. Mr. W. P. Hay² has recorded this form from the following new localities in Indiana: Turkey Lake, Kosciusko County; Lake Maxinkuckee, Marshall County; Kankakee River, Lake County; Terre Haute, Vigo County.

Specimens procured by Professor Meek at McAlister, Indian Territory, are peculiar. The rostrum is narrower, more deeply excavated, with more convergent sides than in typical specimens of *C. b. acutus*. The rostral acumen, too, is longer, surpassing the antennular peduncle, the lateral spines more prominent. The rostrum approaches the form seen in the Eastern *C. blandingii*, or even more nearly that of the typical *C. clarkii* from Texas.

CAMBARUS FALLAX Hagen.

Eustis, Lake County, Florida (Coll. U.S.N.M.); Gainesville, Alachua County, Florida (Coll. Mus. Comp. Zool.).

CAMBARUS CLARKII Girard.

There is a fine series of specimens in the United States National Museum, collected in Las Moras Creek, Kinney County, Texas, by F. A. Clark and E. A. Mearns, in 1893. As in the specimens collected by Edward Palmer at San Antonio, Texas, and described on page 26 of my "Revision of the Astacidae," the areola, although very narrow, is

¹ Same as Family *Potamobiidae* Huxley = Subfamily *Potamobiinae* Faxon. *Potamobius* being a synonym of *Astacus* (see p. 662), the subfamily name should be *Astacinae*.

² The Crawfishes of the State of Indiana. By W. P. Hay. 20th Ann. Rep. Dept. of Geology and Natural Resources of Indiana, pp. 475-507, 1896.

not obliterated and the sides of the rostrum are less strongly convergent. This is without doubt to be considered the typical form of *C. clarkii*, since Girard's specimens were collected in the same region, somewhere between San Antonio and El Paso del Norte.

CAMBARUS ACHERONTIS Lönnberg.

(Plate LXII, figs. 1-5.)

Cambarus acherontis LÖNNBERG, Zoolog. Anz., XVII, pp. 125-127, 1894; Bihang till K. Svenska Vet.-Akad. Handlingar, XX, Pt. 4, p. 6., figs. 1-6, 1894.

Female.—Rostrum broad, excavated, superior lateral margins raised into sharp carinæ which overhang the inferior lateral margins and continue backward inside of and parallel with the postorbital ridges; a pair of sharp projecting angles or teeth near the tip at base of the acumen; acumen short, acute. Rostrum, gastric region, and areola smooth and polished; sides of carapace thickly studded with small papillæ or tubercles; postorbital ridges furnished with a small spine at the anterior end; areola almost obliterated in the middle by the apposition of the branchio cardiac lines; posterior section of carapace equal in length to the distance between the cervical groove and the anterior spines of the postorbital ridges.

Abdomen a little longer than the cephalo-thorax, smooth; telson three or two spined on each side of the anterior segment, posterior segment subtruncate.

Antennæ very long, much longer than the body; a small external spine behind the base of the antennal scale; antennal scale very broad, broadest at the middle, apical end rounded and armed with a small external spine. Epistome short, broad, anterior border convex.

Chelipeds slender; merus furnished with the customary biserial spines below, superior margin spinulose, outer and inner faces sparsely granulated; carpus with a longitudinal furrow above, tuberculiferous, the tubercles tending to assume the form of short spines on the inner side; chelæ subcylindrical, granulated, the granules on the inner or upper margin of the hand taking on the form of blunt spines; fingers long, slender, inner and outer sides costate, upper margin of the dactylus tuberculate, cutting edges of fingers irregularly denticulate on the proximal half.

Length 75 mm.; carapace 39 mm.; from tip of rostrum to cervical groove 23.5 mm.; from cervical groove to posterior border of carapace 16 mm.; length of rostrum from tip to anterior spines of postorbital ridges 9 mm.; width of rostrum 4.5 mm.

Annulus ventralis transverse, with a prominent posterior tubercle and a crescentic anterior fossa.

In a young male of the second form, 43 mm. in length, the third pair of legs are furnished with a blunt hook on the third segment, while the corresponding segment of the fourth pair bears a small tubercle, the vestige of the hook of the adult. The first abdominal appendages

are truncate at the tip, the outer part terminating in two small recurved teeth, the inner part in a slender spine which is directed outward.

Gum Cave, Citrus County, Florida (Coll. U.S. N.M.). Two females, twelve young (male, Form II; female).

Lönnerberg's types of *Cambarus acherontis*, two males, 50 and 55 mm. long, were procured in sinking a well, from a subterranean rivulet about forty-two feet from the surface, in Orange County, Florida. According to Lönnerberg's description and figures, the chela is thicker than in the Citrus County examples above described, the telson is shorter, the abdominal pleuræ more acuminate, and the antennal scales more triangular in form. Following the description alone, the rostral acumen is blunt and its base extends back into the rostral groove as a slight ridge. These conditions are not true of the Citrus County specimens, neither are they shown in Lönnerberg's figures of *C. acherontis*. The only adult examples in the Citrus County lot, moreover, are females, while Lönnerberg's specimens were both males. I am therefore inclined to believe that the discrepancies between the Swedish author's account of *C. acherontis* and the specimens before me are due to differences in age and sex, and in part to inaccuracy of description and delineation.

This species, the fourth blind *Cambarus* described from the United States, is very distinct from any of the others. As pointed out by Lönnerberg, it is probably descended from *C. clarkii*. It is noteworthy that in a specimen of *C. clarkii* collected in St. Johns River, Florida, the areola, although narrow, is not obliterated in the middle. In this respect this specimen agrees with *C. acherontis* as well as with Texan specimens of *C. clarkii*, and differs from the form of *C. clarkii* found in Alabama, Mississippi, and Louisiana. That the maximum age of the caverns in which *C. acherontis* lives is probably Post-pliocene has been shown by Lönnerberg.¹

CAMBARUS PUBESCENS Faxon.

Buckhead Creek, Millen, Burke County, Georgia (Coll. U.S.N.M.).

CAMBARUS VERSUTUS Hagen.

Pollard (Escambia County), Greenville (Butler County), and Calera (Shelby County), Alabama (Coll. U.S.N.M.). All of these specimens have a carinated rostrum.²

CAMBARUS ALLENI Faxon.

This species is recorded by Lönnerberg³ from Apopka (Orange County), Arcadia (DeSoto County), and from Hillsboro County, Florida.

¹ Bihang till K. Svenska Vet.-Akad. Handl., XX, Pt. 4, pp. 8, 9, 1894.

² Rev. Astacidae, p. 31, and Proc. U. S. Nat. Mus., XII, p. 619.

³ Bihang till K. Svenska Vet.-Akad. Handl., XX, Pt. 4, p. 1, 1894.

CAMBARUS PELLUCIDUS (Tellkampf).

This species has been found by Mr. W. P. Hay in Shiloh Cave, Down's Cave, and other caves near Bedford, Lawrence County, Indiana, and in a small cave near Paoli, Orange County, Indiana.¹ The specimens from these caves belong rather to the form described by Cope as *C. inermis* (Wyandotte Cave) than to the typical form commonly found in the Mammoth Cave of Kentucky. Mr. Hay has shown that these specimens are very variable as regards the development of the spines of the rostrum and sides of the carapace, and that the reduction of the spines is most marked in specimens from the more northerly localities. A transition is thus formed through these individuals to the following subspecies:

CAMBARUS PELLUCIDUS TESTII Hay.

Cambarus pellucidus testii HAY, Proc. U. S. Nat. Mus., XVI, 1893, p. 285, pls. XLIV, XLV, figs. 2, 5, 6, 10, 11, 12; Crawfishes of the State of Indiana, p. 484, fig. 4, 1896.

In this form, which has been found in Mayfield's Cave and Truett's Cave, near Bloomington, Indiana (the most northern locality in which cave crayfishes were found by Mr. Hay), the reduction of the spines is carried to the extreme. The lateral spines of the rostrum, the anterior spines of the postorbital ridges, and the spines on the sides of the carapace are altogether wanting, while the external spine of the second antennal segment and the apical spine of the antennal scale are much reduced in length. So this form comes to bear a close likeness to *C. bartonii* and suggests the possible derivation of *C. pellucidus* from *C. bartonii*. It is true that in regard to the structure of the male external organs *C. pellucidus* is similar to those species of *Cambarus* that are placed in Group I. But, as I pointed out in my "Revision of the Astacidæ" (p. 18), this type of the male organ is a very simple and primitive one, and might be acquired through an inherent reversionary tendency by cave-dwelling species of any of the groups into which the genus *Cambarus* has been divided. The presence of hooks upon the fourth pair of legs may, in this case, be correlated with the reversion of the male appendages to the type of Group I. It will be observed that in Form II (the less perfect form of the male) the hooks on the fourth pair of legs are more or less abortive not only in *C. p. testii* but also in the typical form of *C. pellucidus* from the Mammoth Cave.

The difference, pointed out by Hay, between *C. p. testii* and *C. pellucidus* from Shiloh and Wyandotte caves, with regard to the shape of the hooks on the third pair of legs, probably results from comparing the second form of *C. p. testii* with the first form of *C. pellucidus*.

Three types (two males, Form II, one female) of this subspecies are in the collection of the United States National Museum (No. 17702, Mayfield's Cave, Indiana, W. P. Hay).

¹Proc. U. S. Nat. Mus., XVI, 1893, pp. 283-285.

GROUP II. (Type, *Astacus advena* Le Conte.)

Third segment of third pair of legs of male hooked. First pair of abdominal appendages of male similar to those of Group I.

CAMBARUS CARINATUS, new species.

(Plate LXIII.)

Male, Form I.—Rostrum of moderate width, excavated, lateral margins slightly convergent, carinated, and armed near the tip with a pair of spiniform teeth; acumen of moderate length, reaching to the distal end of the antennular peduncle; a median longitudinal carina extends from the base of the acumen backward to the level of the eyes. Carapace coarsely granulated on the sides, armed with a pair of lateral teeth behind the cervical groove; branchiostegian spine small; postorbital ridges furnished with sharp anterior spines, posterior spines represented by slight tubercles; anterior border of carapace angulated below the orbit. Areola of moderate width, about one-half the length of the anterior section of the carapace.

Abdomen equal to the cephalo-thorax in length, smooth; pleurae broad, bluntly angled. Anterior segment of telson three-spined on each side of the posterior margin; posterior segment short, rounded.

Basal segment of antennule armed with a spine below. Antennal scale broadest at the middle, tapering to a sharp apical spine. A sharp tooth at external base of the antennal scale. Epistoma triangular.

Chelipeds: Merus granulated on superior border, and armed with a single spine near the distal end; lower face with biserial arrangement of spines; carpus tuberculate within, with four spiniform teeth near the anterior border, viz, one near each point of articulation with the propodite and two between these points; hand of moderate width, inflated, covered with small squamous tubercles.

Third segment of third legs hooked.

First abdominal appendages stout, curved forward at apex, inner and outer parts ending in a small horny tooth, anterior margin furnished with a small tooth near the tip.

Length 125 mm.; carapace 62 mm.; length from tip of rostrum to cervical groove 40 mm.; length of rostrum from tip to anterior spine of postorbital ridge 17 mm.; acumen 5 mm.; cheliped 104 mm. (merus 25 mm., carpus 16 mm., chela 51 mm., dactylus 30 mm.); breadth of chela 17 mm.

Type.—Guadalajara, Mexico, altitude 5,200 feet (No. 17699, U.S.N.M.), P. L. Jouy. One male, Form I.

Ameca, Jalisco, Mexico (No. 16085, U.S.N.M.), A. Dugès. Hacienda de Villachuato, Michoacan, Mexico (No. 17707, U.S.N.M.), A. Dugès. Three males, Form I.

According to the manuscript label this species is brought to the market of Guadalajara as food.

CAMBARUS MEXICANUS Erichson.

Mirador and Santa Maria, Mexico (Coll. U.S.N.M.). The annulus ventralis of the female forms a prominent tubercle, with perpendicular posterior wall, facing a roundish tubercle arising from the posterior thoracic segment. The anterior and ventral sides of the annulus are divided by a longitudinal groove which is bounded on each side by a rather prominent lip.¹

CAMBARUS GRACILIS Bundy.

Six young specimens from Day Brook, Jasper County, Missouri, Miss Ruth Hoppin, probably belong to this species. (No. 4341, Mus. Comp. Zool.)

GROUP III. (Type, *Astacus bartonii* Fabricius.)

Third segment of third pair of legs hooked. First pair of abdominal appendages of male thick, the inner and outer parts both terminating in a short recurved tooth.

CAMBARUS BARTONII (Fabricius).

North Adams, Berkshire County, Massachusetts (Coll. Mus. Comp. Zool.); Westmoreland County, Pennsylvania; Waynesville, Haywood County, North Carolina; Roan Mountain, North Carolina, from an altitude of 6,000 feet (Doctor C. H. Merriam); Warren County, Ohio; Albany, Clinton County, Kentucky; Claiborne, Monroe, and McMinn Counties, Tennessee (Coll. U.S.N.M.); caves in Lawrence and Orange Counties, Indiana (W. P. Hay, Proc. U. S. Nat. Mus., XVI, 1893, p. 286).

CAMBARUS BARTONII ROBUSTUS (Girard).

Oneida Creek, Peterboro, Madison County, New York, G. S. Miller, jr. (No. 4329, Mus. Comp. Zool.). According to Doctor R. W. Shufeldt,² *Cambarus bartonii robustus* in Montgomery County, Maryland, builds mud towers at the mouth of its burrow similar to those of *C. diogenes*. A figure of one of these towers, or "chimneys," from a photograph, is given in Shufeldt's article.

CAMBARUS BARTONII LONGIROSTRIS Faxon.

Two males and one female from Will's Creek, Pollard, Escambia County, Alabama (Coll. U.S.N.M.). The suborbital angle is sharply

¹ In the artificial key to the species of Group II on p. 48 of my "Revision of the Astacide," *C. mexicanus* is distinguished from *C. simulans* by the moderate width of the areola contrasted with the narrow areola of *C. simulans*. In fact, the areola is very narrow in both species (it is too broad in the figure of *C. simulans* on pl. 1 of the "Revision"). The distinction should have been drawn from the rostrum and chela. The rostrum is nearly plane above in *C. mexicanus*, deeply hollowed out in *C. simulans*; the chela is much narrower, and more heavily and closely tuberculated in *C. mexicanus* than in the latter species.

² The Observer, VII, No. 3, p. 88, March, 1896.

defined and spiniform, as in specimens from Cumberland Gap.¹ *C. b. longirostris* has been previously known from Blountsville and Cumberland Gap, Tennessee, and the Clinch River, West Virginia.

CAMBARUS LONGULUS Girard.

Cumberland Gap, Tazewell, Greeneville, and Knoxville, Tennessee (Coll. U.S.N.M.).

CAMBARUS LATIMANUS (Le Conte).

Atalla, Etowah County, Alabama (Coll. U.S.N.M.). One male, Form II, three females. The sides of the rostrum are more nearly parallel than in Le Conte's types of *C. latimanus*.

CAMBARUS DIOGENES Girard.

Columbus and Lockbourne, Franklin County, Ohio (Coll. Mus. Comp. Zool.). Minnesota River at Fort Snelling, Minnesota (Coll. U.S.N.M.). Spring Creek at Delhi, Delaware County, Iowa; Belmond, Wright County, Iowa; Paragould, Greene County, Arkansas; Fayetteville, Washington County, Arkansas (Coll. S. E. Meek).

The specimen (male, Form II) from Belmond, Iowa, differs from the typical *C. diogenes* in having a long rostrum, with a narrower, more tapering acumen.

Mr. W. P. Hay has recorded this species from the following new localities in Indiana: Irvington, Marion County; Greencastle, Putnam County; North Salem, Hendricks County.

CAMBARUS ARGILLICOLA Faxon.

Bay Saint Louis, Hancock County, Mississippi; Brazoria and Victoria, Texas (Coll. U.S.N.M.). Irvington, Bloomington, and Wheatland, Indiana (*teste* W. P. Hay). According to Mr. Hay, *C. argillicola*, like *C. diogenes*, builds mud "chimneys" over its burrows.

CAMBARUS EXTRANEUS Hagen.

Fivespecimens from the Big Cahawba River, Alabama (Coll. U.S.N.M.), combine characters belonging to *C. extraneus* and to *C. girardianus* in such a way as to render it necessary to reduce the latter form to the rank of a subspecies. In these intermediate specimens, the areola is long as in *C. girardianus*; there are two spines on the upper border of the merus as in *C. extraneus*, while the posterior wall of the orbit has an outline midway between these two forms.

CAMBARUS EXTRANEUS GIRARDIANUS Faxon.

Cambarus girardianus FAXON, Proc. Amer. Acad. Arts and Sci., XX, p. 117, 1884.

Two males of the second form from Eastanaula Creek, near Athens, Tennessee (Coll. U.S.N.M.).

¹ Rev. Astacidae, p. 64.

GROUP IV. (Type, *Astacus affinis* Say.)

Third segment of third pair of legs of male hooked. First abdominal appendages of male bifid, terminating in two styliiform branches, which are straight or lightly recurved.

CAMBARUS LANCIFER Hagen.

Cambarus lancifer HAGEN, Monogr. N. A. Astacida, p. 59, pl. I, figs. 86, 87; pl. III, fig. 159, 1870 (male, Form I).

Cambarus faxonii MEEK, Amer. Nat., XXVIII, p. 1042, figs. 1-4, 1894 (male, Form II).

In 1891 Mr. W. P. Hay sent me a female specimen of *C. lancifer* collected at Vicksburg, Mississippi. Up to that time Doctor Hagen's type specimen had remained unique. Mr. Hay's specimen differed from the type in having a median spine on the inner side of the carpus of the chelipeds. In the "American Naturalist" for December, 1894, Professor S. E. Meek described and figured the second form of the male under the name of *Cambarus faxonii*. Professor Meek's specimens were taken in St. Francis River at Greenway and Big Bay, Arkansas. Seven (four males, Form II; three females) have been presented to the Museum of Comparative Zoology (No. 4220). In the second form of the male the tips of the first pair of abdominal appendages are not horny, as in the first form; the inner and outer branches are of about equal length, the inner tapering to a rather sharp, straight point, the outer blunt and rounded. These appendages are cleft only for a short distance from the tip, and so present a form very similar to that seen in Groups I and II. The annulus ventralis of the female is depressed in front, more prominent and unituberculate behind, with a closed, curved fissure.

The areola is very incorrectly represented in Meek's fig. 1. The areola is entirely obliterated in the middle, not open as there portrayed.

CAMBARUS INDIANENSIS W. P. Hay.

Cambarus affinis, var. FAXON, Proc. U. S. Nat. Mus., XXII, 1890, p. 628.

Cambarus indianensis HAY, 20th Ann. Rep. Dept. Geol. Indiana, p. 494, fig. 9, 1896.

This form, which I considered as a Western race of *Cambarus affinis*, has been described as a distinct species by Mr. Hay. It has been found in the Patoka River at Patoka, Indiana, and at Huntington, Dubois County, Indiana.

CAMBARUS SLOANII Bundy.

Madison and Marengo, Indiana (*vide* W. P. Hay).

CAMBARUS PROPINQUUS Girard.

Lake Douglas and Saginaw River, Michigan; Indian Lake, Waterloo, Indiana; Portage River at Oak Harbor, Ottawa County, Ohio. (Coll. U.S.N.M.)

C. propinquus is probably the most abundant crayfish in Indiana, according to Mr. W. P. Hay.

CAMBARUS OBSCURUS Hagen.

Westmoreland County, Pennsylvania (Coll. U.S.N.M.).

In the female of *Cambarus obscurus* the anterior part of the annulus ventralis is prominently bituberculate, and behind the tubercles there is a deep transverse fossa. The organ thus has a very different form from that of *C. propinquus*. This difference, together with the peculiarity of the sexual appendages of the first form of the male,¹ supports Doctor Hagen's view that *C. obscurus* is a species rather than a local race of *C. propinquus*, as I considered it in my "Revision."

CAMBARUS NEGLECTUS Faxon.

Day Brook, Jasper County, Missouri (No. 4344, Mus. Comp. Zool.); James River, Springfield, Missouri (Coll. U.S.N.M.). There are specimens of *Cambarus neglectus* in S. E. Meek's collection from the following new localities: Turkey River, Fort Atkinson, Winneshiek County, Iowa; Neosho, Newton County, Missouri; Spring Creek, Johnson, Arkansas; Prairie Grove and Fayetteville, Washington County, Arkansas; Batesville, Independence County, Arkansas; Red River, Arthur, Texas.

CAMBARUS VIRILIS Hagen.

Jasper County, Missouri (No. 4323, Mus. Comp. Zool.); Spirit Lake, Dickinson County, and Ames, Story County, Iowa (Coll. U.S.N.M.); Lake Douglas, Michigan (Coll. U.S.N.M.). In S. E. Meek's collection *C. virilis* is represented from the following localities: Storm Lake, Buena Vista County, Iowa; Cherokee, Cherokee County, Iowa; Yellow Creek, Postville, Allamakee County, Iowa; Spring Creek, Delhi, Delaware County, Iowa; Boyer River, Arion, Crawford County, Iowa; Belmond, Wright County, Iowa; Shell Rock River, Waverley, Bremer County, Iowa; Neosho, Newton County, Missouri; Blue River, Crete, Saline County, Nebraska; Prairie Grove and Fayetteville, Washington County, Arkansas; McAlister, Indian Territory (one female, var. A); Red River, Arthur, Texas.

In Indiana *C. virilis* is confined, according to Mr. W. P. Hay, to the northern part of the State, where it is extremely numerous.

Specimens from Big Piney Creek, Cabool, Texas County, Missouri (Coll. U.S.N.M.), differ in many particulars from the typical form. The cephalo-thorax is more cylindrical, the chela shorter, with more inflated hand and shorter fingers, the immovable finger narrower and less flattened; there are one or two additional spines on the lower side of the carpus between the median and internal spines; the rami of the male sexual appendages are longer, slenderer, and less strongly curved. In the shape of the hand these individuals are very similar to those col-

¹ Rev. Astacidae, p. 93.

lected at Irondale, and in Reynolds County, Missouri.¹ Both in the shape of the claws and in the character of the male appendages the Cabool specimens are transitional forms connecting *C. virilis* with *C. rusticus* and allied species.

CAMBARUS LONGIDIGITUS, new species.

(Plate LXII, figs. 6-9.)

Dorsal surface of the carapace flattened, thickly and coarsely punctate; lateral walls granulate. Rostrum long, concave above, sides parallel from base to the lateral pair of spines, which are sharp and directed forward; acumen long, acute, reaching to the distal extremity of the antennular peduncle, and to the middle of the distal segment of the antennal peduncle. Postorbital ridges curved inward at the posterior end, armed at the anterior end with a sharp spine. Antero-lateral margin of carapace bluntly angulated beneath the orbit, but not armed with a spine. There is a prominent spine on each side of the carapace on the hinder border of the cervical groove; a small branchiostegian spine is also present. The areola is very narrow for the greater part of its length; its narrowest part is well forward, close to the small, but broad, triangular field that borders upon the cervical groove; from this point it widens gradually and slightly to the hinder end.

The abdomen presents no distinctive characters; the pleuræ are punctate, their postero-lateral angles rounded. The telson is rather long, armed with a pair of spines on each side of the transverse suture; its hind margin truncate.

The anterior process of the epistome is broadly triangular, its antero-lateral margins slightly convex, its anterior angle rounded, truncate, or (in a few examples) slightly notched. The basal segment of the antenna bears no spine, but the so-called olfactory turbercle is prominent just in front of the orifice of the green gland; the second segment of the antenna is armed with a small but sharp lateral spine. The antennal scales are about as long as the rostrum, of moderate width, widest at the middle.

The merus of the chelipeds is armed, as usual, with spines biserially disposed on the inferior margins, and with two obliquely placed spines on the superior border near the distal end; the carpus is longitudinally furrowed, punctate, and slightly tuberculate above; there is a small spine near each point of articulation with the manus, two spines besides on the inner border—one median and one smaller one near the posterior end of the segment; the lower surface presents, moreover, a prominent acute median spine together with a minute spinule lying between the inferior median and the internal median spines (the smaller spinule is sometimes obsolete). The palm, or basal part of the propodite, is flattened and very short; its upper face is

¹ Rev. Astacidæ, p. 98, and Proc. U. S. Nat. Mus., XII, p. 630.

coarsely punctate and armed along its inner border with a double row of spiniform tubercles. The fingers are excessively long, the dactylus being more than three times as long as the inner margin of the palm; the fingers meet only at their tips, which cross each other; the grasping edges of both fingers are furnished with blunt teeth, irregular in size, while the opposite margin (or margin toward the median line of the body) of the dactylus is armed with two longitudinal rows of acute teeth. The external finger is barbate within at the base.

The first abdominal appendages of the second form of the male are long and slender, their tips lying between the second pair of legs when directed forward. The outer branch is longer than the inner branch. The tips of both branches are distinctly recurved.

The annulus ventralis of the female is triangular, with a deep transverse central fossa. The anterior wall is indistinctly bituberculate, the posterior wall thickened and divided by a median longitudinal sigmoid closed fissure. The claws of the female do not differ in form from those of the male.

Dimensions of a male, Form II: Length 81 mm.; length of carapace 41 mm.; length of rostrum 13 mm., width of rostrum 4.5 mm.; length of rostral acumen 6 mm.; distance from tip of rostrum to cervical groove 28 mm.; distance from cervical groove to posterior border of carapace 13 mm.; width of areola at its narrowest 0.5 mm.; length of cheliped 67.5 mm.; length of merus 15.5 mm.; length of carpus 10 mm.; length of chela 35 mm.; breadth of chela 10.5 mm.; inner margin of palm 8 mm.; length of dactylus 25.5 mm.

The largest specimen (a female) is 101 mm. long; the large claw measures 47.5 mm. in length, the dactylus 36 mm.

Oxford Bend, White River, Arkansas. (Coll. Mus. Comp. Zool.) Four males, Form II; four females, six young.

This clearly characterized species, discovered by Professor S. E. Meek, is related to *C. virilis*, with which it agrees essentially in the form of the sexual parts, both male and female, and the areola. It is readily distinguished from *C. virilis* by its longer, parallel-sided rostrum, with longer lateral spines and acumen, as well as by the excessive length and slenderness of the fingers. In many individuals the chelæ are unequal in size on the right and left sides, the right being commonly the larger.

In recent alcoholic specimens the fingers are clouded with dusky, and a large spot or blotch of the same hue is seen on both sides of the hand near the articulation with the wrist.

CAMBARUS IMMUNIS Hagen.

Small stream flowing into Oneida Lake, New York (No. 4330, Mus. Comp. Zool.). Sandusky, Erie County, Ohio (No. 5038, Mus. Comp. Zool.). Northern Ohio, near shore of Lake Erie; Ames, Story County, Iowa; South Bend, Cass County, Nebraska (Coll. U.S.N.M.). Also

from the following localities (Professor S. E. Meek's collection): Cedar River, Cedar Rapids, Linn County, Iowa; Mapleton River, Mapleton, Monona County, Iowa; Boyer River, Arion, Crawford County, Iowa; Belmond, Wright County, Iowa; Blue River, Crete, Saline County, Nebraska.

CAMBARUS IMMUNIS SPINIROSTRIS Faxon.

W. P. Hay reports this form as found in Terre Haute, Indiana. The type locality is Obion County, Tennessee. It has also been recorded by me from Shawnee County, Kansas.

CAMBARUS PALMERI Faxon.

St. Francis River, at Greenway and Big Bay, Arkansas; Black River, at Black Rock, Arkansas; Paragould, Green County, Arkansas (Coll. S. E. Meek).

The type specimens of *C. palmeri* are small individuals of the second form of the male and females collected in Obion County, Tennessee. In the collection of Professor S. E. Meek are a good many examples from the above-named localities in northeastern Arkansas which agree essentially with the Tennessee specimens, differing from them merely in the outline of the rostrum, which is somewhat longer and narrower, with more convergent sides. The first abdominal appendages of the first form of the male are strongly recurved, as in *C. immunis*, but the rami are much longer than in that species. The largest specimens attain to a length of 80 mm. The dactylus of the large cheliped in adult individuals varies in length from one and a third to a little over twice the length of the inner border of palm. The upper surface of the claw is ornamented with scattered, roundish, dark spots. In *C. palmeri* there is no very evident spine on the lower face of the carpus between the median spine and the spine on the internal border.

CAMBARUS PALMERI LONGIMANUS, new subspecies.

(Plate LXIV, figs. 1-6.)

Similar to *C. palmeri*, but different in the shape of the hand, the body of which (or palm) is thinner (less inflated) and the fingers much longer proportionally. The antennæ, too, are longer, and the rostrum as a rule is more deeply excavated.

Dimensions of the chela of a male, Form I, 83 mm. long: Length from point of articulation with carpus to end of dactylus 44 mm.; inner margin of palm 10 mm.; dactylus 35 mm.

Good Land, Indian Territory; Walnut Creek, Kainister, Indian Territory; Arthur, Texas (Coll. Mus. Comp. Zool., from S. E. Meek).

Many specimens, including both forms of the male, together with females, from each of the above localities. The upper surface of the carpus and hand is spotted with dusky; the tips of the fingers are red, preceded by a transverse band of dark color which runs along the whole outer margin of the hand.

CAMBARUS DIFFICILIS, new species.

(Plate LXV, figs. 1-4.)

Cephalo-thorax oval, flattened above, of equal length with the abdomen. Carapace obscurely punctate above, lightly granulate on the sides; lateral spines of moderate size, branchiostegian spines obsolete, antero-lateral margins but slightly and bluntly angulated, unarmed with spines. Rostrum of moderate length, reaching a trifle beyond the proximal end of the third antennular segment; upper surface excavate, margins convergent and slightly convex from the base to the single pair of lateral teeth, which are small and acute, with horny tips; acumen of moderate length, acute, horny at the slightly upturned tip. Postorbital ridges ending anteriorly in a sharp tooth or short spine. Areola obliterated throughout a considerable part of its length by the contiguity of the branchio-cardiac lines. Abdominal pleuræ rounded, telson bispinose on each side. Anterior process of epistome squarely truncate at the front end.

Antennæ longer than the body, basal segment unarmed, second segment furnished with a spine on the outer side, at the base of the scale; scale of moderate width, widest near the middle.

The merus of the chelipeds shows the usual biserially arranged spines upon its lower side, and the two obliquely placed spines near the distal end of the upper margin; the carpus is marked by a deep, curved longitudinal furrow on the upper side, just inside of which lies a series of about seven small tubercles, the anterior one sharp pointed and quite near to the upper point of articulation with the propodite; the inner border of the carpus is armed with a stout median spine and a smaller one near the hinder end of the segment; on the lower face of the segment one sees a minute spine at the lower articular surface with the propodite, a prominent median spine, and a much smaller one between the inferior median and the larger spine of the inner border; the chelæ are very large, a little longer than the cephalo-thorax including the rostrum; the palm or basal part is short, its inner border ornamented with a double row of dentiform tubercles, outside of which, on the upper face, appears a row of obsolescent tubercles in line with the axis of the movable finger; the fingers are very long (the movable one being from two and a half to a little over three times the length of the inner border of the palm), pitted and furrowed, armed with blunt teeth along their prehensile edges; the inner border of the dactylus is furnished with dentiform tubercles which show a tendency to an arrangement in two rows, and which decrease in size from the proximal to the distal end of the segment; it is further to be observed that the dactylus is bowed inward in such a fashion that the prehensile edge comes into contact with the immovable finger throughout the distal two-thirds of its length when the fingers are closed, leaving a gape at the base.

The upper surface of the hand and wrist is mottled with dark spots,

The first pair of abdominal appendages of the first form of the male are short and stout, reaching forward only to the base of the antepenultimate pair of thoracic legs. They end in two short, recurved styles, the inner (or posterior) of which is slender and more strongly recurved than the outer one. In males of the second form, these appendages are split for only a short distance from the tip, and the free ends are stouter, blunter, and less strongly recurved. The anterior wall of the annulus of the female is depressed to the level of the sternum so that there is no distinct central fossa. The posterior wall, on the other hand, is very thick and protuberant, forming a transverse tubercle across the hind margin of the penultimate thoracic sternum. The chela of the female is shorter and broader than that of the first form of the male, and the dactylus less bowed. The chela of the second form of the male is similar to that of the female.

Length 93 mm.; carapace 46 mm.; rostrum 11.5 mm.; from tip of rostrum to cervical groove 30 mm.; from cervical groove to hind border of carapace 16 mm.; antenna 106 mm.; cheliped 90 mm.; merus 20 mm.; carpus 13 mm.; chela 48 mm.; dactylus 36 mm.; width of palm 19 mm.; length of inner border of palm 14 mm.; length of first pair of abdominal appendages 12 mm.

McAlister, Indian Territory. (Coll. Mus. Comp. Zool., from S. E. Meek.) Twelve males, Form I; five males, Form II; eleven females. Prairie Grove, Washington County, Arkansas. (Coll. S. E. Meek.) One male, Form I.

This species bears the closest possible resemblance to *Cambarus palmeri longimanus*, with which it would surely be confounded if it were not for the peculiar form of the sexual appendages of the male. These organs consist of a stout peduncle terminating in two very short recurved spines. In *C. palmeri longimanus* the two terminal spines are represented by two very long slender branches, equal in length to the peduncle itself. The annulus ventralis of the female also differs from that of *C. palmeri* inasmuch as the central fossa is well-nigh obliterated.

The upper side of the wrist and hand display the same spots of dark color which are seen in *C. palmeri longimanus*.

CAMBARUS MEEKI, new species.

(Plate LXV, figs. 5-9.)

Cephalo-thorax cylindrical, polished, conspicuously punctate, except in the middle of the gastric area, granulated on the anterior portion of the sides, lateral spine small or obsolete, antero-lateral border bluntly angulated below the orbit, postorbital ridges armed with a sharp anterior spine. Rostrum deeply excavated, often very faintly carinated near the tip; margins thickened, concave, strongly divergent at base, each with a longitudinal row of impressed dots; lateral spines and acumen horny-tipped, strongly upturned; acumen reaching to distal end of antennular peduncle. Areola narrow, punctate. Anterior

process of epistome blunt at the anterior end, the sides convex, the lateral angles protuberant. Carpus armed with a large median and a small posterior spine on the inner border; below, the carpus presents a prominent median spine together with a smaller one situated between the latter and the median internal spine. The chela is of moderate size, punctate, doubly serrate on the internal border, fingers armed with blunt teeth along their prehensile edges, the base of the immobile fingers commonly beared within; dactylus about twice as long as the inner margin of the palms. Antennal scale broad, broadest beyond the middle, internal margin very convex.

First pair of abdominal appendages of the male similar to those of *C. palmeri*.

Annulus ventralis of the female triangular, central cavity roundish, not elongated transversely, posterior wall much swollen and divided in the middle by an almost straight, longitudinal closed fissure.

Length 59 mm.; carapace 29 mm.; rostrum 7 mm.; from tip of rostrum to cervical groove 18.5 mm.; from cervical groove to posterior margin of carapace 10.3 mm.; cheliped 46 mm.; merus 11.5 mm.; carpus 7 mm.; chela 22.5 mm.; dactylus 15 mm.

Walnut Fork, Piney, Arkansas (Coll. Mus. Comp. Zool., from S. E. Meek.). Twelve males, Form II; fifteen females.

Fayetteville, Arkansas (Coll. S. E. Meek.). One male, Form I; seven males, Form II; five females.

This small species, discovered in northwestern Arkansas by Professor S. E. Meek, appears to be distinct from any hitherto described. In its general appearance it resembles *C. rusticus*, but the areola is much narrower, as in *C. virilis*, while the male appendages are fashioned like those of *C. palmeri*. The first pair of abdominal appendages of the female are reduced to the merest rudiments in the shape of a pair of soft papillæ springing from the first sternal segment of the abdomen.

CAMBARUS RUSTICUS Girard.

Grand Rapids, Wood County, Ohio; Defiance, Defiance County, Ohio; Ottawa, Putnam County, Ohio; McCutchenville, Wyandot County, Ohio; Tiffin, Seneca County, Ohio; Waterloo, Indiana; Moscow, Hickman County, Kentucky; Saginaw and Tiffin, Michigan; Springfield and Marshfield, Missouri. (Coll. U.S.N.M.) Black River, Black Rock, Arkansas; Shell Rock River, Waverley, Iowa; Indian Creek, Marion, Iowa. (Coll. S. E. Meek.)

CAMBARUS SPINOSUS Bundy.

Indian Creek, tributary of Powell's River, six miles southeast of Cumberland Gap, Tennessee; Clinch River at Walker's Ford, eleven miles southwest of Tazewell, Tennessee; Courtland, Alabama. (Coll. U.S.N.M.)

The specimens from Courtland, Alabama, are three females and one

male, Form II, with uncommonly long rostral acumen and long-spined antennal scale. The epistoma is not emarginate in front in these four specimens.

CAMBARUS ERICHSONIANUS, new species.

(Plate LXIV, figs. 7-12.)

Male, Form I.—Rostrum of moderate width, sides parallel, not thickened, lateral spines minute, acumen reaching to the distal end of the antennular peduncle. Carapace cylindrical, heavily punctated, lightly granulate and ciliate on the sides; lateral spines well developed; postorbital ridges armed with a small anterior spine; anterolateral border scarcely angulated below the eye; areola of moderate width, but little longer than the distance from the cervical groove to the lateral spines of the rostrum. Abdomen as long as the cephalo-thorax. Epistome triangular, often truncate or notched in front. Carpus of chelipeds with an internal median and inferior median spine. Chela broad, inflated, setiferous, fingers somewhat longer than the palm; internal margin of palm with a double row of depressed tubercles. First pair of abdominal appendages straight, without any prominent angle or shoulder on the anterior border, bifid, the two branches slender and acute, reaching forward to the base of the second pair of legs.

In the second form of the male the first pair of abdominal appendages are thicker, blunter at the tips, and not horny, as in the first form.

In the female the annulus ventralis is depressed, only very imperfectly bituberculate in front, the hind border more prominent than the front border, the central fossa obsolescent.

Dimensions of a male, Form I: Length 70 mm.; cephalo-thorax 35 mm.; areola 11 mm.; rostrum 5 mm.; chela 25 mm.; dactylus 15.5 mm.; breadth of chela 6 mm.

Rip Roaring Fork, five miles northwest of Greeneville, Tennessee; Eastanaula Creek, Athens, Tennessee; Matlock Spring Creek, near Athens, Tennessee; Big Cahawba River, Alabama. (Colls. U.S.N.M. and Mus. Comp. Zool.)

In large males, Form I, the inner branch of the first abdominal appendages is somewhat enlarged and spoon-shaped at the tip.

This species has the facies of *C. spinosus*, but the male appendages are nearly like those of *C. propinquus*, although the rami are a little longer. Compared with *C. spinosus*, the rami of the sexual appendages in the male, Form I, are much shorter, and there is no angle or shoulder on the anterior margin of these appendages; in the second form of the male of *C. erichsonianus* the sexual appendages are much shorter and blunter than in *C. spinosus*, and the two rami are of equal length. The female of *C. spinosus*, may be distinguished from the present species by the prominent annulus ventralis with bituberculate anterior border and deep transverse central fossa. *C. propinquus*, compared with *C. erichsonianus*, is distinguished by its more ovoid cephalo-thorax,

the greater length of the section of the carapace behind the cervical groove, and its shorter, more tapering, and carinated rostrum. All of these characters, with the exception of the carination of the rostrum, also serve to separate *C. propinquus sanbornii* from the present species.

The habitat of *C. erichsonianus*, eastern Tennessee and northern Alabama, is closely adjacent to that of *C. spinosus*. *C. propinquus* is a more northern form, unknown south of the Ohio. *C. propinquus sanbornii* has been found in Kentucky and Ohio.

CAMBARUS FORCEPS Faxon.

Clinch River at Walker's Ford, eleven miles northwest of Tazewell, Tennessee; Bull's (or Big Sycamore) Creek, tributary of Clinch River, seven miles south of Tazewell, Tennessee. (Coll. U.S.N.M.)

GROUP V. (Type, *Cambarus montezumæ* Saussure.)

Third segment of second and third pairs of legs of male hooked. First abdominal appendages similar to those of Group IV.

CAMBARUS MONTEZUMÆ Saussure.

The typical form of *C. montezumæ* comes from the plain of the City of Mexico. It has also been recorded from Puebla¹ and from Vera Cruz.² The Puebla specimens (var. *tridens* von Martens) are described as having a pair of small lateral teeth near the apex of the rostrum, but this is also true of many of the specimens, especially the second form males and the females, from the type locality. In the typical form the rostrum is smooth and lightly hollowed out above, the sides of the rostrum are nearly parallel (but slightly convex) from the base to the proximal end of the acumen, which is short (not surpassing the second antennular segment) and flanked by very small lateral teeth (often obsolete). The postorbital ridges are unarmed, or furnished at the most with the merest vestige of the anterior spines. The portion of the carapace posterior to the cervical groove is much more than half the distance from the groove to the anterior extremity of the rostrum.

CAMBARUS MONTEZUMÆ DUGESII, new subspecies.

(Plate LXVI, fig. 1.)

Cambarus montezumæ FAXON, Proc. U. S. Nat. Mus., XII, 1889, p. 633.

Differs from *C. montezumæ* as follows: The upper surface of the rostrum is perfectly flat, except for the margins, which are raised so as to form lateral carinæ; the sides of the rostrum converge from the base to the proximal end of the acumen, which is slenderer and a little longer than in *C. montezumæ*; the lateral teeth of the rostrum are

¹ Von Martens, Arch. f. Naturgesch., 38ter Jahrg., 1872, I, p. 130.

² Ortmann, Zoolog. Jahrb., Abth. f. Syst., VI, 1891, p. 12.

more strongly developed; the postorbital ridges bear distinct anterior spines; the hand is broader and more hirsute, and the fingers are tipped with more conspicuous, yellow, corneous nails.

Length 38 mm.

State of Guanajuato, Mexico, A. Dugès (No. 16087, U.S.N.M.).

CAMBARUS MONTEZUMÆ AREOLATUS Faxon.

(Plate LXVI, fig. 2.)

Cambarus montezumæ, var. *areolata* FAXON, Rev. Astacidæ, Pt. 1, 1885, p. 123.

In this form the outline of the rostrum is similar to that of *C. m. dugesii*, but the lateral margins are not raised so as to form prominent carinæ. The lateral rostral spines and the spines at the anterior end of the postorbital ridges are developed to about the same degree as in *C. m. dugesii*. The characteristic feature of this form is the shortness of the posterior section of the carapace, which involves a very short and broad areola.

Parras, Coahuila, Mexico, Edward Palmer (No. 3650, Mus. Comp. Zool.).

CAMBARUS MONTEZUMÆ OCCIDENTALIS, new subspecies.

(Plate LXVI, figs. 3, 4.)

Cambarus montezumæ FAXON (pars), Rev. Astacidæ, Pt. 1, 1885, p. 123.

Rostrum plane above, margins but very slightly raised, tapering gradually from the base to the tip without distinct lateral spines or definitely limited acumen. It reaches at the most to the distal end of the second antennular segment. Postorbital ridges unarmed.

Mazatlan, Mexico (No. 3652, Mus. Comp. Zool.).

CAMBARUS CHAPALANUS, new species.

(Plate LXVII, figs. 1, 2.)

Similar to *C. montezumæ*, but differs in the following regards: Body slenderer and more cylindrical; rostrum much longer and narrower, reaching to the end of the antennular peduncle, somewhat hirsute, armed with a pair of stout and sharp lateral spines, and a long spiniform acumen; postorbital ridges terminating anteriorly in long and strong spiniform teeth; antennal scales much longer and narrower and armed with a much longer apical spine.

Type.—Lake Chapala, State of Jalisco, Mexico, P. L. Jouy (No. 17698, U.S.N.M.). One male.

Same locality and collector (No. 16294, U.S.N.M.). Three males.

The upper surface of the rostrum is plane, with raised lateral margins. The sides of the rostrum are convex, distinctly converging before attaining to the lateral spines. The chelipeds and the male sexual organs are like those of the typical form of *C. montezumæ*.

In some respects *C. montezumae dugesii* shows an approach toward this species, but the two forms can not be confounded on account of the greater slenderness of *C. chapalanus*, the great length of the rostral and postorbital spines, etc. *C. shufeldtii* is distinguished from *C. chapalanus* by the presence of lateral spines on the carapace, broader rostrum, differently shaped male appendages, etc.

Genus ASTACUS Fabricius (s. s.).¹

< *Cancer* LINNÆUS, Syst. Nat., 10th ed., I, p. 625, 1758.

< *Astacus* FABRICIUS, Syst. Entomol., p. 413, 1775; Species Insectorum, I, p. 514, 1781; Mantissa Insectorum, I, p. 331, 1787; Entomol. Syst. emend., II, p. 478, 1793; Suppl. Entomol. Syst., p. 382, 1798.

< *Astacus* LATREILLE, Considérations Générales, p. 101, 1810 (*Astacus fluviatilis* FABRICIUS = *Cancer astacus* LINNÆUS, specified as the type, p. 422).

< *Astacus* LEACH, Edinb. Encycl., VII, p. 398, 1814; Trans. Linn. Soc. London, XV, pp. 336, 343, 1815.

< *Potamobius* LEACH, Samonelle's Entomologist's Useful Compendium, p. 95, 1819 (Type, *Potamobius fluviatilis* = *Cancer astacus* LINNÆUS).

< *Astacus* MILNE-EDWARDS, Hist. Nat. Crust., II, p. 329, 1837.

= *Astacus* (subgenus) ERICHSON, Arch. f. Naturgesch., 12ter Jahrg., I, p. 90, 1846.

Type, *Cancer astacus* Linnæus.

The genus *Astacus*, as first established by Fabricius,² included eighteen species. The dismemberment of this heterogeneous assemblage was begun by Fabricius himself in 1781,³ by the removal of three species to the genus *Squilla*. In 1798,⁴ he eliminated several other species from *Astacus*, forming for their reception the genera *Crangon*, *Alpheus*, *Palæmon*, and *Palinurus*. As left by its founder in 1798, the genus *Astacus* contained only five of the original species, namely, *A. marinus* (= *Cancer gammarus* Linnæus), *A. fluviatilis* (= *Cancer astacus* Linnæus), *A. cærulescens*, *A. fulgens*, and *A. norvegicus*. Two of these, *cærulescens* and *fulgens*, are indeterminable. In 1810 Latreille,⁵

¹Those who accept the genera defined by polynomialists after the year 1758 will ascribe the genus *Astacus* to Gronovius, 1764 (*Zoophylacium Gronovianum*, Fasciculus II, p. 227). Even as early as 1760 Gronovius (*Acta Helvetica*, IV, p. 23) assigned *Galatca strigosa* polynomially to *Astacus*, using *Astacus* in its old pre-Linnæan sense. In 1772 Pallas, a binomialist, in his "Spicilegia Zoologica," Fasciculus IX, p. 81, used the combination *Astacus dauuricus* in treating of the Daurian crayfish. Pallas wrote in Latin, and it is evident that *Astacus* was here used merely as the Latin word for "crayfish" or "lobster," and not as a technical generic name; for the diagnosis of the Daurian crayfish is headed "Descriptio *Caneri dauurici*," conformably with Linnæus's nomenclature. Even if one forces the point and carries the genus *Astacus* back to Pallas, 1772, it will not make the Daurian crayfish the type of the genus, since the description of the Daurian crayfish is a comparative one, the lesser European *Astacus* [*Astacus nostras minor*], i. e., *Cancer astacus* Linnæus, serving as the standard for comparison. To regard as a type the thing compared, rather than the standard of comparison, would be a manifest absurdity.

²Syst. Ent., 1775.

³Species Insectorum.

⁴Suppl. Ent. Syst.

⁵Considérations Générales sur l'Ordre Naturel des Animaux composant les Classes des Crustacés, des Arachnides, et des Insectes.

in a "Table des Genres avec l'indication de l'espèce qui leur sert de type," designated *A. fluviatilis* as the type of the genus *Astacus*. In 1814 and 1815 Leach¹ further curtailed the genus by removing *A. norvegicus* as the type of the new genus *Nephrops*. The genus *Astacus*, thus restricted, retained only two of the valid original species, namely, *A. marinus* (the European lobster) and *A. fluviatilis* (the common European crayfish). In 1819² Leach went a step further, and separated the crayfishes from the lobster, instituting a new genus *Potamobius* for the former, leaving the latter as the representative of the restricted genus *Astacus*. This restriction of *Astacus* to the marine species is nullified by Latreille's specification of *A. fluviatilis* as the type of *Astacus* in 1810.³ In 1837 Milne-Edwards⁴ did essentially the same thing that Leach had done in 1819, but he left the crayfishes in *Astacus*, and made the lobster the type of the new genus *Homarus*. This being in accord with Latreille's designation of *A. fluviatilis* as the type of *Astacus*, the European lobster should be called by the modern rules of nomenclature (restoring the Linnæan specific name) *Homarus gammarus* (Linnaeus), while the European crayfish, as *Astacus astacus* (Linnaeus), stands as the type of the genus *Astacus*.

Mr. T. R. R. Stebbing⁵ argues that Latreille, in his "Table des Genres avec l'indication de l'espèce qui leur sert de type," probably designated *Astacus fluviatilis* "not as the type, but merely as a type, an example," of the genus *Astacus*, and that Leach's restriction in 1819 was therefore valid. As I understand it, the French word 'type' means 'model,' 'type,' or 'standard,' not 'example' or 'illustration' (Gallicè *exemple*). I see no reason for going behind Latreille's plain words, to indulge in uncertain speculation concerning his possible meaning. If Mr. Stebbing is unwilling to allow Latreille the use of the word 'type' in its technical sense, by what 'statute of limitation' will he fix the year when the word acquired that meaning? Even if it be admitted that there is some doubt concerning the significance of the word 'type' as employed by Latreille, the benefit of the doubt should, by a reasonable ruling applicable to all such cases, be given to a long-established terminology. Between 1819 and 1893, the date of Stebbing's "History of the Crustacea," the name *Potamobius* was applied to the crayfishes but thrice, so far as I know, namely, by Adam White in his "Catalogue of British Crustacea," 1850, and in his "Popular History of British Crustacea," 1857, and by G. B. Sowerby in his continuation of Leach's "Malacostraca Podophthalma Britannia," 1875. "But," continues Mr. Stebbing, "if it be insisted that Latreille here intended to set up the crayfish as technically type of the genus, in preference to the lobster, of which his book makes no mention, the answer is simple. His inten-

¹ Edinb. Encycl., VII, p. 398; Trans. Linn. Soc. London, XV, pp. 336, 343.

² Samouelle's Entomologist's Useful Compendium, p. 95.

³ F. H. Herrick, Bull. U. S. Fish Comm. for 1895, p. 9.

⁴ Hist. Nat. des Crustacés, II, p. 329.

⁵ Natural Science, IX, 1896, p. 40.

tion was inoperative, because he had been forestalled by an earlier writer. J. C. Fabricius, in his various writings, of which it will be sufficient to cite the 'Species Insectorum,' 1781, and the 'Entomologia Systematica,' 1793, consistently places *Astacus marinus* (*Cancer gammarus* Linnaeus) as the first species of the genus *Astacus*, giving to *A. fluviatilis* invariably the second place. There can therefore be no reasonable gainsaying that he made the European lobster, and not the river crayfish, the type. From this it follows * * * that the generic name of the lobster is properly *Astacus*, and that of the European crayfish *Potamobius*."

It is hard to believe that this contention of Mr. Stebbing's is made in good faith, involving as it does an unreasonable and long-discarded method of ascertaining a type. Such a method is repudiated every time we concede to an author who first subdivides a genus in which no type has been specified, the right to restrict the original name to such part of it as he pleases. It is not true that the first species is presumably the author's implied type. Fabricius's genus *Astacus* was formed by a dismemberment of the genus *Cancer* of Linnaeus, and the sequence of the two species under consideration in Fabricius's works was undoubtedly derived from the "Systema Natura," where (in the twelfth edition) *Cancer gammarus* stands as No. 62, *Cancer astacus* as No. 63, in the genus *Cancer*. A better, though not a valid, claim might be set up for *A. fluviatilis* as Fabricius's implied type of his genus *Astacus*, since that species is the *Cancer astacus* of Linnaeus.

In Agassiz's "Nomenclator Zoologicus" the name *Potamobius* is entered as a genus of Brachyura, with a citation of Leach's article in "Dictionnaire des Sciences Naturelles," XII, 1818. By reference to this work it appears that the name occurs on page 75, under the Gallicized form "Potamobie," in a merely nominal, alphabetical list of the genera of Crustacea. Since the crayfish and lobster are both entered elsewhere in the same list, by the names of "Ecrevisse" and "Homard," I am inclined to think that "Potamobie" was here really intended for a genus of fluviatile crabs, as assumed in the "Nomenclator," and that it was written through a *lapsus pennae* for "Potamophile," i. e., *Potamophilus* or *Potamon*. As the name occurs as a pure *nomen nudum* in the "Dictionnaire," it would be unworthy of notice but for the fact that Desmarest said in 1823:¹ "Il est probable que ce genre [*Thelphusa* ou *Potamophilus*] diffère peu, ou ne diffère pas de ceux qui ont été nommés *Potamon* par M. Savigny, et *Potamobia* par M. Leach," and that Risso in 1826² adopted "*Potamobius* Leach" (with "Potamophile" as the French equivalent) as the generic name for the fresh-water crab, *Potamon fluviatilis*. In this way, probably, it came to pass that Huxley³ was led into the essentially erroneous assertion that *Potamobius* had been used in another sense before it was applied to the crayfish.

¹ Dictionnaire des Sciences Naturelles, XXVIII, p. 246.

² Hist. Nat. de l'Europe Mérid., V, p. 14.

³ Proc. Zool. Soc. London, 1878, p. 752.

White, in his "List of the Specimens of Crustacea in the Collection of the British Museum," 1847, page 71, gives "*Potamobius europæus* Leach, Edin. Enc." as a synonym of *Astacus fluviatilis*. This seems to be an error. Leach's article, "Crustaceology," in the seventh volume of the Edinburgh Encyclopædia, was published in 1814. The European crayfish is there called *Astacus fluviatilis*; the name *Potamobius europæus* does not appear.

Subgenus **CAMBAROÏDES** Faxon.

Cambaroïdes FAXON, Proc. Amer. Acad. Arts and Sci., XX, p. 150, 1884.

Type, *Astacus japonicus* De Haan.

ASTACUS (CAMBAROÏDES) SIMILIS Koelbel.

Astacus (Cambaroïdes) similis KOELBEL, Anzeiger d. kais. Akad. d. Wissensch. in Wien, math.-naturw. Classe, 29ter Jahrg., 1892, pp. 176, 177; Sitzungsberichte, CI, Pt. 1, 1892, pp. 650-656, figs. 1, 2, 4, 5, 7-11.

There are three specimens (two males, one female) of this species in the United States National Museum, collected by P. L. Jouy near Fusan, and at Seoul, Korea; Koelbel's specimens came from the Province of Kjöng-Kwi-do, Korea.

The Korean crayfish is exceedingly close to *Astacus japonicus*. The only constant differences appear to be these: In *A. japonicus* the rostrum terminates in a minute horny denticle, and the lateral margin bears a similar denticle¹ on each side, a little way behind the apex, while in *A. similis* the lateral denticles are wanting. The fingers of *A. japonicus* are a little shorter than those of *A. similis* and there is some difference in the form of the first pair of abdominal appendages (See Plate X, fig. 10, of my "Revision of the Astacidæ" and figs. 8, 9 of Koelbel). The other differences pointed out by Koelbel are not constant; the median rostral carina is more pronounced in two of the specimens of *A. similis* in the National Museum than in any of the nine specimens of *A. japonicus* that I have seen, and in one of the three Korean specimens the spine on the inner branch of the sixth abdominal appendage is as far removed from the margin as it is in *A. japonicus*.

In two of the examples in the United States National Museum (including the largest one of the three) the rostrum is shorter than the antennal peduncle.

Subgenus **ASTACUS**.

ASTACUS KLAMATHENSIS Stimpson.

Klamath River, Siskiyou County, California; Umatilla River, Pendleton, Oregon; Hangman Creek, Tekoa, Washington; Dart's Mill, Little Spokane River, Washington; Cœur d'Alene Lake, Idaho (Coll. U.S.N.M.).
Specimens from the Walla Walla River at Wallula, Washington, and

¹ According to Koelbel (Sitzungsber. d. kais. Akad. d. Wissensch. in Wien, CI, Pt. 1, p. 651, fig. 3) there are *two* denticles on each side of the rostrum in some specimens of *A. japonicus*.

from Potlatch Creek, at Lewiston, Idaho, with the general facies of *A. klamathensis*, show certain characters of *A. trowbridgii*. For instance, in most of them the posterior pair of postorbital spines is very evident, while the rostral spines, the apical spine of the antennal scale, the external spine of the second segment of the antenna, and the spine at the anterior internal angle of the carpus are much more strongly developed than in typical specimens of *A. klamathensis*.

ASTACUS TROWBRIDGII Stimpson.

A large female specimen, 138 mm. long (Coll. U.S.N.M.), said to have been taken from a bunch of seaweed in salt water at Monterey, California, approaches *A. leniusculus* in three respects, namely: The posterior pair of spines on the back of the carapace, behind the eyes, are rather more strongly developed than in the typical *A. trowbridgii*; the rostral acumen is as long as in *A. leniusculus*; the tubercle at the orifice of the green gland ends in a sharp, horny point. In other respects this specimen agrees with *A. trowbridgii*. The body is very broad across the branchial region, and there are three spines on the left side of the telson, two on the right. There is a rudimentary limb on the right side of the first abdominal segment, a condition seldom seen in the American species of *Astacus*.

Astacus trowbridgii has been previously known only from the region near the mouth of the Columbia River.

ASTACUS LENIUSCULUS Dana.

There is a large female, 122 mm. long, from San Francisco County, California, in the collection of the California Academy of Sciences (No. 3259). The right and left chelipeds of this specimen are of equal size; the upper margin of the right merus is armed with two spines, of the left merus with three spines; the telson is armed with one spine on the right side, two on the left. This species has been previously recorded from the Columbia River and Puget Sound.

ASTACUS GAMBELII (Girard).

Crawfish Creek, at Moose Falls, one mile above junction with Lewis River, Yellowstone National Park, Wyoming; Snake River, just south of Yellowstone Park, Wyoming; Mink Creek and Port Neuve River, Pocatello, Idaho; Shoshone Falls, Idaho; Blue Lakes, four miles below Shoshone Falls, Idaho (Coll. U.S.N.M.).

All of these localities are in the Snake River drainage.

ASTACUS TORRENTIUM (Schrank).

Recorded from Cologne, Germany, and from St. Gallen, eastern Switzerland, by Doctor A. P. Ninni.¹

¹Atti della Soc. Italiana di Sci. Nat., XXIX, pp. 322-326, 1886.

ASTACUS PALLIPES Lereboullet.¹

Neighborhood of Madrid, Spain (No. 4349, Mus. Comp. Zool.). These Spanish crayfishes do not differ from French and English specimens of *A. pallipes*.

Doctor Ninni,² in a note on the crayfishes of Italy, shows that *A. pallipes* is the common crayfish of that country, being widely distributed through the Kingdom, as far south as Naples. A form found in the province of Belluno, characterized by the presence of spines on the outer margin of the antennal scale, is named by him *Astacus pallipes*, var. *fulcisiانا*.³

Two specimens in the United States National Museum from Piobezì, near Turin, vary in the direction of *A. astacus*. This variation is chiefly shown in the outlines of the rostrum.

The *Astacus rugosus* of Rafinesque,⁴ presumably from Sicily, is quite indeterminable, and the *Astacus tomentosus* of the same writer⁵ is a pure *nomen nudum*.

ASTACUS ASTACUS Linnæus.

Cancer astacus LINNÆUS, Syst. Nat., 10th ed., I, p. 631, 1758.

Astacus fluviatilis FABRICIUS, Syst. Entomol., p. 413, 1775, et auct. plurim.

Astacus astacus MEUSCHEN, Museum Gronovianum, p. 85, 1778; Zoophyl. Gronov., Fasc. III, Index [p. 389], 1781.

Cancer (Astacus) astacus GMELIN, Linn. Syst. Nat., 13th ed., Pt. 5, p. 2985, 1788 (in part).

Cancer nobilis SCHRANK, Fauna Boica, III, p. 246, 1803.

Potamobius fluviatilis LEACH, Samouelle's Entomologist's Useful Compendium, p. 95, 1819 (in part).

Potamobius astacus WHITE, List of the Specimens of British Animals in the Collection of the British Museum, Pt. 4, Crustacea, p. 34, 1850 (in part).

Astacus fluviatilis communis GERSTFELDT, Mem. Acad. Impér. Sci. St. Pétersbourg, IX, pp. 554, 584, 1859.

Astacus nobilis HUXLEY, The Crayfish, p. 233, fig. 61, B, E, H; p. 245, fig. 62, B, E; p. 296, 1880.

A. P. Ninni² records *Astacus astacus* from Carniola and Göritz. One young specimen from Belluno, northern Italy, is also considered by Ninni to belong to this species.

Since the publication of my "Revision of the Astacidae,"⁶ V. M. Shimkevitch⁷ has printed (in Russian) a fuller account of the Turkestan crayfish, *Astacus kessleri* Shimkevitch.

¹ On page 141 of my "Revision of the Astacidae," lines 2 and 5, for "antennule" read "antennal peduncle."

² Atti della Soc. Italiana di Sci. Nat., XXIX, pp. 322-326, 1886.

³ Ibid., p. 326.

⁴ Précis des Découvertes et Travaux Somnologiques, p. 22, 1814.

⁵ Ibid.

⁶ See p. 152 of that work.

⁷ Bull. Imper. Soc. Friends of Nat. Hist., Anthropol., Ethnogr., Moscow, L, Pt. 1 (Proc. Zoolog. Sect., I, Pt. 1, p. 20), 1886.

Subfamily PARASTACINÆ.

First abdominal somite devoid of appendages in both sexes; podobranchiæ lacking a bilobed plaited lamina, although the stem may be expanded into a wing; epipod of first maxilliped generally furnished with branchial filaments, coxopoditic setæ hooked at the end; telson not divided by a transverse suture.

ASTACOÏDES Guérin.

Astacoïdes GUÉRIN, Revue Zoologique, II, p. 109, 1839.

Type, *Astacoïdes goudotii* Guérin = *Astacus madagascariensis* Audouin et Milne-Edwards.

Rostrum short, quadrilateral, concave above, margins furnished with small teeth or tubercles. Antennal scale very small.¹ Anterior process of epistome long triangular. Superior border of the hand dentate. Sides of the carapace armed with small tubercles, some of which assume the form of small spines. Number of well-developed gills reduced to twelve on each side of the body; posterior arthrobranchiæ rudimentary and functionless; one pair of pleurobranchiæ (on the fourteenth somite); the branchial formula, according to Huxley,² being as follows:

SOMITE.	PODOB-RANCHIÆ.	ARTHROBRANCHIÆ.		PLEUROBRANCHIÆ.		
		Anterior.	Posterior.			
VII.	0 (ep r)	0	0	0	=	0 (ep r)
VIII.	1	r	0	0	=	1 + r
IX.	1	1	0	0	=	2
X.	1	1	r	0	=	2 + r
XI.	1	1	r	0	=	2 + r
XII.	1	1	r	0	=	2 + r
XIII.	1	1	r	0	=	2 + r
XIV.	0	0	0	1	=	1
		6 + ep r	+ 5 + r	+ 4 r	+ 1	= 12 + 5 r + ep r

One species known.

Habitat.—Madagascar.

ASTACOÏDES MADAGASCARIENSIS (Audouin et Milne-Edwards).

Astacus madagascariensis AUDOIN ET MILNE-EDWARDS, Journ. de l'Institut, 1839, p. 152; Arch. du Mus. d'Hist. Nat., II, p. 35, pl. III, 1841.

Astacoïdes goudotii GUÉRIN, Revue Zoologique, II, p. 109, 1839.³

Astacus (Astacoïdes) madagascariensis ERICHSON, Arch. f. Naturgesch., 12ter Jahrg., I, p. 89, 1846.

¹Erroneously said to be wanting by Guérin.

²Proc. Zool. Soc. London, 1878, p. 775.

³Guérin's description of the Madagascar crayfish must have been published about the same time as Audouin and Milne-Edwards's. The Revue Zoologique was issued monthly. Guérin's description occurs in the April number, 1839. Audouin and Milne-Edwards's description in the Institute, p. 152, was communicated to the Société Philomatique on the 27th of April, 1839. In cases like this it seems reasonable to retain the name adopted by the next following author who treated of the species—in this instance, Audouin and Milne-Edwards in the Archives du Muséum d' Histoire Naturelle, II, 1841.

Astacus caldwelli BATE, Proc. Zool. Soc. London, 1865, p. 469, pl. XXVII.

Astacoides madagascariensis HUXLEY, Proc. Zool. Soc. London, 1878, p. 759, fig. 2 B; p. 773, fig. 7; The Crayfish, p. 251, fig. 65, 1880.

Habitat.—Madagascar.

The only specimen of this species that I have seen is Guérin's type, in the Museum of the Academy of Natural Sciences of Philadelphia (No. 290, Guérin Coll.). The color in life, according to Goudot, is brownish green.

ASTACOPSIS Huxley.

Astacopsis HUXLEY, Proc. Zool. Soc. London, 1878, p. 764.

Type, *Astacus franklinii* Gray.

Rostrum triangular, concave above, margins toothed. Antennal scale of moderate width, tapering off to an apical spine. Anterior process of epistome long triangular. Superior border of hand dentate. Carapace and abdomen more or less tuberculous or spinous, at least in mature individuals. Form homaroid. Twenty-one gills on each side of the trunk, disposed as shown in the following formula :

SOMITE.	PODOBRANCHIÆ.	ARTHROBRANCHIÆ.		PLEUROBRANCHIÆ.					
		Anterior.	Posterior.						
VII.	0 (ep r)	0	0	0	=	0 (ep r)			
VIII.	1	1	0	0	=	2			
IX.	1	1	1	0	=	3			
X.	1	1	1	0	=	3			
XI.	1	1	1	1	=	4			
XII.	1	1	1	1	=	4			
XIII.	1	1	1	1	=	4			
XIV.	0	0	0	1	=	1			
	6 + ep r	+	6	+	5	+	4	=	21 + ep r

Habitat.—Australia and Tasmania.

ASTACOPSIS FRANKLINII Gray.

Astacus franklinii GRAY, Eyre's Journals of Expeditions of Discovery into Central Australia, I, p. 409, pl. III, fig. 1, 1845; List Crust. Brit. Mus., p. 72, 1847 (no description).

Astacus franklinii ERICHSOHN, Arch. f. Naturgesch., 12ter Jahrg., I, p. 375, 1846 (after Gray).

Astacopsis franklinii HUXLEY, Proc. Zool. Soc. London, 1878, p. 764, figs. 4, 5.

Astacopsis franklinii HASWELL, Cat. Australian Stalk- and Sessile-eyed Crustacea, p. 176, 1882 (after Gray).

Habitat.—Tasmania. One specimen (male), 96 mm. long, in Museum of Comparative Zoology (No. 1140), from Hobart Town, Mr. Robertson. The angles of the abdominal pleuræ in this specimen tend to develop spiny points.

Astacopsis franklinii is similar in external appearance to the Madagascar crayfish (*Astacoides madagascariensis*). The latter, however, as has been shown by Huxley, has the number of gills reduced to twenty-four, against forty-two in the former. *A. franklinii* appears to be rep-

resented in New South Wales by an allied species, *Astacopsis nobilis* (Dana), through which we pass to the great Murray River crayfish, *Astacopsis spinifera* (Heller).

ASTACOPSIS SPINIFERA (Heller).

- Cancer serratus* SHAW, Zoology of New Holland, pl. VIII, 1794. (Nec *Cancer serratus* Forskål, 1775.)
Potamobius serratus WHITE, Proc. Zool. Soc. London, XVIII, p. 95, pl. XV, 1850.
Astacoides spinifer HELLER, Reise der Novara, Zool. Th., II, Pt. 3, Crust., p. 102, pl. IX, 1865.
Astacus armatus VON MARTENS, Ann. Mag. Nat. Hist., 3d ser., XVII, p. 359, 1866.
Astacoides serratus MCCOY, Ann. Mag. Nat. Hist., 3d ser., XX, p. 189, 1867; Prodrömus of the Zoology of Victoria, Decade II, pl. xv, 1878.
Astacus serratus VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 615.
Australian crayfish HUXLEY, The Crayfish, p. 307, fig. 76, 1880.
Astacopsis serratus HASWELL, Cat. Australian Stalk- and Sessile-eyed Crust., p. 174, 1882.
Astacopsis spinifer BATE, Rep. Challenger Crust. Macrura, p. 195, pl. XXVIII, 1888.

Habitat.—Australia, in Murray River, the Murrumbidgee and tributaries, the Paramatta River at Sydney (Bate), Richmond River (White), Brisbane Water (White), and at Mount Wilson (Haswell).

List of specimens examined: Australia, Doctor F. Müller, one male (Coll. Mus. Comp. Zool.); Melbourne, Doctor F. Müller, one female ovig. (Coll. Mus. Comp. Zool.); Murray River, one female ovig. (Coll. Mus. Comp. Zool.); Murrumbidgee River, one male (Coll. Mus. Comp. Zool.), and Moreton Bay, one (Coll. Acad. Nat. Sci. Phila.).

The largest specimen in the Museum of Comparative Zoology (an egg-bearing female) is $12\frac{1}{4}$ inches (310 mm.) long. Von Martens records a specimen 13 inches (330 mm.) in length, while according to Stebbing a length of 20 inches (507 mm.) is sometimes attained. The eggs measure 4 by 3 mm.

According to McCoy the Murray lobster is brought to the Melbourne market from the Murray River in considerable numbers. In living specimens the anterior legs, the middle of the back, and the apices of the spines and tubercles are rich, creamy white or ivory color; the ground color of the other legs, sides of the carapace, and the abdomen pale prussian blue of varying shades of intensity in different individuals, or sometimes mottled with dull olive green. The semicorneous, flexible edges of the tail fin are brownish. Some specimens are olive green where the blue appears in others.

According to Haswell, "specimens from Mount Wilson differ from those from the Murrumbidgee in having the apical spine of the rostrum very short, the tubercles of the carapace blunt, and the tubercles of the abdomen small, the inner row being altogether rudimentary; the color of this variety is deep red, with bluish shades on the sides of the carapace and legs, as in Shaw's figure."

The telson of the specimen figured by Heller is more spiny than usual.

This species was first described by Shaw as *Cancer serratus*, a name already used by Forskål for a different animal, *Scylla serrata*. Following the American Ornithologists' Union Committee's code of nomenclature,¹ the name *serratus* must be discarded in favor of *spinifer* of Heller.

The number and arrangement of the gills are the same as in *A. franklinii*, as shown in the formula on page 669. But the inner wall of the stem of all the podobranchiæ, except the hindmost, develops a broad limb or ala, as in the genus *Cheraps*; this ala, however, bears long hair-like setæ in place of the hooked branchial filaments seen in *Cheraps*. In *A. franklinii* this ala is very rudimentary, in which regard that species shows again its affinity to *Astacoïdes madagascariensis*. The epipod of the first maxilliped bears a large number of hookless branchial filaments.

Genus CHERAPS Erichson.

Cheraps ERICHSON, Arch. f. Naturgesch., 12ter Jahrg., I, p. 101, 1846.

Type, *Astacus (Cheraps) preissii* Erichson.

Rostrum rather narrow, triangular, plane or even a little convex above, obscurely marginate, entire or obscurely toothed near the tip. Antennal scale broadly oval, or often broadly truncate at the distal end. Anterior process of epistome broadly triangular. Superior border of hand with a denticulated carina. Carapace and abdomen smooth, nearly free from spines and tubercles; areola narrow. Distal moiety of telson and of both branches of the posterior abdominal appendages membranaceous; median carina of inner branch of the latter terminating in a small spine near the middle of the segment; transverse suture of the outer branch halfway between the proximal and distal ends. Form cambaroid. Gills forty-two (one pair very small—almost rudimentary), disposed as shown in the following table:²

SOMITE.	PODOB-RANCHLÆ.	ARTHROBRANCHLÆ.		PLEUROBRANCHLÆ.		
		Anterior.	Posterior.			
VII.	0 (ep r)	0	0	0	= 0 (ep r)	
VIII.	1	1	0	0	= 2	
IX.	1	1	1	0	= 3	
X.	1	1	1	0	= 3	
XI.	1	1	1	1	= 4	
XII.	1	1	1	1	= 4	
XIII.	1	1	a1	1	= 4	
XIV.	0	0	0	1	= 1	
		6+ep r	6	5	4	= 21+ep r

a Very minute, almost rudimentary.

Habitat.—Australia.

¹ Canon XXXIII.

² The arrangement and structure of the branchial apparatus in *Cheraps* was first described by Huxley, from an undetermined specimen in the British Museum from the Yarra-Yarra River, Australia. From the locality, this specimen was presumably *Cheraps bicarinatus*. I have examined the branchial organs in specimens of *C. bicarinatus* in the Museum of Comparative Zoology and find that they agree in every respect with Huxley's description (Proc. Zool. Soc. London, 1878, pp. 768, 769, fig. 6). Erichson was manifestly wrong in saying that *Cheraps*, like *Cambarus*, lacked gills on the last thoracic somite.

CHERAPS PREISSII Erichson.

- Astacus (Cheraps) preissii* ERICHSON, Arch. f. Naturgesch., 12ter Jahrg., I, p. 101, 1846.
- ?*Astacoïdes plebejus* HESS, Arch. f. Naturgesch., 31ter Jahrg., I, p. 164, pl. VII, fig. 17, 1865.
- Astacus preissii* VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 617 (after Erichson).
- Astacopsis preissii* HASWELL, Cat. Australian Stalk and Sessile-eyed Crust., p. 177, 1882 (after von Martens).

Southwestern Australia (Erichson). Erichson's types could not be found in the Berlin Zoological Museum by Doctor von Martens in 1868. Victoria, Australia (No. 4356, Coll. Mus. Comp. Zool., one male).

The specimen in the Museum of Comparative Zoology agrees well with Erichson's diagnosis, so far as it goes. It shows a low postorbital ridge on each side of the gastric area, terminating anteriorly in a minute blunt tubercle. The rostrum is flat and punctate, lightly margined, the margins passing anteriorly into the short, triangular acumen without developing lateral spines or teeth. The areola is much broader than in *C. bicarinatus*, measuring 5.5 mm. in width (length of the whole animal, 109 mm.). The outer part of the upper surface of the hand is thickly sown with very large, deep pits. The fingers are strongly curved, the movable one armed within with a large, blunt tooth. The carpus bears a long and stout tubercle on its inner border; this tubercle is curved forward and is blunt at the end; there are, besides, a few low tubercles on the anterior border of the lower face of the carpus. The anterior process of the epistoma is bounded behind by a slight transverse furrow; its sides are very convex, and its anterior angle is produced so as to form a thin, vertical plate.

Hess's *Astacoïdes plebejus* came from Sydney, New South Wales. The shape of the large cheke, the breadth of the areola, and the color (yellowish, the large claws dusky) make it probable that this specimen was *Cheraps preissii*. The specimen (dry) of *C. preissii* in the Museum of Comparative Zoology has chelipeds of a very dark purplish color, in striking contrast with the yellow hue of the rest of the body. It is true that the deep, large pits seen on the cheke of *C. preissii* are ignored in both the description and the figure of *Astacoïdes plebejus*, and that the telson has a very different shape, if Hess's figure be correctly drawn. Ortmann treats *Astacoïdes plebejus* as a synonym of *Cheraps preissii*, but I think that Ortmann's specimen of *C. preissii* was in reality *C. bicarinatus*. (See below.)

CHERAPS BICARINATUS (Gray).

- Astacus bicarinatus* GRAY, Eyre's Journals of Expeditions of Discovery into Central Australia, I, p. 410, pl. III, fig. 2, 1845; List Crust. Brit. Mus., p. 72, 1847 (no description).
- Astacus bicarinatus* ERICHSON, Arch. f. Naturgesch., 12ter Jahrg., I, p. 376, 1846 (after Gray).

Astacus bicarinatus HESS, Arch. f. Naturgesch., 31ter Jahrg., I, p. 164, 1865 (after Gray; no description).

Astacus bicarinatus VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 617.

Astacoides bicarinatus MCCOY, Prod. Zool. Victoria, Decade III, pl. XXIX, 1879.

Astacopsis bicarinatus HASWELL, Cat. Australian Stalk- and Sessile-eyed Crust., p. 177, 1882 (after Gray).

Cheraps bicarinatus ORTMANN, Zoolog. Jahrb., Abth. f. Syst., VI, p. 7, pl. I, fig. 2, 1891; Semon's Zoolog. Forsch. in Australien, V, 1 Lief., p. 21 (Denkschr. med.-naturwissensch. Gesellsch. zu Jena, VIII), 1894.

? *Cheraps preissii* ORTMANN, Zoolog. Jahrb., Abth. f. Syst., VI, p. 8, pl. I, fig. 1, 1891.

Habitat.—Australia. Port Essington (Gray), Cape York (von Martens), Rockhampton (Ortmann), Manning River (Haswell), Sydney (Coll. Mus. Comp. Zool.), Murray River (von Martens), Melbourne (Coll. Mus. Comp. Zool.).

Gray's description and figure of *Astacus bicarinatus* (from Port Essington, northern Australia) do not apply very closely to the species now commonly known by this name. The wrist, for instance, is described and figured as "triangular, angularly produced in front;" the areola is too broad, and the account of the carinæ on the tail fin is not at all clear. Gray's type should be in the British Museum. In close connection with his description of *A. bicarinatus*, Gray notices a drawing brought home by Eyre, representing the "Ukodko," or smaller crayfish of the Murray River—undoubtedly the *Cheraps bicarinatus* of more recent authors. Gray's failure to identify the "Ukodko" with his own *Astacus bicarinatus* may have been due to the inaccuracy of the drawing, which showed no indications of the carinæ or postorbital ridges.

Cheraps bicarinatus attains to a length of about 6 inches. The rostrum is long triangular in outline, plane above, the margins slightly raised, commonly armed with a minute tooth on each side near the tip; but the lateral teeth are wholly wanting in some individuals. The postorbital ridges may terminate anteriorly in a blunt tubercle, or in others they may be quite free from any tendency to develop tubercle or spine. The areola is narrow, widening gradually from the anterior end backward. The antennal scale is very broad, broadest at the distal end, its inner margin very convex. In large specimens the dactylus of the chelipeds is equal in length to the inner margin of the palm, but in small specimens the fingers are commonly longer in proportion to the palm. The upper surface of the hand is sparsely and not very conspicuously punctate, the punctations being most evident on the outer half of this surface.

According to Mr. Eyre, as quoted by Gray, this crayfish (known to the aborigines of the Murray River district as the *Ukodko* or *Koongola*) "is found in the alluvial flats of the river Murray, in South Australia, which are subject to a periodical flooding by the river. It burrows deep below the surface of the ground as the floods recede and are dried up, and remains dormant until the next flooding recalls it to the surface. At

first it is in a thin and weakly state, but soon recovers and gets plump and fat, at which time it is most excellent eating. Thousands are procured from a small space of ground with ease, and hundreds of natives are supported in abundance and luxury by them for many weeks together. It sometimes happens that the flood does not occur every year, and in this case the eu-kod-ko lie dormant until the next, and a year and a half would thus be passed below the surface. I have often seen them dug out of my garden, or in my wheat field, by men engaged in digging ditches for irrigation. The floods usually overflow the river flats in August or September, and recede again in February or March."

This species has been well figured (in color) by McCoy. Different specimens vary considerably in color, "some having the body and abdomen dark olive, others paler or with a yellow tinge, and some are of a dull pale brown or horn color; the large anterior pair of claws are always blue, with red joints, and the flexible part of the five tail fins dull brown; the smaller pairs of legs are blue, or greenish, or whitish in different living individuals." According to the same author, this species is commonly known about Melbourne by the native name of *Yabber* or *Yabbie*. It does not inhabit the streams, "but is abundant in the quarry holes and swamps round Melbourne and in most water-holes in the colony, doing great damage to drains and reservoirs from burrowing holes through the banks. The individuals live for a long time underground in their burrows after the pools of water on the surface have dried up." Professor McCoy could detect no difference between specimens from the swamps near Melbourne and those of the Murray district.

As noted above, the lateral teeth near the tip of the rostrum are sometimes obsolete, and the proportional length of the fingers may vary according to the size of the specimen. It therefore seems to me probable that the specimen from Victoria in the Strasburg Museum assigned to *Cheraps preissii* by Ortmann is in reality *Cheraps bicarinatus*. The obsolescence of the lateral rostral spines is, in a few cases, accompanied by an appreciable shortening of the rostrum, but, after examining all the material before me, I can see no ground for forming two species.

List of specimens examined: Australia, eight males, four females (Coll. Mus. Comp. Zool.); Sydney, Australia, one male, one female (Coll. Mus. Comp. Zool.); Melbourne, Australia, two females (Coll. Mus. Comp. Zool.); no locality, one male, one female (Coll. Mus. Comp. Zool.); southern Australia, two males (Coll. U.S.N.M.); Happy Valley Creek, South Australia, two males (Coll. U.S.N.M.).

For convenience of reference I append a summary of the Australian and Tasmanian species of crayfish that are doubtful or that are unknown to me.

ASTACOPSIS NOBILIS (Dana).

Astacoides nobilis DANA, U. S. Explor. Exped., XIII, Pt. 1, p. 526, 1852; Atlas, pl. XXXIII, fig. 3, 1855.—HESS, Arch. f. Naturgesch., 31ter Jahrg., I, p. 164, 1865 (Göttingen Mus.).—HELLER, Reise der Novara, Zool. Th., II, Pt. 3, Crust., p. 101, 1865.

Astacus nobilis VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 616 (after Dana, Hess, and Heller).

Astacopsis nobilis HASWELL, Cat. Australian Stalk- and Sessile-eyed Crust., p. 175, 1882 (after Dana).

Habitat.—New South Wales? (Dana); Sydney, New South Wales (Heller, Hess).

Von Martens and Haswell incline to identify this species with *A. franklinii*; Huxley with *A. spinifera*. It seems to me more likely that it is a valid species, the Australian representative of the Tasmanian *A. franklinii*.

ASTACOPSIS PARAMATTENSIS Bate.

Astacopsis paramattensis BATE, Rep. "Challenger" Crust. Macrura, p. 202, pl. XXVII, fig. 1, 1888.

Habitat.—Paramatta River, Sydney, Australia (Bate).

Bate described this species from a single female specimen 94 mm. (about 3 $\frac{3}{4}$ inches) long, collected by the "Challenger" expedition. *Astacopsis spinifera* was collected at the same place (Paramatta River, Sydney), and I am inclined to think that *A. paramattensis* is nothing but a young, small specimen of *A. spinifera*. It can be demonstrated that among the *Parastacina*, as, for instance, in the genus *Paranephrops*, the heavy armature of spines or tubercles may be acquired only by large individuals, long after sexual maturity has been reached.

ASTACOPSIS SYDNEYENSIS Bate.

Astacopsis sydneyensis BATE, Rep. "Challenger" Crust. Macrura, p. 204, pl. XXVII, fig. 2, 1888.

Habitat.—Sydney, Australia (Bate).

Based on single female specimen in the "Challenger" collections, 50 mm. (about 2 inches) long. Probably an immature specimen of an *Astacopsis*, perhaps *A. spinifera*.

"ASTACUS" AUSTRALASIENSIS Milne-Edwards.

Astacus australasiensis MILNE-EDWARDS, Hist. Nat. des Crustacés, II, p. 332, pl. XXIV, figs. 1-5, 1837.—AUDOUIN ET MILNE-EDWARDS, Arch. du Mus. d'Hist. Nat., II, p. 36, 1841.

Astacus australiensis ERICHSON, Arch. f. Naturgesch., 12ter, Jahrg., I, p. 94, 1846 (after Milne-Edwards).—HELLER, Reise der Novara, Zool. Th., II, Pt. 3, Crust., p. 100, 1865.—VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 618 (after Milne-Edwards and Heller).

Astacopsis australiensis HASWELL, Cat. Australian Stalk- and Sessile-eyed Crust., p. 178, 1882 (after Milne-Edwards).

Habitat.—Australia (Milne-Edwards), Sydney, Australia (Heller). Length about 2 inches (Milne-Edwards), $2\frac{1}{4}$ inches (Heller). Color greenish (Heller, as also in Milne-Edwards's figure).

Probably an immature specimen of an *Astacopsis*, possibly *A. nobilis*.

“ASTACUS” TASMANICUS Erichson.

Astacus tasmanicus ERICHSON, Arch. f. Naturgesch., 12ter Jahrg., I, p. 94, 1846.—
VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 618.

Astacopsis tasmanicus HASWELL, Cat. Australian Stalk- and Sessile-eyed Crust., p. 178, 1882 (after von Martens).

Habitat.—Tasmania. Type in Berlin Zoological Museum, No. 1579, female (von Martens).

“ENGÆUS” FOSSOR Erichson.

Astacus (Engæus) fossor ERICHSON, Arch. f. Naturgesch., 12ter. Jahrg., I, p. 102, 1846.

Astacus fossor VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 618.

Engæus fossor HASWELL, Cat. Australian Stalk- and Sessile-eyed Crust., p. 178, 1882 (after von Martens).

Habitat.—Tasmania (Erichson, von Martens), Australia (von Martens). Types in Berlin Zoological Museum, Nos. 1123, 1124 (von Martens).

“ENGÆUS” CUNICULARIS Erichson.

Astacus (Engæus) cunicularis ERICHSON, Arch. f. Naturgesch., 12ter Jahrg., I, p. 102, 1846.

Astacus cunicularis VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 619.

Engæus cunicularis HASWELL, Cat. Australian Stalk- and Sessile-eyed Crust., p. 179, 1882 (after von Martens).

Habitat.—Tasmania (Erichson, von Martens). Type in Berlin Zoological Museum, No. 1122 (von Martens).

“ASTACOÏDES” PLEBEJUS Hess.

Astacöides plebejus HESS, Arch. f. Naturgesch., 31ter Jahrg., I, p. 164, pl. VII, fig. 17, 1865.

Astacus plebejus VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 616 (after Hess).

Astacopsis plebejus HASWELL, Cat. Australian Stalk- and Sessile-eyed Crust., p. 175, 1882 (after Hess).

Habitat.—Sydney, Australia (Hess). Type in Göttingen Museum (Hess).

This is probably a *Cheraps*—*C. preissii* Erichson, or else *C. bicarinatus* (Gray). (See p. 672.)

CHERAPS QUINQUE-CARINATUS (Gray).

Astacus quinque-carinatus GRAY, Eyre's Journals of Expeditions of Discovery into Central Australia, I, p. 410, pl. III, fig. 3, 1845; List. Crust. Brit. Mus., p. 72, 1847 (no description).—ERICHSON, Arch. f. Naturgesch., 12ter Jahrg., I, p. 376, 1846 (after Gray).—VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 616 (after Gray).

Astacopsis quinque-carinatus HASWELL, Cat. Australian Stalk- and Sessile-eyed Crust., p. 176, 1882 (after Gray).

Habitat.—Western Australia, near Swan River (Gray).

CHERAPS QUADRICARINATUS (von Martens).

Astacus quadricarinatus VON MARTENS, Monatsber. Akad. Wissensch. Berlin, 1868, p. 617.

Astacopsis quadricarinatus HASWELL, Cat. Australian Stalk- and Sessile-eyed Crust., p. 177, 1882 (after von Martens).

Habitat.—Cape York, Australia (von Martens). Type in Berlin Zoological Museum, No. 2972 (von Martens).

Genus PARANEPHROPS White.

Paranephrops WHITE, Gray's Zoolog. Miscell., No. 2, p. 79, 1842.

Type, *Paranephrops planifrons* White.

Rostrum triangular, upper surface plane or subplane, margins raised and armed with spines or teeth. Carapace more or less spiny or tuberculate (at least in large individuals). Chelæ more or less armed with spines and teeth. Form astacoid. Branchial formula:

SOMITE.	PODOBRANCHIÆ.	ARTHROBRANCHIÆ.		PLEUROBRANCHIÆ.	
		Anterior.	Posterior.		
VII.	0 (ep r)	0	0	0	= 0 (ep r)
VIII.	1	1	0	0	= 2
IX.	1	1	1	0	= 3
X.	1	1	1	0	= 3
XI.	1	1	1	1	= 4
XII.	1	1	1	1	= 4
XIII.	1	1	r	1	= 3+r
XIV.	0	0	0	1	= 1
	<hr/> 6+ep r	<hr/> + 6	<hr/> +	<hr/> 4+r	<hr/> + 4 = 20+r+ep r

Habitat.—New Zealand.¹

¹Huxley (Proc. Zool. Soc. London, 1878, p. 771) mentions two specimens of a *Paranephrops* in the British Museum, said to have come from the Fiji Islands. Mr. Edward J. Miers wrote to me, February 4, 1894, that he could not find any such specimens in the collection of the British Museum. Mr. Charles Chilton, of Christchurch, New Zealand, to whom I am indebted for a fine collection of the crayfishes of that country, has been at some pains to procure specimens of the fresh-water Crustacea of the Fijis, and he informs me that all the "crayfishes" have proved to be fresh-water prawns (*Palamon*). It is probable that the specimens of *Paranephrops* labelled "Fiji Islands" in the British Museum were assigned to the wrong locality.

PARANEPHROPS PLANIFRONS White.

Paranephrops planifrons WHITE, Gray's Zoolog. Miscell., No. II, p. 79, 1842; Dieffenbach's Travels in New Zealand, II, p. 267, 1843; List Crust. Brit. Mus., p. 72, 1847 (no description).

?*Paranephrops tenuicornis* DANA, U. S. Explor. Exped., XIII, Crust., Pt. 1, p. 527, 1852; Atlas, pl. XXXIII, fig. 4, 1855.

Paranephrops tenuicornis HELLER, Reise der Novara, Zoolog. Th., II, Pt. 3, Crust., p. 104, 1865.

Paranephrops planifrons MIERS, Zool. "Erebus and Terror," Crust., p. 4, pl. III, fig. 1, 1874; Cat. Stalk- and Sessile-eyed Crustacea of New Zealand, p. 72, 1876; Ann. Mag. Nat. Hist., 4th ser., XVIII, p. 413, 1876; Trans. and Proc. New Zealand Inst., IX, p. 476, 1877.

Paranephrops planifrons HUXLEY, Proc. Zool. Soc. London, 1878, p. 770.

Paranephrops planifrons CHILTON, Trans. and Proc. New Zealand Inst., XXI, pp. 242, 249, pl. x, figs. 1-3, 1888.

Types in British Museum (White, Miers).

Paranephrops planifrons is a very puzzling species. The type locality is the river Thames, North Island, New Zealand. In specimens from Puriri Creek, a tributary of the Thames, the rostrum tapers off into a long and sharp acumen, which overreaches the distal end of the antennular peduncle. Each side of the rostrum is armed with three teeth, which are produced into long spine-like points. In one of the five specimens before me there are four spines on the right side, three on the left; the lower side of the rostrum is furnished with one or two spines. The antennal scale is long, and diminishes in width from the basal third to the tip; it exceeds the rostrum in length. The postorbital ridge is interrupted between the two sharp spines with which it is armed. A median ridge runs along the gastric area, reaching forward as far as the anterior pair of postorbital spines, but not continued on the rostrum. There are two or three sharp spines on each side of the carapace, just behind the cervical groove, besides several more on the hepatic and pterygostomial regions. The areola is very short and broad—not much over one-third as long as the distance from the cervical groove to the tip of the rostrum. The abdominal pleuræ are bluntly angulated. The hand is long and narrow, its superior and inferior margins nearly straight, parallel, and armed with a double row of spines—those on the superior margin the longest. The inner and outer faces of the hand are convex and sparsely armed with spines, the largest of which are disposed in a median longitudinal row on each face.

Specimens from Karaka, Manukau Harbor (near Auckland), are altogether similar to typical examples from the Thames. The largest of these (an ovigerous female) measures 8.3 mm. from tip of rostrum to end of telson.

Individuals from localities south of the Thames basin, from the lake called Roto-Iti (North Island) southward to Cook Strait and beyond, differ almost constantly from the typical form in having a shorter rostral acumen, shorter lateral rostral teeth, shorter and broader antennal

scale; the areola, or, in other words, the posterior section of the carapace, is much longer, being nearly one-half as long as a line drawn from the cervical groove to the anterior end of the rostrum; the hand, too, is provided with shorter fingers and the lower half of the hand is more heavily tuberculate both on the inner and outer faces. The number of lateral rostral spines varies from three to five on each side; the number of inferior spines on the rostrum is one or two. In large specimens from Roto-Iti and Napier the sides of the carapace are thickly set with blunt tubercles which become spiny only on the hepatic and pterygostomian regions, and along the cervical suture; but in similarly large examples from Nelson (South Island) all the tubercles, even those on the branchial regions, tend to assume the form of sharp spines. Finally, in individuals collected at Wellington and in Pelorus River, Marlborough (localities on opposite sides of Cook Strait), a tendency is manifested to variation in the direction of *Paranephrops zealandicus*, inasmuch as the lateral rostral spines are increased in number and reduced to short, blunt teeth, and the antennal scale is short and broad, broadest at the middle, with very convex internal border. The largest of these specimens is only 73 mm. long. The number of lateral rostral spines varies between three and eight on each side, the average number being five. The lower side of the rostrum is in many cases destitute of teeth. In three out of the four specimens from Pelorus River the median carina of the carapace is very prominent, and extends forward from the gastric area half way to the tip of the rostrum. Usually in *P. planifrons* it runs forward only as far as the anterior postorbital spines.

The most southern locality where *P. planifrons* has been found is Greymouth, on the western side of the South Island.

It thus appears, as was first pointed out by Mr. Chilton, that *P. planifrons* is a variable species distributed throughout the whole length of the North Island (where it is the only species found) and through the northern part of the South Island as far south as Greymouth. Hence it would seem, in the words of Mr. Chilton, "that Cook Strait has not proved so great, or rather so old a barrier to these crayfish as the mountains in Nelson forming the northern continuation of the Southern Alps. As this point seemed to be of some importance in connection with the geographical distribution of the fauna of New Zealand, and as I was ignorant of the configuration of that part of the South Island, I applied to Professor Hutton for information. With his characteristic kindness and promptness, he at once told me that there was no great division (by mountains, that is,) between Nelson and Greymouth, but that the first great division would be along the Kaikoura Mountains and across westerly to Mount Franklin, and then down the Spencer Mountains and the Southern Alps; though the part between the Kaikoura Mountains and Mount Franklin is much broken by rivers, some running north and some south. He also told me that several North Island plants extend to Nelson and down the

west coast to Westport and Greymouth. Another fact pointing in the same direction is found in the distribution of *Armadillo speciosus*, a terrestrial isopod. This is known from the North Island (Bay of Islands, Dana, and Wellington, Hutton), and I have specimens from Nelson; but I have never heard of it occurring in the southern part of the South Island." On either side of Cook Strait (Wellington, Pelorus River) specimens were found which show a marked approach in the form of the rostrum, antennal scale, etc., to *P. zealandicus*.

Paranephrops tenuicornis Dana, from fresh-water streams about the Bay of Islands, northern New Zealand, is described as having a short point or tooth on the inner border of the antennal scale, near the apex, and the lower margin of the hand spinuli-scabrous, but not seriatly spinous. It is probably the same species as *P. planifrons*.

List of specimens examined:

Karaka, Manukau Harbor (North Island), four males, three females (Colls. Mus. Comp. Zool. and Dunedin Mus.); Puriri Creek, River Thames (North Island), three males, four females (Colls. Mus. Comp. Zool. and Dunedin Mus.); Roto-Iti (North Island), eight males, one female (Colls. Mus. Comp. Zool. and Dunedin Mus.); Napier (North Island), one male, one female (Coll. Dunedin Mus.); Wellington (North Island), three males, four females, four young (Coll. Dunedin Mus.); Pelorus River (South Island), two males, three females (Coll. Dunedin Mus.); Nelson (South Island), three males, two females (Colls. Mus. Comp. Zool. and Dunedin Mus.); Greymouth (South Island), one female (Coll. Dunedin Mus.).

PARANEPHROPS ZEALANDICUS (White).

Astacus zealandicus WHITE, Proc. Zool. Soc. London, Pt. 15, p. 123, 1847; List Crust. Brit. Mus., p. 72, 1847 (no description); Ann. Mag. Nat. Hist., 2d ser., I, p. 225, 1848; Zool. "Erebus and Terror," pl. II, fig. 2, 1874.

Paranephrops zealandicus MIERS, Zool. "Erebus and Terror," Crust., p. 4, 1874.

Paranephrops zealandicus MIERS, Cat. Stalk- and Sessile-eyed Crust. of New Zealand, p. 73, 1876; Ann. Mag. Nat. Hist., 4th ser., XVIII, p. 413, 1876; Trans. and Proc. New Zealand Inst., IX, p. 476, 1877.

Paranephrops neo-zealanicus CHILTON (in part), Trans. and Proc. New Zealand Inst., XXI, p. 249, 1888.

Types in British Museum (Miers).

In *P. zealandicus* the chela is much shorter and broader than in *P. planifrons*, and it is furnished with conspicuous dense tufts of silky hair, disposed in longitudinal rows. The upper margin of the hand is armed with a series of prominent spines, continued as a double row on the margin of the dactylus. The lower margin of the hand is furnished with a double row of shorter spinous teeth. The outer face of the hand is provided with a few tubercles, which seldom develop any spinous points; the inner face bears two longitudinal rows of short teeth. The rostrum is armed on each side with small, blunt teeth, usually five in number, but in some individuals three, four, or six; the inferior edge is either unarmed or else provided with one or two acute teeth; a median carina runs over the gastric area, ceasing abreast of the ante-

rior pair of postorbital spines, the rostrum proper being wholly destitute of a median dorsal keel. In small specimens the sides of the carapace are smooth, or at the most reveal only the slightest trace of low, rounded papillæ; but in large specimens, that have attained a length of 115 mm. or more, the sides of the carapace are thickly studded with rounded tubercles. The antennal scale is rather short, and it is broadest in the middle.

White does not state from what part of New Zealand his type specimens came. These are still in the British Museum, and belong to this form, judging from the figure in the Zoology of the "Erebus and Terror," and from Miers's brief notice of them,¹ rather than to the following species, *P. setosus*.

List of specimens examined:

Near Dunedin (South Island), ten males, thirteen females (Colls. Mus. Comp. Zool. and Coll. Dunedin Mus.); Oamaru (South Island), one male (Coll. Dunedin Mus.).

According to Chilton,² *P. zealandicus* has been found in the western tributaries of the Waiau (in the southwestern part of Otago) and in Stewart Island.

Of a series of specimens collected in a small valley at Sawyer's Bay, near Dunedin, sent to me by Mr. Charles Chilton, some were taken from small streams affording a small flow of water, while others were captured in a little reservoir, not more than ten feet deep, formed by damming up one of the small streams. The maximum length attained by the individuals inhabiting the streams is about 84 mm. These specimens are sexually mature, as is shown by the fact that some of the females carry young beneath the abdomen. In all these examples from the small streams the carapace is well-nigh destitute of spines and tubercles. The specimens from the reservoir, on the contrary, are all very large, attaining a length of 118 to 158 mm., and heavily tuberculated on the sides of the carapace, the tubercles having the form of prominent, smooth, rounded papillæ.

PARANEPHROPS SETOSUS Hutton.

Paranephrops setosus HUTTON, Ann. Mag. Nat. Hist., 4th ser., XII, p. 402, 1873.

Paranephrops setosus MIERS, Cat. Stalk- and Sessile-eyed Crust. New Zealand, p. 72, 1876; Ann. Mag. Nat. Hist., 4th ser., XVIII, p. 413, 1876; Trans. and Proc. New Zealand Inst., IX, p. 476, 1877.

Paranephrops horridus "S[EMPER ?] MS.," MIERS, Cat. Stalk- and Sessile-eyed Crust. New Zealand, p. 73, 1876.

?*Astacoides tridentatus* WOOD-MASON, Proc. Asiatic Soc. Bengal, 1876, p. 4.

?*Astacoides zealandicus* WOOD-MASON, Ann. Mag. Nat. Hist., 4th ser., XVIII, p. 306, 1876.

Paranephrops setosus CHILTON, Trans. and Proc. New Zealand Inst., XV, p. 150, pls. XIX-XXI, 1882.

Paranephrops neo-zealandicus CHILTON (in part), Trans. and Proc. New Zealand Inst., XXI, pp. 246, 249, pl. X, figs. 1a, 2a, 1888.

¹ Ann. Mag. Nat. Hist., 4th ser., XVIII, p. 413, 1876.

² Trans. New Zealand Inst., XXI, p. 241, 1888.

Paranephrops setosus is nearly related to *P. zealandicus*, but may be distinguished by the following characters: The cephalothorax is more oval than in *P. zealandicus*, owing to the bulging of the sides of the carapace; the sides of the carapace are thickly strewn with acute, forward-turned spines, which take the place of the rounded tubercles in *P. zealandicus*. The rostrum and antennal scale are longer, the lateral rostral teeth longer and more spiniform; the rostrum is furnished with an evident median keel, most prominent on the distal half of the rostrum (in *P. zealandicus* there is a gastric keel, but no keel on the rostrum). These characters are manifest even in small specimens not more than 65 mm. in length, although in them the carapacial spines are much reduced in number—limited, indeed, to the hepatic area and the parts near the cervical groove. In *P. zealandicus* of a similar size the carapace is smooth.

The number of spines on each side of the rostrum varies between three and six. In every specimen I have examined there is at least one spine on the under side of the rostrum; in several individuals there are two, in one individual three.

The largest specimen before me is 145 mm. long.

When Professor Hutton described *P. setosus* he was apparently unacquainted with White's description of *P. zealandicus*,¹ and his type material probably included both the present species and *P. zealandicus*, for he gives as the habitat of *P. setosus* "stream near Invercargill, Province of Otago, and the river Avon, near Christchurch, Canterbury." The form from Invercargill is presumably (from what we know of the distribution of the New Zealand crayfishes) *P. zealandicus*. This is rendered the more certain in that Chilton² tells us that a large specimen in the Otago Museum, labeled *P. setosus* by Professor Hutton himself, has a cylindrical carapace, furnished with numerous rounded tubercles—features peculiar to large specimens of *P. zealandicus*. Hutton's description, however, seems to have been drawn up from the Avon River form, to which the name *setosus* may be properly restricted. I have received specimens of *P. setosus* (*sensu strictiori*) from Mr. Chilton, collected in the neighborhood of Christchurch, in the Avon and Heathcote rivers, and one pair taken at Rangiora, fifteen or twenty miles north of Christchurch.

Mr. Chilton³ considers *P. zealandicus* and *P. setosus* to be one and the same species. As far as can be determined from the material at my disposal, the two species are perfectly distinct, even young, very small specimens being easily distinguishable.

List of specimens examined:

River Avon, Christchurch, New Zealand (South Island), four males, four females (Coll. Mus. Comp. Zool. and Coll. Dunedin Mus.); river Heathcote, near Christchurch, New Zealand (South Island), one male,

¹ Chilton, Trans. New Zealand Inst., XXI, p. 237.

² Ibid., p. 248.

³ Ibid., p. 238.

three females (Coll. Mus. Comp. Zool. and Coll. Dunedin Mus.); Rangiora, New Zealand (South Island), one male, one female (Coll. Dunedin Mus.).

Genus PARASTACUS Huxley.

Parastacus HUXLEY, Proc. Zool. Soc. London, 1878, p. 771.

Type, *Astacus pilimanus* von Martens.

Form cambaroid. Rostrum of moderate width, rather flat above, marginate, entire or armed with a pair of denticles near the tip. Antennal scale broad. Anterior process of epistome broadly triangular. Superior margin of hand not carinate. Carapace and abdomen smooth (without prominent spines or tubercles). Telson and posterior pair of abdominal appendages more or less membranaceous at distal end, but no sharp line of demarcation between the membranaceous and calcified portions. Median carina of inner branch of the posterior abdominal appendages terminating not far from the posterior border (usually in a small spine); transverse suture of outer branch one-third way from the posterior border. Gills forty, arranged as shown in the subjoined table:

SOMITE.	PODOBRANCHLE.	ARTHROBRANCHLE.		PLEUROBRANCHLE.			
		Anterior.	Posterior.				
VII.	0 (ep r or ep)	0	0	0	=	0 (ep r or ep)	
VIII.	1	1	0	0	=	2	
IX.	1	1	1	0	=	3	
X.	1	1	1	0	=	3	
XI.	1	1	1	1	=	4	
XII.	1	1	1	1	=	4	
XIII.	1	1	r	1	=	3+r	
XIV.	0	0	0	1	=	1	
	6+ep r or ep	+6	+	4+r	+	4	= 20+r+ep r or ep

Habitat.—South America (and Mexico?).

Von Martens¹ notes the existence of a pair of genital orifices on the basal segment of the third pair of legs in a male *Parastacus pilimanus* and in a male *P. brasiliensis*. The coexistence of sexual orifices in both the third and fifth pairs of legs of the same individual appears to be the normal condition in the burrowing species of *Parastacus*. I have found it in every specimen of the following species examined: *P. saffordi*, *P. varicosus*, *P. defossus*, and *P. hassleri*. In most cases the vulvæ are closed by a chitinous membrane.

PARASTACUS SAFFORDI, new species.

(Plate LXVIII.)

Rostrum of moderate length, plane above, with raised toothless margins, which extend backward for a short distance on the gastric area inside the postorbital ridges; margins parallel throughout their basal third, then gradually converging to the acute, depressed acumen; the end of the rostrum reaches to the distal end of the antennular peduncle; infero-lateral margins fringed with long cilia. Cephalo-thorax laterally compressed. Postorbital ridges continuous, parallel with each

¹Sitzungs-Berichte der Gesellschaft naturforschender Freunde zu Berlin, 1870, p. 3.

other except posteriorly, where they converge; they are armed anteriorly with a minute spine. Anterior border of the carapace produced to form a short subocular spine. Branchiostegian spinule minute. Cervical groove sinuous. Areola broad, about one-half as long as the anterior section of the carapace. The branchio-cardiac lines form a slightly raised, blunt ridge in the anterior part of their course. Sides of carapace granulate; no lateral spines. Abdomen longer than cephalothorax, pleurae broadly rounded. Telson truncate, with posterior corners rounded; a pair of lateral spines about two-thirds the way from the proximal to the distal ends. Anterior process of epistome broad, separated from the posterior part by a transverse furrow, sides slightly convex, apex blunt.

Antennae rather short; proximal segment armed with one small spine external to the orifice of the green gland; two more small spines on the external side of the antenna, one at the base of the scale, the other farther forward and at a lower level; antennal scale short and broad, broadest at the middle, internal border very convex, external border inflated and terminated by a small spine. Third maxillipeds densely bearded. Chelipeds of moderate length; margins of merus spinulose, lower face spinuloso-granular, as is also the distal part of the inner face; carpus triangular, upper border and inner face thickly set with small spiniform tubercles, outer face squamoso-tuberculous; chela of moderate length, symmetrical, inflated, ornamented with low squamous tubercles on the superior and inferior margins, outer face nearly smooth, inner face clothed with long hairs; fingers longer than the palm, incurved, their inner faces excavated, bearded, cutting edges denticulate, with one prominent denticle on each finger—the one on the movable finger proximad of the one on the immovable finger; tips acute.

Length 90 mm.; carapace 42 mm.; from tip of rostrum to cervical groove 28 mm.; from cervical groove to posterior border of carapace 14 mm.; length of abdomen 45 mm.; width of areola 5 mm.; length of cheliped 59 mm.; merus 16 mm.; length of chela 25 mm.; breadth of chela 11 mm.; length of dactylus 15 mm.

Habitat.—Montevideo, Uruguay. W. E. Safford, U. S. S. "Vandalia." (No. 12581, Coll. U.S.N.M.) Three specimens. There is also a small specimen in the collection of the Philadelphia Academy of Sciences labeled, "Brazil" (No. 287 Guérin Coll.). According to the manuscript label accompanying the specimens in the United States National Museum, they were found in burrows one hundred meters from the coast and two meters deep, in strata of sand covered by soil.

This species is allied to *Parastacus pilimanus*¹ and *P. brasiliensis*.²

¹ *Astacus pilimanus* VON MARTENS, Arch. f. Naturgesch., 35ter Jahrg., I, p. 15, pl. II, figs. 1, 1b, 1869.—*Parastacus pilimanus* HUXLEY, Proc. Zool. Soc. London, 1878, p. 771. *Habitat*.—Porto Alegre, and also Santa Cruz, in upper part of the Rio Pardo basin, tributary of the Jacuhy, Brazil. Types in Berlin Zool. Mus., Nos. 3323, 3447 (von Martens).

² *Astacus brasiliensis* VON MARTENS, Arch. f. Naturgesch., 35ter Jahrg., I, p. 16, pl. II, figs. 2, 2b, 1869.—*Parastacus brasiliensis* HUXLEY, Proc. Zool. Soc. London, 1878,

PARASTACUS VARICOSUS, new species.

(Plate LXIX.)

Similar to *P. saffordi*, but different in the following particulars: The branchio-cardiac lines bounding the areola are elevated so as to form very prominent, rounded ridges, serrated externally; these ridges run a short distance down the cervical groove in front, but cease before reaching the hind border of the carapace. The cheliped is very much longer than in *P. saffordi*; the distal end of the merus, which in the latter species only reaches to the subocular angle, in *P. varicosus* attains to the level of the rostrum; the hand, too, is very much longer, and different in outline, the superior and inferior margins being straight instead of convex, while the external face is beveled off so as to form a nearly flat field, oblique to the vertical plane of the hand, on each side of a low, blunt, longitudinal keel, which runs from the carpal joint to the base of the thumb. In *P. saffordi* the superior and inferior margins of the hand are distinctly convex, the external face swollen and roundish. The dorsal surface of the rostrum is conspicuously pitted in *P. varicosus*, obscurely or not at all pitted in *P. saffordi*. The anterior ventral margin of the proximal antennal segment is armed with two spines in the former species; one of these spines lies in front of the orifice of the green gland, the other at the external angle of the segment. In *P. saffordi* only one of these spines exists—the one at the external angle of the segment. The posterior border of both branches of the swimmerets has a more truncate outline in *P. varicosus* than in *P. saffordi*.

Length 100 mm.; carapace 49 mm.; from tip of rostrum to cervical groove 34 mm.; from cervical groove to posterior border of carapace 15 mm.; abdomen 52 mm.; width of areola 5 mm.; cheliped 91 mm.; merus 24 mm.; length of chela 40 mm.; breadth of chela 13 mm.; length of dactylus 22 mm.

The number and arrangement of the branchial organs are exhibited in the subjoined table:

SOMITE.	PODOBRANCHIÆ.	ARTHROBRANCHIÆ.		PLEUROBRANCHIÆ.		
		Anterior.	Posterior.			
VII.	0 (ep r)	0	0	0	=	0 (ep r)
VIII.	1	1	0	0	=	2
IX.	1	1	1	0	=	3
X.	1	1	1	0	=	3
XI.	1	1	1	1	=	4
XII.	1	1	1	1	=	4
XIII.	1	1	r	1	=	3 + r
XIV.	0	0	0	1	=	1
	$\overline{6 + ep\mathit{r}}$	$\overline{+ 6}$	$\overline{+ 4 + r}$	$\overline{+ 4}$	=	$\overline{20 + r + ep\mathit{r}}$

The epipod of the first maxillipeds bears about twenty gill filaments on the upper half of its external face. The posterior arthrobranchia

p. 771; The Crayfish, p. 250, fig. 64, 1880.—ORTMANN, Zoolog. Jahrb., Abth. f. Syst., VI, p. 9, 1891. *Habitat*.—Southern Brazil: Porto Alegre and near Rödgersberg (von Martens), Rio Grande do Sul, São Lourenço (Ortmann). Types in Berlin Zoolog. Mus., Nos. 3322, 3448 (von Martens).

of the thirteenth somite is reduced to a small, simple filament. The podobranchiæ are alate and the alæ are provided with hooked tubercles similar to those of the *Astacine*. The coxopoditic setæ are long and hooked at the end.

Habitat.—Colima, Mexico. J. Xantus. (No. 4133, Coll. U.S.N.M.) One specimen.

The locality is notable as being the only one north of the equator where Parastacine crayfishes occur. Furthermore, the close affinity between this species and a native of Uruguay (*Parastacus saffordi*) is surprising. But beyond this there appears to be no reason to discredit the legend which accompanies the type specimen of *P. varicosus* in the United States National Museum.

PARASTACUS DEFOSSUS, new species.

(Plate LXVII, figs. 3, 4.)

Cephalo-thorax laterally compressed, the sides high and nearly vertical. Anterior segment of abdomen small. Rostrum small, triangular, deflexed, plane above, lateral borders slightly marginate, strongly converging from the base to the blunt tip which hardly reaches to the proximal end of the third antennular segment. The margins of the rostrum are prolonged backward for a short distance on the gastric area, where they tend to fuse with the anterior end of the postorbital ridges. The latter are but slightly marked, unarmed, strongly divergent in their backward course. The suborbital angle is prominent, but perfectly rounded off. The dorsal surface of the carapace is smooth, polished, and sparsely punctate, the lateral walls lightly granulate. The areola is very long and narrow, the gastric area proportionally short. Abdominal pleuræ rounded, telson long, posteriorly oval in outline. Anterior process of epistome rather long, but slightly separated from the body of the epistome by transverse suture; anteriorly truncate. Antennæ about equal in length to the cephalo-thorax; scale small, broad, broadest near the distal end, external border terminating in a long, stout spine directed a little outward; a blunt spine or tubercle on the lower side of the first antennal segment, just in front of the orifice of the green gland; no external spine at base of the scale. Third maxillipeds hairy within. Chelipeds symmetrical; merus trigonal, outer face smooth, inferior edges serrate, superior edge armed with one blunt tooth near the distal end; carpus broadly triangular, internal border armed with a single series of blunt teeth which increase in size toward the distal end of the segment; hand short and broad, the palm as broad as long, outer face convex, smooth, with scattering coarse puncta, superior (or internal) margin ornamented with a low crest of squamous, setiferous tubercles, inferior border similarly adorned with single row of tubercles running from the proximal end of the hand as far as to the base of the immobile finger, where they are replaced by shallow pits; dactylus equal in length to the breadth of the hand, upper margin rounded, with a single

row of confluent pits, outer face with a longitudinal furrow just below the superior margin; cutting edges of the fingers armed with a few blunt teeth near the proximal end. The inner branch of the last pair of abdominal appendages bears a longitudinal median rib, which runs nearly to the posterior margin of the segment, but this rib does not end in a spine as it usually does in the crayfishes.

Length 47 mm.; length of carapace 23.5 mm.; from tip of rostrum to cervical groove 15 mm.; from cervical groove to hind border of carapace 9.3 mm.; breadth of areola 1.75 mm.; length of cheliped 31 mm.; length of merus 9 mm.; length of carpus 6 mm.; breadth of carpus 6 mm.; length of chela 13.5 mm.; breadth of chela 8 mm.; superior margin of propodite 6.2 mm.; length of dactylus 8 mm.

Habitat.—Montevideo, Uruguay. W. E. Safford, U. S. S. "Vaudalia." (Coll. U.S.N.M.) Three specimens. Taken, together with *P. saffordi*, in burrows two meters deep, one hundred meters from the coast, in strata of sand covered by soil.

Parastacus defossus is a species whose appearance clearly reveals its subterranean mode of life, like *Cambarus diogenes* of the United States and the so-called *Engaei* of Tasmania. It has some affinity with *P. brasiliensis* of southern Brazil, a species not especially fossorial in habit, but found in brooks and springs. *P. defossus* is easily distinguished from *P. brasiliensis* by the extreme lateral compression of the cephalo-thorax, the small size of the anterior end of the abdomen, the strong convergence of the lateral margins of the rostrum, the length and narrowness of the areola, the shape of the chela (which is much shorter and broader than in *P. brasiliensis*), the long oval outline of the telson, etc.

PARASTACUS HASSLERI, new species.

(Plate LXX, figs. 1-3.)

Cephalo-thorax narrow. Rostrum rather short, reaching nearly to the distal end of the second segment of the antennular peduncle; upper surface slightly excavated, with raised, toothless margins convergent from the base to the blunt (sometimes truncate) extremity. Postorbital ridges slightly marked, strongly divergent from before backward, not confluent with the margins of the rostrum, inflated at the posterior end so as to form a low tubercle. Wall of the orbit produced to form a prominent angle under the eye, but not armed with a spine. Dorsal surface of carapace smooth, polished, nearly free from impressed dots over the gastric area, areola rather narrow, its field thickly strewn with impressed dots; a group of six to nine small, blunt tubercles on the anterior part of the lateral walls of the carapace; branchial regions lightly granular. Distance from tip of rostrum to cervical groove about twice the length of the areola. Abdominal pleuræ rounded. Hind border of telson rounded, lateral spines obsolescent. Anterior process of epis-

tome triangular, bounded behind by a transverse furrow, apex sub-acute. Basal segment of antenna devoid of spines, neither is there any trace of an external spine at the base of the antennal scale; the latter is small, broad, its inner border rounded, its outer border terminating in a long, stout, straight tooth or spine. Third maxillipeds hairy within. Chelipeds long, usually symmetrical on the two sides of the body, but in some individuals distinctly unsymmetrical; upper margin of merus lightly serrate, without any prominent tooth; lower margins armed with a row of small, blunt teeth or tubercles, lower face more or less tuberculous, inner and outer faces smooth; carpus short, triangular, superior internal margin with a series of small obsolescent teeth or tubercles; there is also a short row of similar teeth near the external lower angle of the carpus, near the point of articulation with the chela; chela large and powerful, palm inflated, outer and inner faces smooth, superior margin nearly straight, adorned with low, squamous tubercles which are irregularly disposed in two rows; the inferior margin of the hand is convex, and is similarly ornamented with biserial, depressed obsolescent tubercles which cease at the base of the immobile finger. The fingers are conspicuously marked with longitudinal rows of pits, three rows on each finger; the cutting edges are irregularly toothed, two teeth on the movable finger and three on the immovable finger; the fingers are not conspicuously bearded. The median carina of the inner branch of the posterior pair of abdominal appendages ends near the hind margin without developing a spine.

Dimensions of a specimen: Length 96 mm.; carapace 48 mm.; from tip of rostrum to cervical groove 32 mm.; from cervical groove to posterior border of carapace 15.5 mm.; width of areola 4.5 mm.; length of cheliped 86 mm.; length of merus 22 mm.; length of carpus 17 mm.; breadth of carpus 1.3 mm.; length of chela 39.5 mm.; breadth of chela 18 mm.; length of dactylus 25 mm.

In the number and arrangement of the branchial organs, *Parastacus hassleri* agrees with *P. varicosus*.¹ The epipod of the first maxilliped bears gill filaments, as in the latter species, the podobranchiæ have narrow alæ, the posterior arthrobranchia of the thirteenth somite is reduced to a small filament which bears a single lateral branch. The coxopoditic setæ are long and hooked at the end.

Habitat.—Talcahuano, Chile, No. 3401, Coll. Mus. Comp. Zool., (Hassler Exped., April, 1872). One hundred specimens.

Astacus chilensis Milne-Edwards,² from "the coast of Chile," is not described with enough detail to be determinable. The type, however, may be still extant in Paris. It is said to bear a close resemblance to *Astacus australasiensis* Milne-Edwards,³ but to differ from the latter species in having a shorter rostrum, a carpus destitute of teeth or

¹Page 685.

²Hist. Nat. des Crustacés, II, p. 333, 1837.

³Ibid., II, p. 332, pl. XXIV, figs. 1-5, 1837.

tubercles, hands swollen, rounded above and below, slightly tuberculate on their upper margin, and scarcely punctate. The anterior process of the epistome is shaped as in *Astacus astacus*, but it is separated from the body of the epistome by a transverse furrow. Length about three inches. It would seem from Milne-Edwards's diagnosis and from the same author's description and figure of *Astacus australasiensis* that, whatever *Astacus chilensis* may prove to be, it is neither of the two Chilean crayfishes described in this paper. In 1849, Nicolet¹ described and figured as *Astacus chilensis* Milne-Edwards, a species of crayfish found "in the rivers of Chile"—a species manifestly distinct from Milne-Edwards's. For, not to mention other peculiarities, the carpus is described and figured by Nicolet as furnished with a crest of blunt, tuberculiform teeth on its inner border, whereas Milne-Edwards distinctly says that there are neither teeth nor tubercles upon the carpus of *A. chilensis*. I therefore propose to call Nicolet's crayfish *Parastacus nicoletii* (= *Astacus chilensis* Nicolet nec Milne-Edwards).

Parastacus hassleri is similar to *P. nicoletii*. That both of them are fossorial in their habits is evinced by the marked compression of the cephalo-thorax, small size of the first abdominal segment, etc. The following comparison will make clear the chief specific differences between the two species: In *P. nicoletii* the anterior part of the sides of the carapace is covered with fine spinules; in *P. hassleri* these spinules are replaced by a small group of blunt tubercles. In *P. nicoletii* the rostrum does not overreach the proximal end of the second segment of the antennular peduncle; it is quadrate in form, with straight and parallel lateral margins, its upper surface deeply concave. In *P. hassleri* the rostrum is longer, attaining almost to the distal extremity of the second segment of the antennular peduncle; its upper surface is but lightly hollowed out, while its lateral borders are distinctly convergent from the base forward. The carpus of *P. nicoletii* is furnished with a conspicuous crest of rounded, tuberculiform teeth along its inner superior border, and the outline of the opposite, lower or external border is extremely convex or protuberant. In *P. hassleri* the tubercular crest is obsolete, being represented merely by a few lightly pronounced denticles; the lower or external border is but slightly convex, whereby the carpus comes to have a triangular outline. Finally, the hand of *P. hassleri* is much longer than that of *P. nicoletii*, its upper border longer, straighter, and less strongly tuberculate, the fingers less deeply sulcated.

According to Nicolet, crayfishes are found in the rivers, brooks, and even in the forests, of southern Chile, where they live in holes in the ground, around the entrance of which they construct earthworks in the shape of a cone nearly a foot in height. As is well known, *Cambarus diogenes* Girard, erects similar mud towers or "chimneys" in the

¹Gay's *Historia Física y Política de Chile, Zoología*, III, p. 211; *Atlas*, II, *Crustáceos*, pl. 1, fig. 4.

United States, and Mr. P. R. Uhler tells me that *Cambarus dubius* Faxon, has the same habit in western Virginia.¹ Titian R. Peale informed Girard² that he had observed mud chimneys, altogether similar to those of *C. diogenes*, along the Rio Magdalena in New Grenada, several hundred miles from the seashore. But the builders of these chimneys in New Grenada still remain unknown to science. In this connection it is worthy of note that the earliest mention of adobe towers, erected at the mouth of Crustacean burrows, occurs in Molina's work on the natural history of Chile,³ page 208: "I gamberi fluviali più rimarchevoli sono i *Muratori*, *Cancer cæmentarius*,⁴ i quali hanno circa otto pollici di lunghezza; il lor colore è bruno rigato di vene di un rosso vivo, e la carne bianca e più saporosa di quella de' gamberi marini e degli altri fluviali. Questi si trovano in gran quantità in tutti quei fiumi e rivi, nei margini dei quali essi si fabbricano con dell' argilla un' abituro cilindrico alto un mezzo piede sopra il terreno, ma profondo di maniera che l' acqua corrente vi passa per mezzo di un canaletto sotterraneo."⁵

Pöppig considered the *Cancer cæmentarius* of Molina to be a common edible prawn of Chile, *Palæmon (Bithynis) cæmentarius* Pöppig.⁶ This prawn is said to dig deep holes in the clayey banks of the Chilean rivers near the sea, closing up the mouths of the holes with mud. Molina's description of the mud tenements of *Cancer cæmentarius* vividly recalls the "chimneys" constructed by fossorial crayfishes. The character "*rostro obtuso*," moreover, applies better to *Parastacus nicoletii* or *P. hassleri* than to *Palæmon cæmentarius* Pöppig, although the rostrum of the latter is obliquely truncated at the tip. On the other hand, the aculeate claws and the length of *C. cæmentarius* point rather to the *Palæmon*.

PARASTACUS AGASSIZII, new species.

(Plate LXX, figs. 4, 5.)

Body robust, subcylindrical, first abdominal somite of normal size. Rostrum long, triangular, slightly surpassing the antennular peduncle, and attaining the distal end of the antennal peduncle; upper face flat,

¹Since the above was written, crayfish "chimneys" observed by Mr. W. P. Hay in Indiana and by Doctor R. W. Shufeldt in Montgomery County, Maryland, have been ascribed to *Cambarus argillicola* and *C. bartonii robustus*, respectively.

²Proc. Acad. Nat. Sci. Phila., VI, p. 90, 1852.

³Saggio sulla Storia Naturale del Chili. Del Signor Abate Giovanni Ignazio Molina. Bologna, 1782.

⁴*Cancer macrourus*, thorace lævi cylindrico, rostro obtuso, chelis aculeatis.

⁵Translation: The most remarkable of the river prawns are the "Masous," *Cancer cæmentarius*. They are about eight inches in length, of a brown color, veined with bright red; the flesh is white and more delicious than that of any other kind of prawn, either fluvialile or marine. They are found in great abundance in all the rivers and brooks, on whose banks they build of clay a cylindrical dwelling rising half a foot above the ground, but so deep withal that the current passes into it by means of a small subterranean canal.

⁶Arch. f. Naturgesch., 2ter Jahrg., I, p. 143, 1836.

with scattered setæ; margins slightly raised, convergent, lightly convex, armed near the tip with a pair of small, blunt denticles; acumen short, subacute. Suborbital angle prominent, but rounded off, unarmed with tooth or spine. Postocular ridges obsolete except their anterior ends, which form a tubercle on each side of the base of the rostrum—a tubercle channeled along its outer face and terminating anteriorly in an obsolescent tooth. Carapace smooth and lightly punctate above, minutely granular on the sides. Cervical groove sinuous, no lateral spine. Areola very broad. Distance from tip of rostrum to cervical groove upward of twice and a half as long as the areola. Abdomen smooth, pleuræ rounded. Sides of telson slightly convergent, armed with a spine on each side, one-third way from the distal end; distal border truncate, postero-lateral corners rounded. Anterior process of the epistome triangular, sides straight or slightly convex, tip blunt or slightly truncate; a slight furrow divides the anterior process from the body of the epistome, and the latter is divided in halves by a longitudinal depression. Basal segment of antenna armed with a sharp spine in front of the orifice of the green gland; another spine lies at the base of the outer edge of the antennal scale; the antennal scale is of moderate size, a little longer than the rostrum, broadest near the middle, its outer margin slightly convex, ending in a small apical spine. Third pair of maxillipeds hairy within and below. Right and left chelipeds very unequal, the left usually the larger; lower margins of the merus denticulate, upper margin furnished with one small tooth near the distal end of the segment; outer and inner faces smooth; carpus marked with a conspicuous longitudinal groove on its upper outer face, and with a few small, blunt tubercles on its inner margin; lower external border of carpus short, rounded, and protuberant; chela without prominent tubercles or spines, but when viewed under a lens the surface is finely squamoso-tuberculate proximally, punctate distally; the superior and inferior borders of the chela are rounded, the fingers setose along their cutting edges; the fingers of the left (larger) chela are stout, somewhat gaping, with one evident round tubercle on the prehensile margin; the fingers of the right (smaller) chela are relatively longer and slenderer and are devoid of tubercles on the prehensile margins. The median longitudinal ridge on the inner blade of the last abdominal appendages ends in a small spine near the posterior border.

Length of a male 83 mm.; cephalo-thorax 38 mm.; abdomen 45 mm.; length of rostrum 9 mm.; width of rostrum at base 5 mm.; length of telson 12 mm.; width of telson at base 11 mm.; from tip of rostrum to cervical groove 28 mm.; from cervical groove to posterior margin of carapace 10 mm.; width of areola 8.8 mm.; length of left cheliped 67 mm. (merus 15 mm., carpus 11 mm., chela 32 by 16 mm., dactylus 20 mm.); length of right cheliped 54 mm. (merus 14 mm., carpus 9 mm., chela 25 by 8.5 mm., dactylus 16 mm.).

The largest individual (a male) is 97 mm. long.

The branchial formula for *P. agassizii* is as follows:

SOMITE.	PODOBRANCHIÆ.	ARTHROBRANCHIÆ.		PLEUROBRANCHIÆ.					
		Anterior.	Posterior.						
VII.	0 (ep)	0	0	0	= 0 (ep)				
VIII.	1	1	0	0	= 2				
IX.	1	1	1	0	= 3				
X.	1	1	1	1	= 4				
XI.	1	1	1	1	= 4				
XII.	1	1	1	1	= 4				
XIII.	1	1	r	1	= 3+r				
XIV.	0	0	0						
	6+ep	+	6	+	4+r	+	4	=	20+r+ep

The epipod of the first maxilliped is destitute of branchial filaments, a condition rarely found among the *Parastacinae*. The stems of the podobranchiæ are alate. The posterior arthrobranchia of the thirteenth somite is a simple, slender filament. Coxopoditic setæ long, hooked at the free end.

Habitat.—Talcahuano, Chile, No. 3400, Coll. Mus. Comp. Zool., (Hassler Exped., April, 1872). Nine males, eight females (two ovig.).

The egg measures 3.5 by 2.5 mm.

In nine out of fourteen specimens the larger claw is on the left side.

Judging from the form of the body, this is probably not a burrowing species.

Museum of Comparative Zoology,

Cambridge, Massachusetts, August 1, 1896.

EXPLANATION OF PLATES.

[NOTE.—All of the figures were drawn by James H. Emerton. Owing to errors in the photographic reduction of the original drawings, it is impossible to give the exact scale for many of the figures in these plates.]

PLATE LXII.

- Fig. 1. *Cambarus acherontis* Lönnberg. Female. Gum Cave, Citrus County, Florida. Reduced. (U.S.N.M.)
2. The same, lateral view of the head.
 3. *Cambarus acherontis* Lönnberg. First abdominal appendage of a young male, Form II, from the outside.
 4. The same, from the inside.
 5. *Cambarus acherontis* Lönnberg. Annulus ventralis of adult female.
 6. *Cambarus longidigitus* Faxon. Male, Form II. White River, Arkansas. Reduced. (No. 4364, Mus. Comp. Zool.)
 7. The same, first abdominal appendage from the outside.
 8. The same, first abdominal appendage from the inside.
 9. *Cambarus longidigitus* Faxon. Annulus ventralis of female.

PLATE LXIII.

- Fig. 1. *Cambarus carinatus* Faxon. Male, Form I. Guadalajara, Mexico. $\times \frac{1}{2}$. (No. 17699, U.S.N.M.)
2. The same, first abdominal appendage from the outside.
 3. The same, first abdominal appendage from the inside.

PLATE LXIV.

- Fig. 1. *Cambarus palmeri longimanus* Faxon. Male, Form I. Arthur, Texas. $\times \frac{2}{3}$.
(Mus. Comp. Zool.)
2. The same, first abdominal appendage from the outside. $\times 2\frac{2}{3}$.
 3. The same, first abdominal appendage from the inside. $\times 2\frac{2}{3}$.
 4. *Cambarus palmeri longimanus* Faxon. First abdominal appendage of the male, Form II, from the outside. $\times 2\frac{2}{3}$.
 5. The same, from the inside. $\times 2\frac{2}{3}$.
 6. *Cambarus palmeri longimanus* Faxon. Annulus ventralis of female. Arthur, Texas. $\times 2\frac{2}{3}$.
 7. *Cambarus erichsonianus* Faxon. Greeneville, Tennessee. $\times 1$. (No. 4347, Mus. Comp. Zool.)
 8. *Cambarus erichsonianus* Faxon. First abdominal appendage of the male, Form I, from the outside. Greeneville, Tennessee.
 9. The same, from the inside.
 10. *Cambarus erichsonianus* Faxon. First abdominal appendage of the male, Form II, from the outside. Greeneville, Tennessee.
 11. The same, from the inside.
 12. *Cambarus erichsonianus* Faxon. Annulus ventralis of female. Greeneville, Tennessee.

PLATE LXV.

- Fig. 1. *Cambarus difficilis* Faxon. Male, Form I. McAlister, Indian Territory. $\times \frac{2}{3}$.
(Mus. Comp. Zool.)
2. The same, first abdominal appendage of the male from the outside. $\times 2\frac{2}{3}$.
 3. The same, first abdominal appendage of the male from the inside. $\times 2\frac{2}{3}$.
 4. *Cambarus difficilis* Faxon. Annulus ventralis of female. McAlister, Indian Territory. $\times 2\frac{2}{3}$.
 5. *Cambarus meeki* Faxon. Male, Form II. Piney, Arkansas. $\times 1$. (Mus. Comp. Zool.)
 6. *Cambarus meeki* Faxon. Chela of female. Piney, Arkansas. $\times 1$.
 7. *Cambarus meeki* Faxon. First abdominal appendage of the male, Form II, from the outside. Piney, Arkansas. $\times 2\frac{2}{3}$.
 8. The same, from the inside. $\times 2\frac{2}{3}$.
 9. *Cambarus meeki* Faxon. Annulus ventralis of female. Piney, Arkansas. $\times 2\frac{2}{3}$.

PLATE LXVI.

- Fig. 1. *Cambarus montezumæ dugesii* Faxon. Female. Guanajuato, Mexico. $\times 2\frac{2}{3}$.
(No. 16087, U.S.N.M.)
2. *Cambarus montezumæ arcolatus* Faxon. Female. Cohahuila, Mexico. $\times 2\frac{2}{3}$.
(No. 3650, Mus. Comp. Zool.)
 3. *Cambarus montezumæ occidentalis* Faxon. Female. Mazatlan, Mexico. $\times 2\frac{2}{3}$.
(No. 3652, Mus. Comp. Zool.)
 4. The same. Left chela, viewed from the outside.

PLATE LXVII.

- Fig. 1. *Cambarus chapalanus* Faxon. Male, Form I. Lake Chapala, Mexico. $\times 2\frac{1}{4}$.
(No. 17698, U.S.N.M.)
2. The same. Right chela, viewed from the outside. $\times 2\frac{1}{4}$.
 3. *Parastacus defossus* Faxon. Montevideo, Uruguay. $\times 1\frac{1}{2}$. (U.S.N.M.)
 4. The same. Right chela, viewed from the outside. $\times 1\frac{1}{2}$.

PLATE LXVIII.

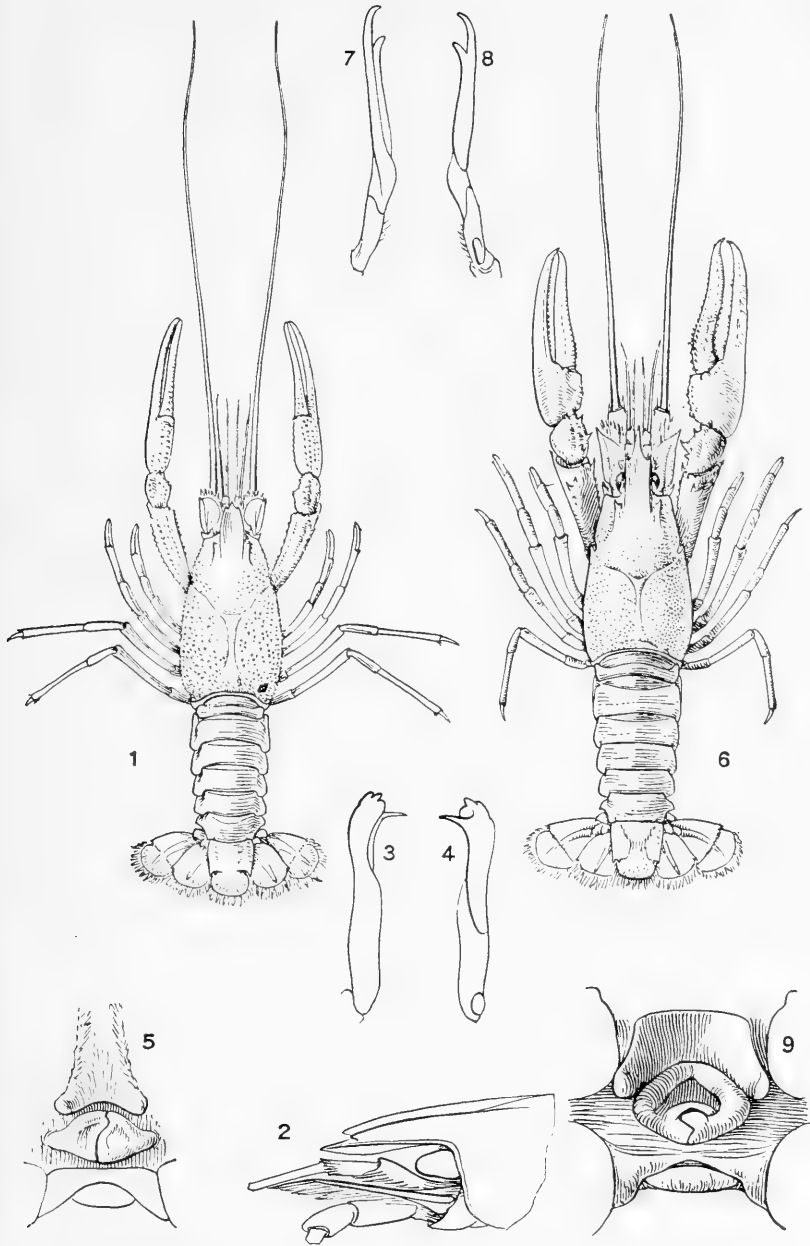
- Fig. 1. *Parastacus saffordi* Faxon. Female. Montevideo, Uruguay. Somewhat enlarged. (No. 12581, U.S.N.M.)
2. The same. Right claw, from the outside.

PLATE LXIX.

- Fig. 1. *Parastacus varicosus* Faxon. Colima, Mexico. Slightly enlarged. (No. 4133, U.S.N.M.)
2. The same. Right chela, viewed from the outside. Slightly enlarged.

PLATE LXX.

- Fig. 1. *Parastacus hassleri* Faxon. Talcahuano, Chile. Somewhat reduced. (No. 3401, Mus. Comp. Zool.)
2. The same. Right chela, viewed from the outside. Somewhat reduced.
 3. The same. Part of the sternum, showing sexual orifices on the proximal segments of the third and fifth pairs of legs.
 4. *Parastacus agassizii* Faxon. Male. Talcahuano, Chile. Somewhat reduced. (No. 3400, Mus. Comp. Zool.)
 5. The same. Part of the sternum, showing the extended *vasa deferentia* on the proximal segments of the fifth pair of legs.



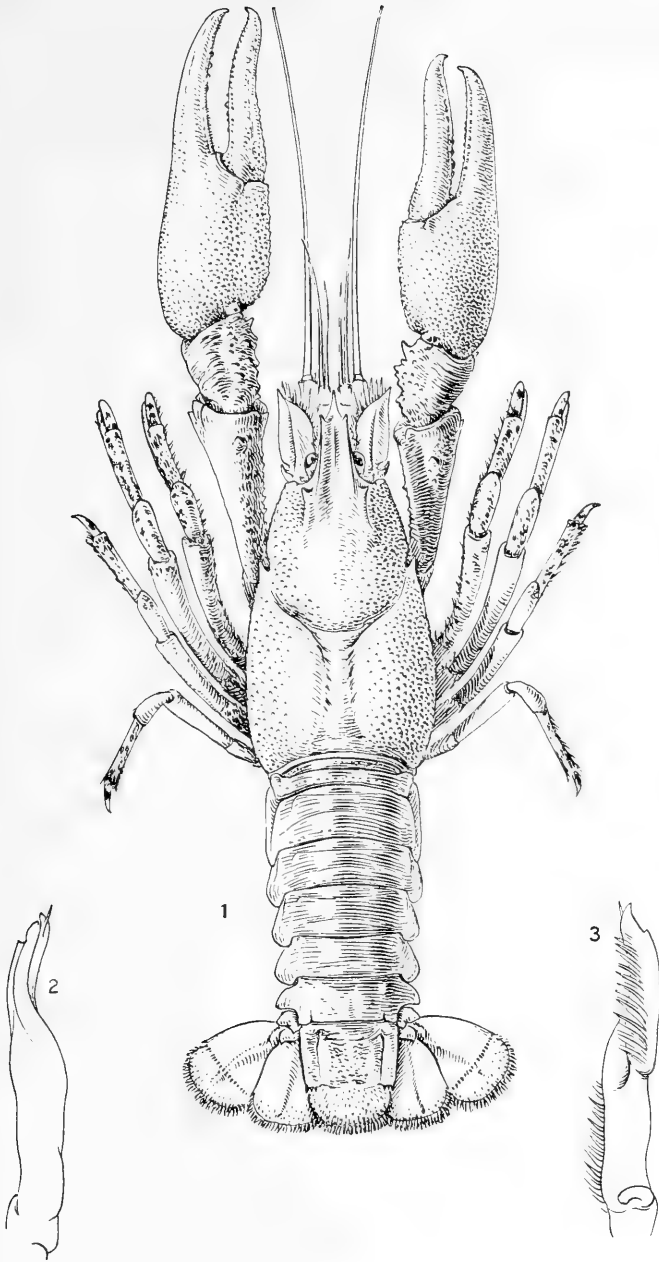
CRAYFISHES.

FIGS. 1-5. *Cambarus acherontis*.

FIGS. 6-9. *Cambarus longidigitus*.

FOR EXPLANATION OF PLATE SEE PAGE 692.



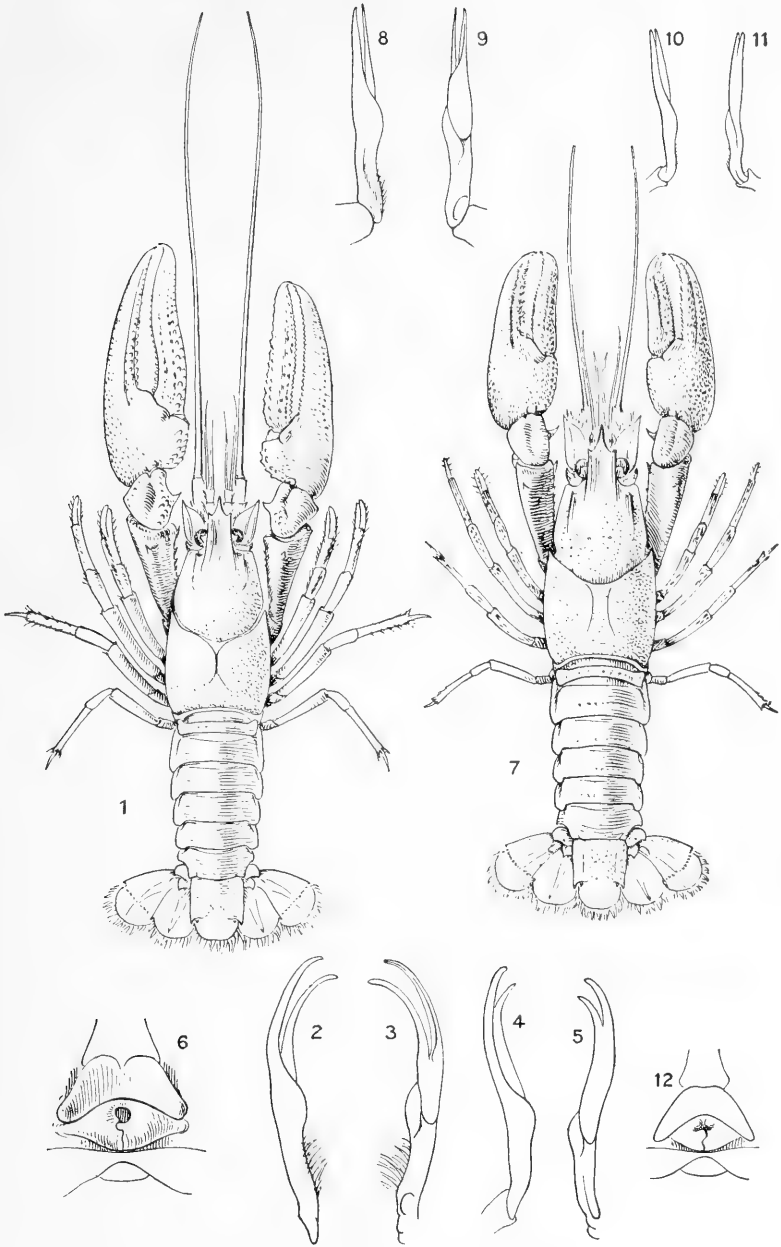


CRAYFISHES.

Cambarus carinatus.

FOR EXPLANATION OF PLATE SEE PAGE 692.





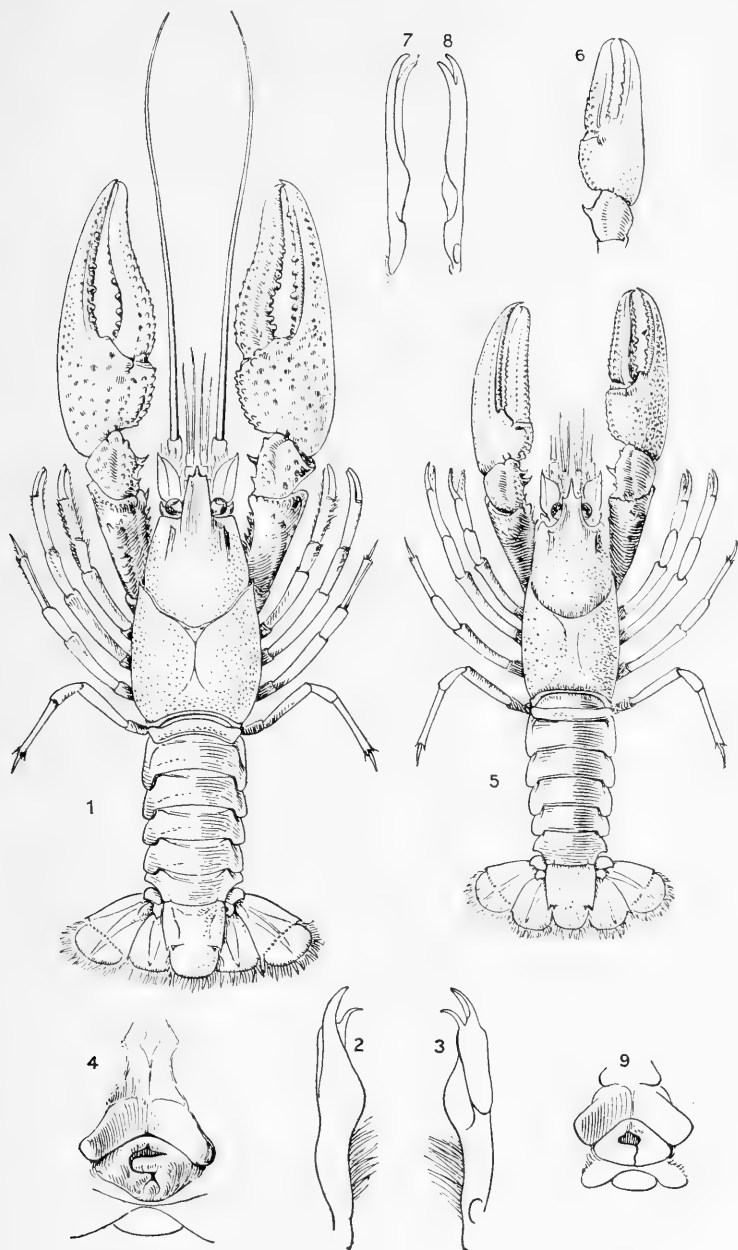
CRAYFISHES.

FIGS. 1-6. *Cambarus palmeri longimanus*.

FIGS. 7-12. *Cambarus erichsonianus*.

FOR EXPLANATION OF PLATE SEE PAGE 693.





CRAYFISHES.

FIGS. 1-4. *Cambarus difficilis*.

FIGS. 5-9. *Cambarus meeki*.

FOR EXPLANATION OF PLATE SEE PAGE 693.



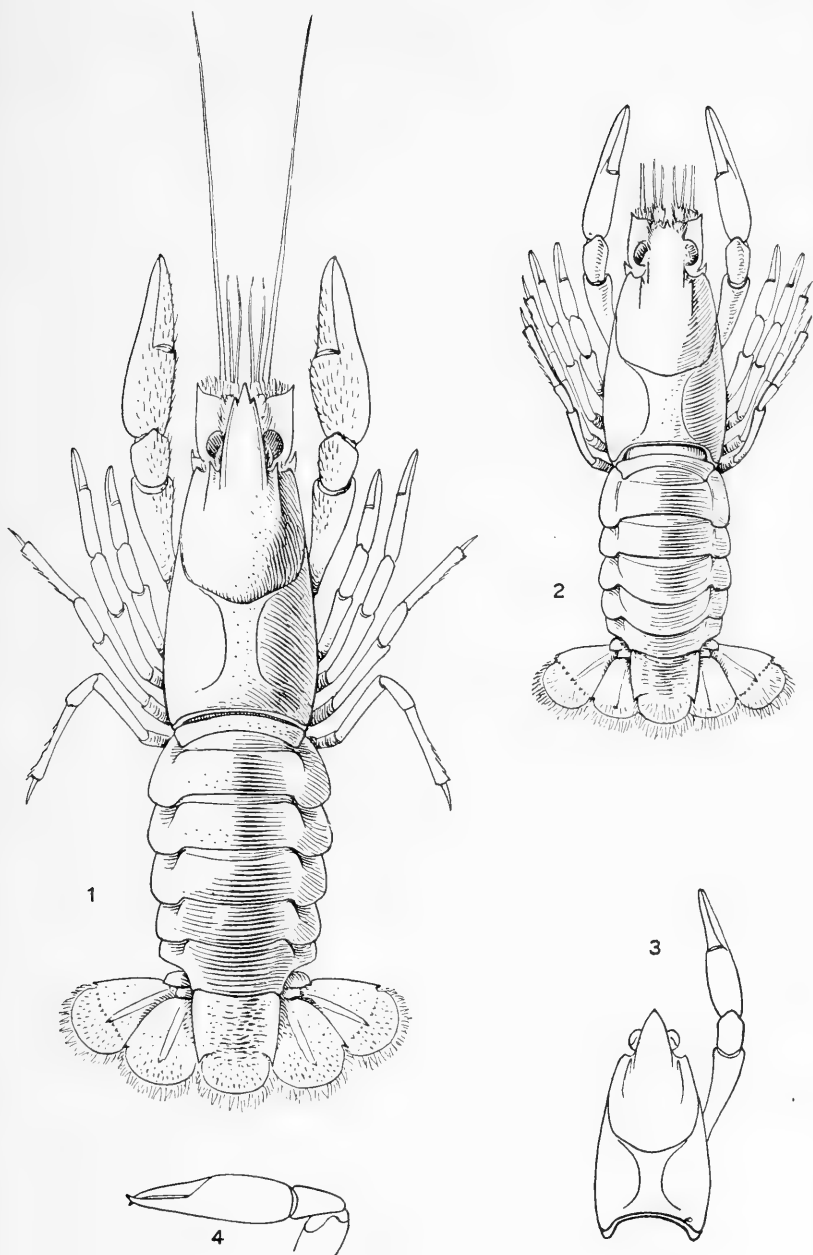
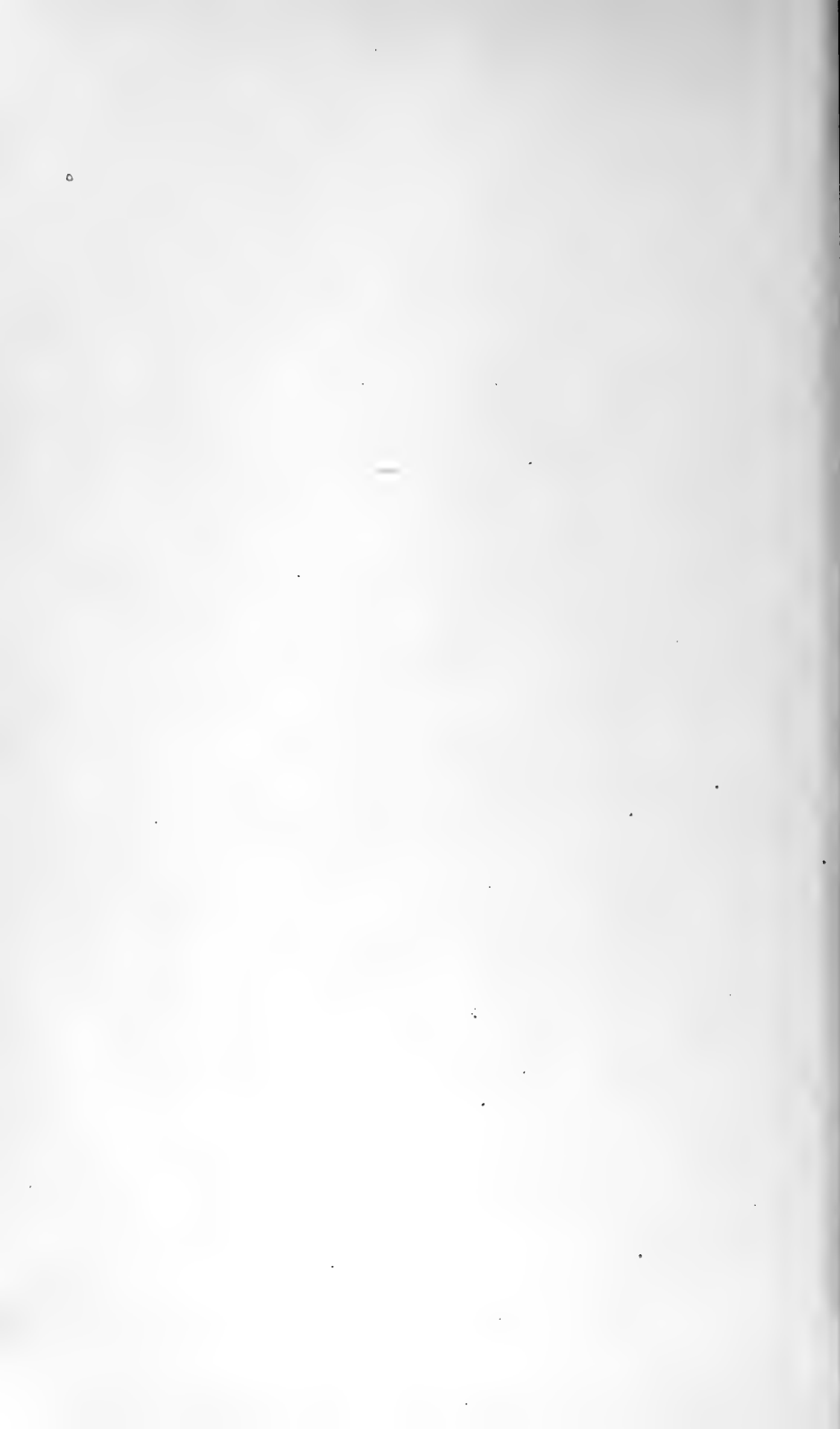
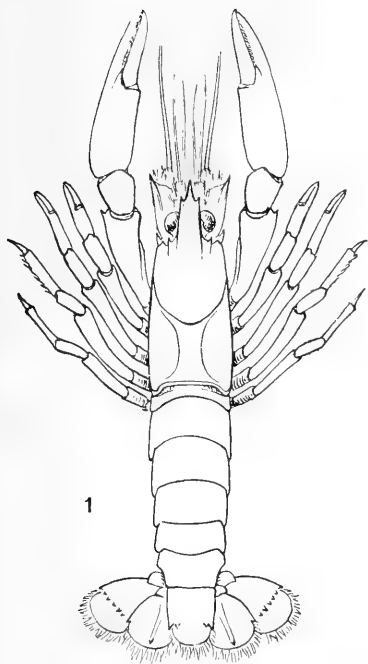


FIG. 1. *Cambarus montezumæ dugesii*.
FIG. 2. *Cambarus montezumæ areolatus*.

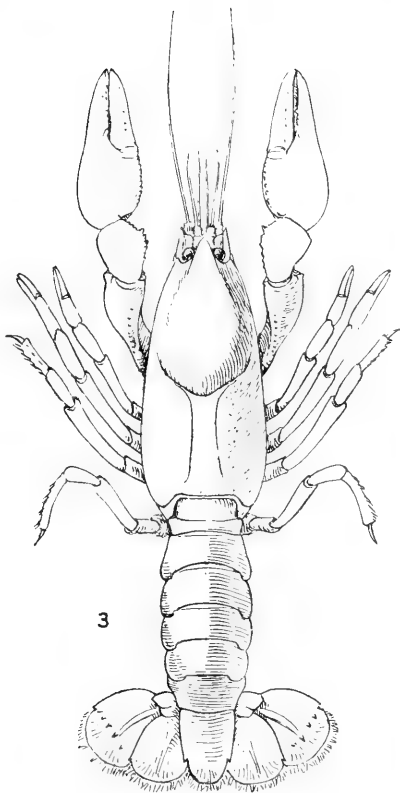
FIGS. 3, 4. *Cambarus montezumæ occidentalis*.

CRAYFISHES.

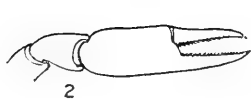




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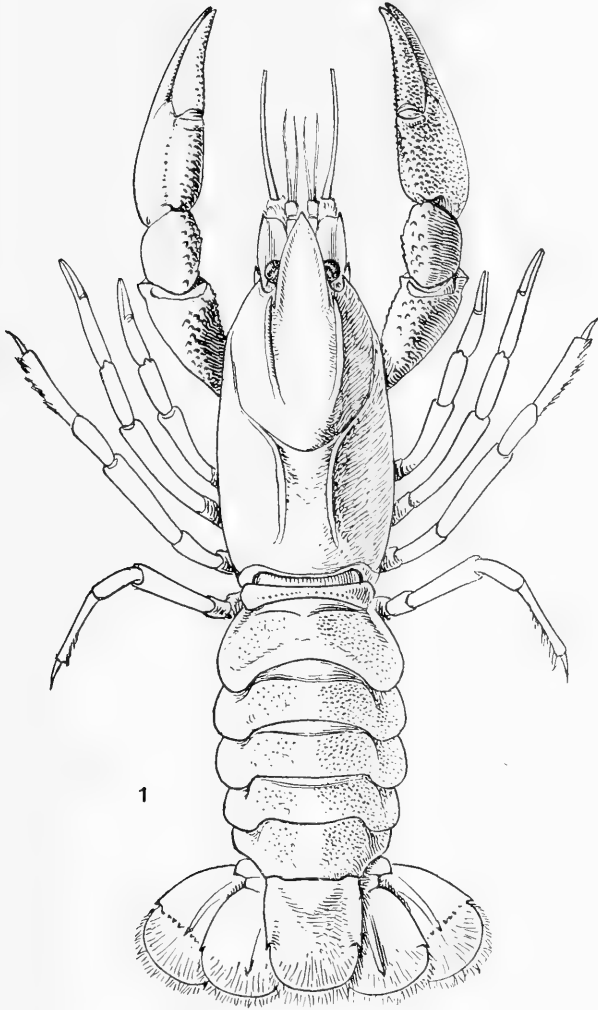
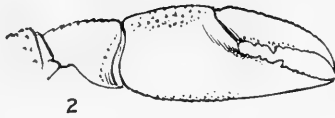
CRAYFISHES.

FIGS. 1, 2. *Cambarus chapalanus*.

FIGS. 3, 4. *Parastacus defossus*.

FOR EXPLANATION OF PLATE SEE PAGE 693.

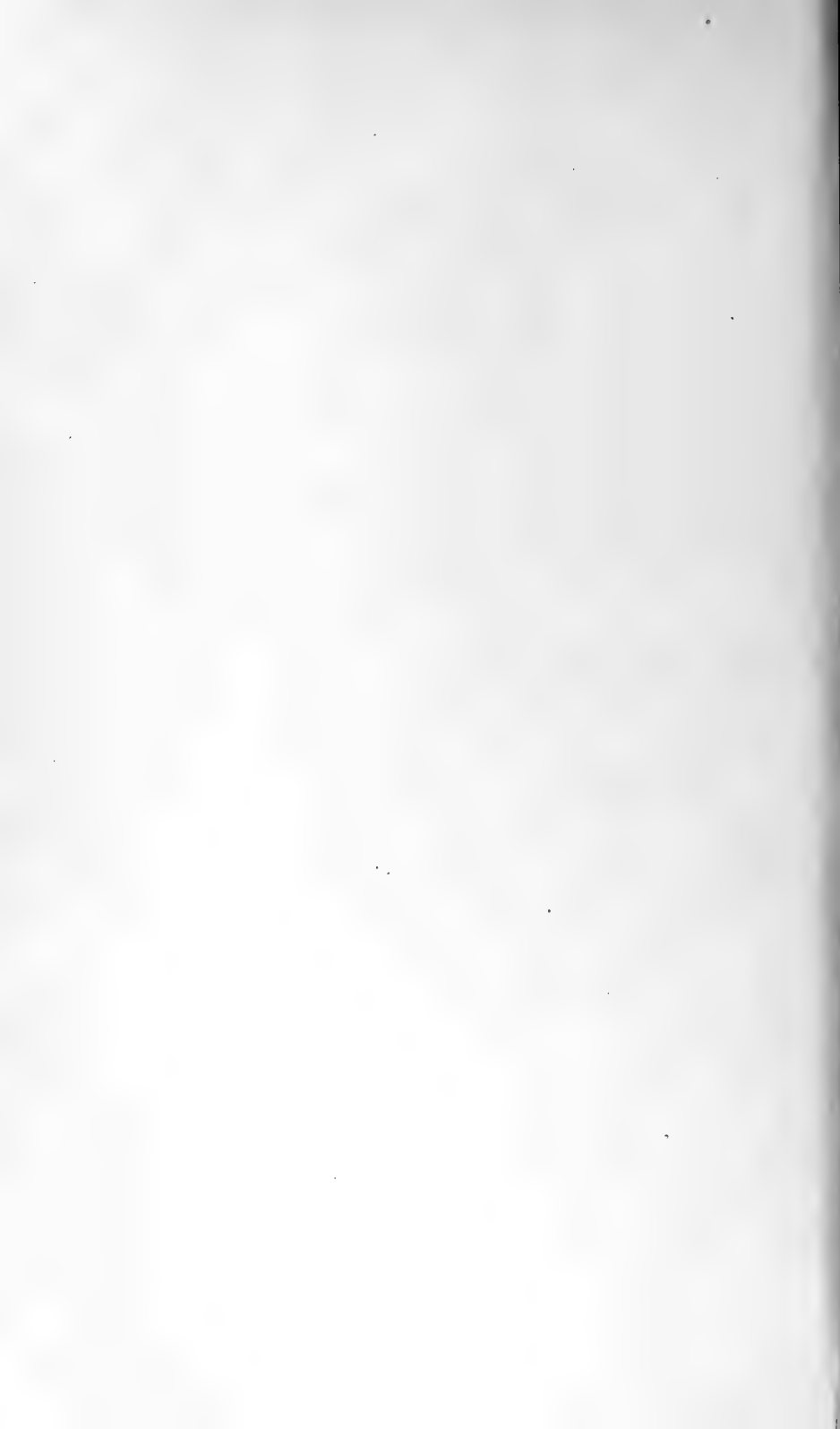


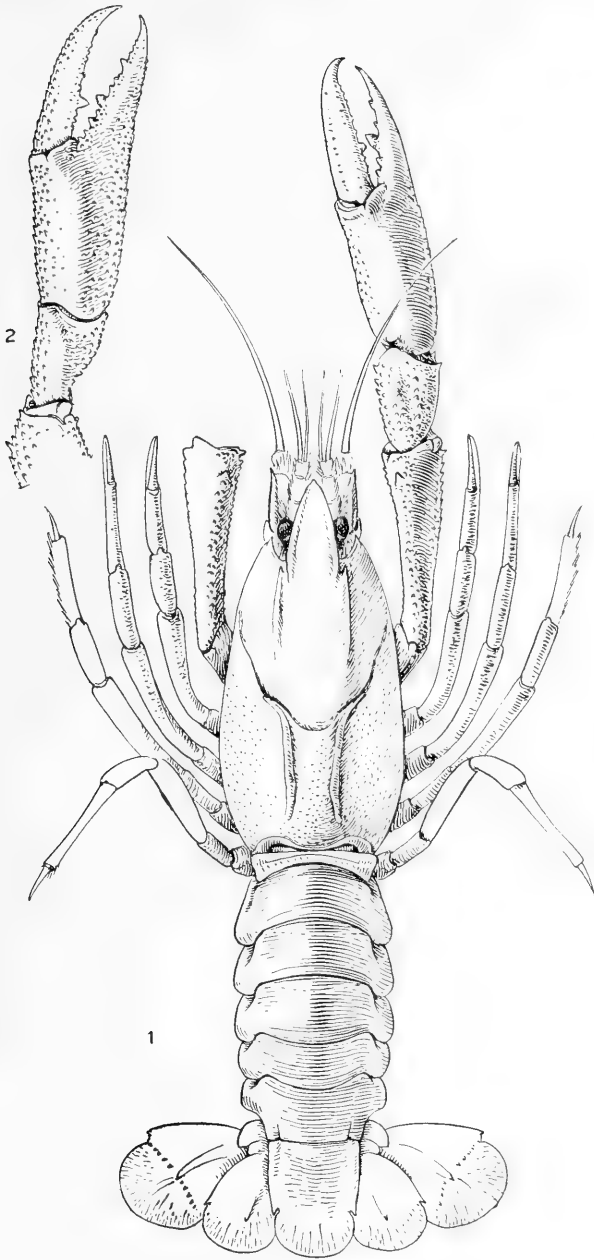


CRAYFISHES.

Parastacus saffordi.

FOR EXPLANATION OF PLATE SEE PAGE 694.

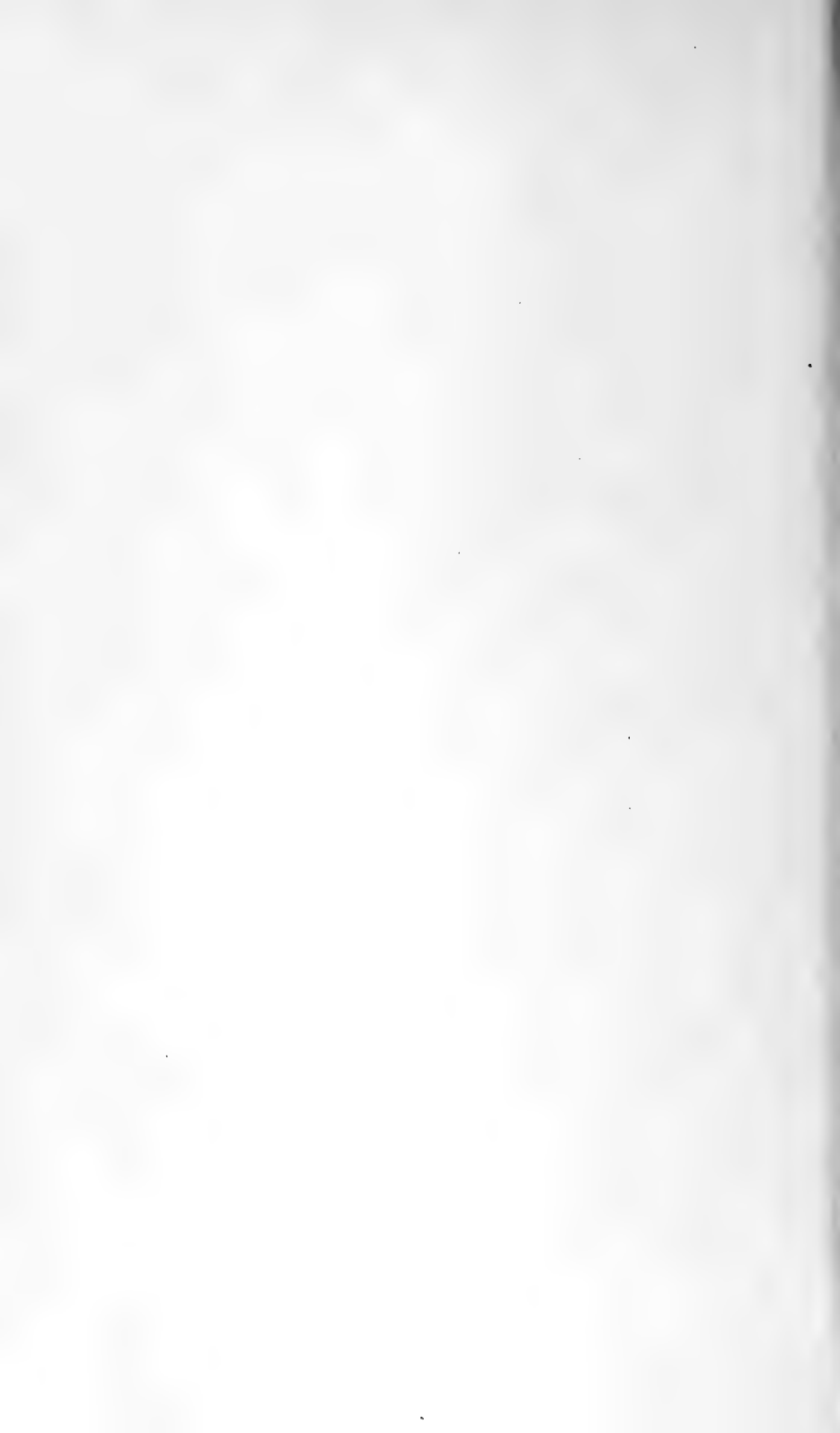


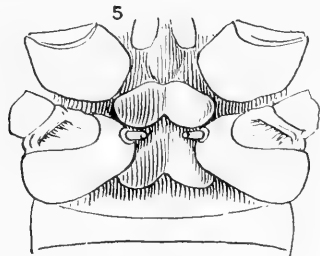
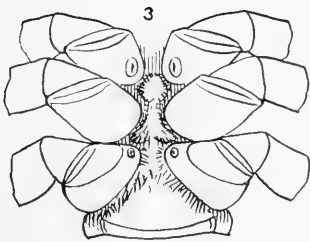
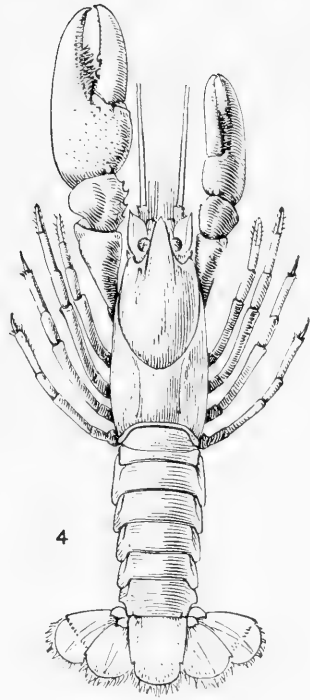
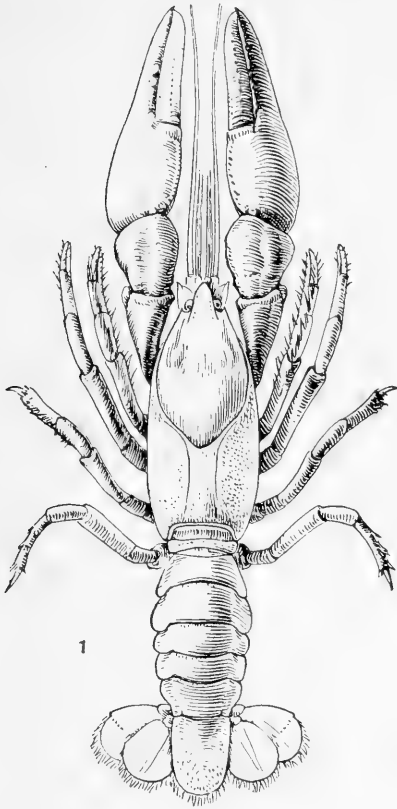


CRAYFISHES.

Parastacus varicosus.

FOR EXPLANATION OF PLATE SEE PAGE 694.



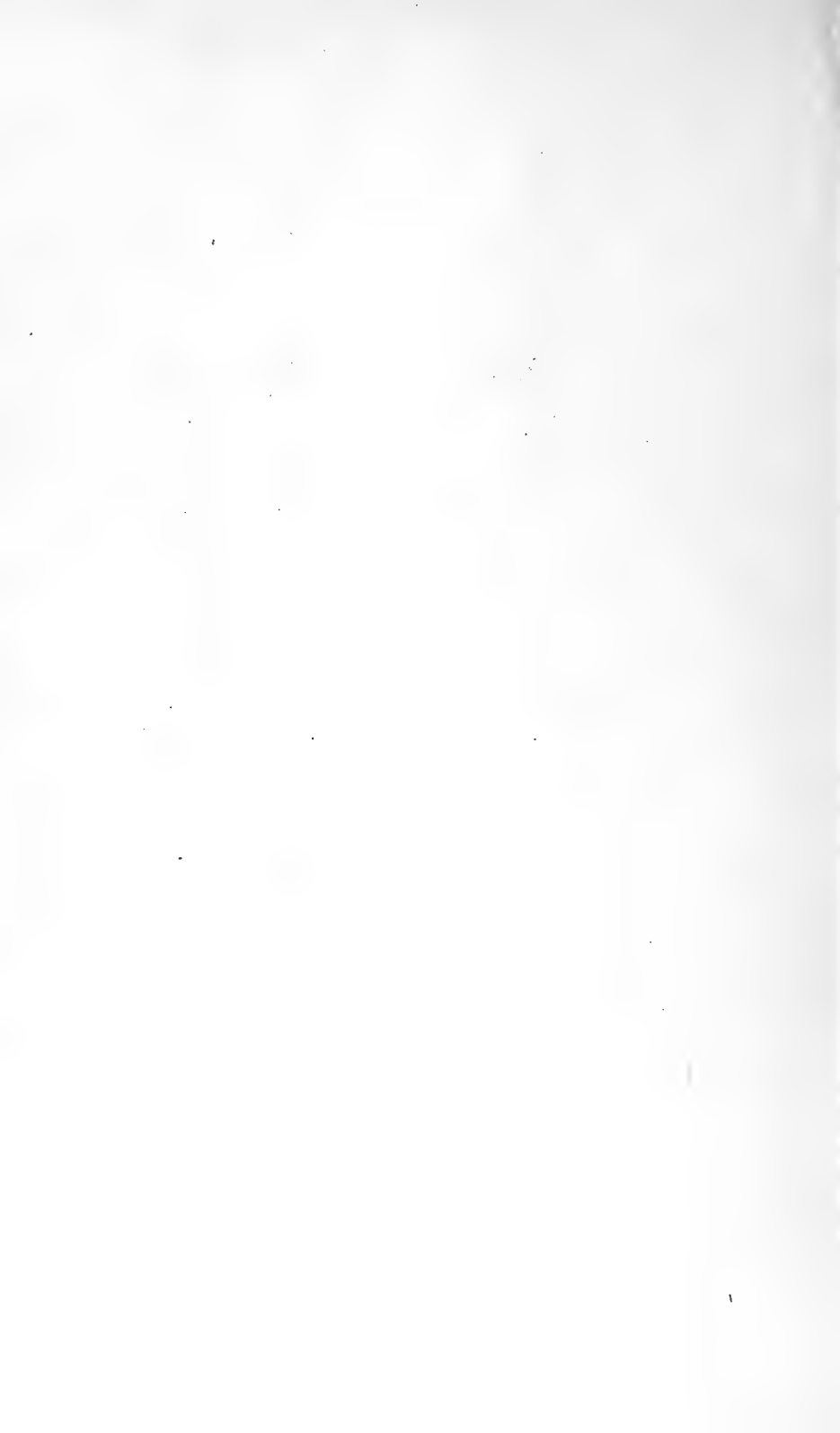


CRAYFISHES.

FIGS. 1-3. *Parastacus hassleri*.

FIGS. 4, 5. *Parastacus agassizi*.

FOR EXPLANATION OF PLATE SEE PAGE 694.



A REVISION OF TROPICAL AFRICAN DIPLOPODA OF THE
FAMILY STRONGYLOSOMATIDAE.

BY O. F. COOK,
Custodian of Myriapoda,

IN THE present paper are included more or less extended descriptions of new species of Diplopoda, as well as expansions and amendments to those of such old species as an examination of type specimens shows to be desirable. It is now unsafe to make identifications from many of the older descriptions, so that a better knowledge of their types is even more important than the description of new forms. In all cases the ownership of the type has been indicated, and the localities have been carefully specified, this being rendered necessary by the frequent confusion occurring in African geography by reason of changes and duplications of names.

Family STRONGYLOSOMATIDAE Cook.

Strongylosomatidae COOK, Ann. N. Y. Acad. Sci., IX, p. 5.

This family includes nearly all the Merocheta with slight development of lateral carinae and long legs. These characters are, however, not sufficient for diagnosis, but are supplemented by the long antennae, the distinct inferior carinae, the more or less spined sterna, and the long falcate or hamate copulatory legs, of which the basal joint is longer than in most other families. As distinctive secondary sexual characters may be mentioned the development of processes from the sternum of the fifth segment of males and of pads of dense hairs on the two distal joints of the anterior male legs.

ANALYTICAL KEY TO THE AFRICAN GENERA OF STRONGYLOSOMATIDAE.

Dorsum slightly convex, the carinae rather large, prominent along the entire posterior subsegment; legs and antennae short; sterna broad, all unarmed; copulatory legs very long, slender and attenuate: Genus *Orthomorpha*, cosmopolitan in the tropics, but not indigenous in Africa.

Dorsum strongly convex, the carinae small or rudimentary, affecting only the posterior half of the subsegment; legs and antennae long and slender; sterna narrow, armed with more or less distinct conic processes; copulatory legs shorter, more or less falcate and complex

Copulatory legs with distal ungual portion of second joint not exceeding in length the hairy basal part, and not produced into one or more attenuate prongs; anterior male legs without cushions of densely crowded hairs on the two distal joints: Genus *Scolodesmus*, Liberia.

Copulatory legs produced into one or more attenuate prongs, so that the hairless apical part of the second joint would, if extended, much exceed the basal hairy portion; anterior legs of males with distinct cushions or pads of dense hairs on the two distal joints

Copulatory legs distally produced into a long arm which is curved at first mesad and then turned in a circle so that its two-pronged apex lies laterad; carinae very small, rudimentary or obsolete on poreless and posterior segments: Genus *Ectodesmus*, new, type *E. extortus*, new species, Lindi, Berlin Museum.

Copulatory legs turned mesad and superposed, their apices thus not turned outward except as they extend beyond each other after crossing; carinae distinct and produced, at least on posterior segments

Fifth segment without repugnatorial pores: Genus *Xanthodesmus*, new, type *X. abyssinicus*, new species, Berlin Museum.

Fifth segment provided with pores

Copulatory legs with two rather short, broad processes rising from near the middle of the leg and projecting mesad; sternum of fourth legs with a thin, strongly chitinized process as high as broad and somewhat narrowed laterally at base: Genus *Phaeodesmus*, new, type *Ph. longipes* (Attems), Quilimane, Hamburg Museum.

Copulatory legs without such processes; sternum of fourth legs with process very small or bifid

Legs 4-6 with the third joint crassate and enlarged below into a distinct tuberculoid process; carinae all produced caudad beyond the posterior margin of the segment: Genus *Cnemodesmus*, Congo.

Legs with third joint not specially modified; carinae slightly produced only on anterior and posterior segments: Genus *Habrodesmus*, Liberia.

Genus SCOLODESMUS Cook.

Scolodesmus COOK, Proc. U. S. Nat. Mus., XVIII, p. 97, 1895.

Body rather small and slender, nearly cylindrical, somewhat constricted behind the first segment.

Carinae very small, rudimentary or wanting on poreless and posterior segments.

Sterna of posterior legs of each segment with a pair of conic processes; sternum of fourth legs of male with a rather large, thick, bidentate process; sternum of sixth legs without a process.

Legs very long and slender; anterior legs of male without distinct cushions of densely crowded hairs; third joint unmodified.

Copulatory legs rather short, broad and simple, not produced into slender arms or prongs as in the other genera.

SCOLODESMUS GRALLATOR Cook.

Scolodesmus grallator COOK, American Naturalist, XXX, p. 418, 1896; Proc. Acad. Nat. Sci. Philadelphia, 1896, p. 261.

Color dark vinous, sometimes lighter in the middle of each posterior subsegment, which gives the effect of a light median line; legs and antennae pink or yellowish in life, fading to white in alcohol.

Copulatory legs consisting distally of a broad lamina and a narrower curved, pointed process which from the ventral view is seen to cross its fellow and in lateral aspect extends at first at right angles to the leg and then bends to become somewhat parallel to it.

Length 28 mm., width 2.5 mm.; length of antenna 7.4 mm., of leg from tenth segment 7 mm.

Locality.—Liberia. This species is rather rare in the deep forests of western Liberia. When disturbed the living animals run away with considerable speed and on account of their long, stilt-like legs have an appearance quite unlike Diplopoda of other families.

Type.—No. 617, U.S.N.M. A male specimen collected at Monrovia.

SCOLODESMUS SECURIS Cook.

Scolodesmus securis COOK, Proc. Acad. Nat. Sci. Philadelphia, 1896, p. 265.

Color dark vinous, without lighter median spots, but in some specimens not fully colored there is a distinct dark median line; legs and antennae distinctly brownish, but not so dark as the body.

Copulatory legs with the larger lamina much narrower and more falcate than in *S. grallator*, being shaped much like a broad billhook. The basal hairy part of the leg is also shorter than in *S. grallator*.

Length of male 18 mm., width 1.6 mm.; length of antenna and of leg from the tenth segment, 5 mm.

Locality.—Togo Colony, Misahöhe, Baumann, "*Im Urwaldmoder.*" There are numerous specimens.

Type.—Berlin Museum.

This species is throughout smaller and more slender than *S. grallator*, from which it offers considerable differences in color and copulatory legs. The sternum of the fourth legs has the process more deeply bifid than in former species.

SCOLODESMUS SCUTIGERINUS (Porat).

Strongylosoma scutigerinum PORAT, Bihang till K. Sv. Vet.-Akad. Handl., IV, No. 5, p. 37, pl. II, fig. 9, 1894.

A specimen probably referable to this species is in the Berlin Museum from North Kamerun, collected by Conradt. The copulatory legs are, as appears from Porat's figure, somewhat longer and more slender than those of *S. grallator* or *S. securis*, and they are divided at apex somewhat differently from the other species. The habit, carinae, and secondary sexual characters are also those of the present genus, but the color pattern is very distinct from the other species, the anterior subsegments being dark brown and the posterior nearly white on the specimen in hand. According to Porat, the colors are very variable, but unless he has given the measurements of young animals he was probably dealing with more than one species, for the specimen studied is a male and fully equals Porat's largest measurements, 32 mm by 3 mm. The antennae are brown, the legs whitish.

ECTODESMUS, new genus.

Body rather robust, at least more so than the other African genera of this family; not constricted cephalad.

Carinae very small, like those of *Scolodesmus*, rudimentary and obsolete caudad.

Sterna of the posterior legs of each segment armed with distinct conic spines; sternum of fourth legs with a large, subentire, hirsute process; sternum of sixth legs with a distinct rounded-conic, hirsute median process.

Legs very long and slender; anterior legs of male with cushions of dense hairs; third joint unmodified.

Copulatory legs broad and thick near the middle, and dentate mesad; distally they are produced into a gradually attenuate, deeply divided armature, which extends at first mesad and lies in contact with the base of its fellow; it is then bent downward (caudad) and turned laterad, so that the two-pronged apex of the armature lies near its base.

Ectodesmus agrees with *Scolodesmus* in habit, rudimentary carinae, slender legs and antennae, and color pattern. It differs in having the body more robust, the process of the sternum of the fourth pair of legs more prominent, thinner and entire, in the possession of a distinct rounded process from the sternum of the sixth pair of legs, in having the ventral face of the second and third joints of anterior legs membranous or fleshy, in being provided with a pad of densely crowded hairs on the two distal joints of the anterior male legs, and finally it is distinguishable from all known African Strongylosomatidae in that the copulatory legs are distally turned laterad.

ECTODESMUS EXTORTUS, new species.

Head slightly narrower than first segment; sulcus rather shallow; clypeus smooth, sparsely hirsute.

First segment oblong, the corners rounded and the anterior margin slightly curved laterad.

Second and third segments equal in width to the first and fourth, there being no trace of the neck-like constriction which appears in *Scolodesmus*; the second segment has the carinae very distinct and extended obliquely cephalad on a large triangular process.

Segments dorsally smooth, but not shining, a distinct transverse sulcus on the fifth and following segments to the eighteenth.

Carinae of anterior poriferous segments consisting of a slight subtriangular prominence, those of poreless segments scarcely defined, except by the superior impressed line; on posterior segments the carinae are obsolete, even the impressed line being deficient. The pores are rather large and are surrounded by a fine ring.

Transverse sulcus rather deep, not crenulate.

Last segment with the apex rather broad and rounded; between the four setiferous punctations is a small denticule.

Anal valves nearly smooth, the bristles borne on slight prominences located near the sloping margins.

Preanal scale broadly subtriangular, the apex truncate.

Sterna with conic processes much larger at the base of the posterior leg of each segment; these processes are smaller on the posterior segments and do not appear on the anterior.

Sternum of fourth pair of legs with a broad, prominent, hirsute, entire process which is strongly flattened antero-postically; sternum of sixth pair of legs with a broadly conic median process.

Legs long and slender, rather sparsely hirsute with short hairs, more numerous and longer distad; anterior legs of male slightly crassate, the two distal joints with pads of dense hairs, and the second and third joints with the ventral face smooth and membraneous or fleshy.

Copulatory legs with a subconic prominence on the lateral face of the basal hairy part; above strongly thickened and then abruptly narrowed into a slender strongly curved and distally divided process, which turns laterad upon itself instead of lying across its fellow, as in other species of the present group.

Color of alcoholic specimens brown, a median band of chestnut, broadened at each transverse sulcus; on either side of this is an area of light brown, and then an equal longitudinal band of very dark brown or black, extending to the level of the pores; below this the anterior subsegments have a series of brown spots, while the surface is elsewhere very light, becoming nearly white below. Basal joints of legs white, the distal brown; antennae dark brown.

Length of male, 31 mm.; width, 3 mm.; length of antennae, 6.2 mm.; length of leg from tenth segment, 5.5 mm.

Locality.—Lindi, an island near Wito, off the coast of British East Africa.

Type.—Two male and three female specimens collected by Fülleborn in the Berlin Museum.

The process of the sternum of the fourth pair of legs differs from that of *Phaeodesmus longipes* in being broader, not so strongly chitinized, less prominent and hirsute over its entire surface.

The color pattern, while somewhat different from *Scolodesmus*, resembles that form rather than *Habrodesmus*, there being no transverse band of bright color.

Genus HABRODESMUS Cook.

Habrodesmus COOK, Proc. U. S. Nat. Mus., XVIII, p. 97, 1895.

Body rather small and very slender, not constricted behind the first segment, slightly depressed.

Carinae small but still distinct, their posterior corners produced beyond the transverse margin on anterior and posterior segments, but not on middle segments.

Sterna with conic processes short or indistinct; sternum of fourth

legs of male with two distinct conic spines or a bidentate process; sternum of sixth legs without a process.

Legs long and slender; anterior legs of male with cushions of dense hairs; third joint unmodified.

Copulatory legs terminating typically in a thicker and a more slender spine of subequal length, both turned mesad and crossing their fellows.

Habrodesmus belongs, apparently, to the same series as *Phaeodesmus* and *Cnemodesmus*, but is easily distinguishable from these by having the third joint of anterior male legs unmodified, and by the much smaller carinae.

HABRODESMUS LAETUS Cook.

Habrodesmus laetus COOK, American Naturalist, XXX, p. 418, 1896; Proc. Acad. Nat. Sci., Philadelphia, 1896, p. 261.

Color in life black, the carinae and posterior margins of the segments yellow, shading through orange into the darker general color. Legs bright orange and pink; antennae dark brown. The first segment has a broader yellow border running entirely around. In alcohol the colors fade so that the body is dark chestnut brown, the legs and margins of the segments whitish.

Copulatory legs with larger distal arm produced and attenuate, with a large tooth some distance below the incurved apex. The slender arm is entirely hidden in ventral view.

Length of male, 27 mm.; width, 2 mm.; length of antennae, 5.2 mm.; of leg from tenth segment, 4.5 mm.

Locality.—Liberia. A very rare species inhabiting the denser parts of the forests along creeks. The very brilliant colors and agile movements give the living animal a striking appearance.

Type.—No. 619, U.S.N.M. A male specimen.

The sternum of the fourth legs bears two entirely distinct, somewhat rounded, and antero-postically flattened processes not heavily chitinized.

HABRODESMUS FALX Cook.

Habrodesmus falx COOK, Proc. Acad. Nat. Sci. Philadelphia, 1896, p. 265.

In size, habit, and probably in living colors closely resembling *H. laetus*.

Lateral carinae slightly larger than those of *H. laetus*, especially on middle segments where there is a very slight corner, which is obsolete in *H. laetus*.

Sterna of fourth legs with processes similar to those of *H. laetus*, but more prominent and somewhat connate at base.

Copulatory legs with larger arm expanded at apex and terminating in a broad, obliquely truncate lamina, with a small transparent process from near the middle of the apical edge.

Color in alcohol brown or black; the margins of the first, the posterior margins of the other segments, the ventral surface and legs, whitish; antennae dark brown.

Length of male, 25 mm.; width, 2.5 mm.; length of antenna, 5 mm., of leg, 5 mm.; a female is 30 mm. by 3.5 mm., with antennae 5.5 mm. and legs 5 mm. in length.

Locality.—Togo Colony. Numerous specimens including the type are in the Berlin Museum. One of the labels states that the legs are, supposedly in life, pinkish-red.

HABRODESMUS HARTMANNI (Peters).

Strongylosoma hartmanni PETERS, Monatsber. K. Akad. Wiss. Berlin, Phys.-Math. Kl., July 18, 1864, p. 534.

Habrodesmus hartmanni (PETERS) COOK, Proc. U. S. Nat. Mus., XVIII, p. 98, 1895.

Head broader than anterior segments, though nearly equaled by the first.

Vertex smooth, the sulcus distinct, but not deep; clypeus smooth, sparsely hirsute below.

First segment subelliptic, nearly straight in the middle in front, slightly and broadly emarginate behind, the lateral corners rounded.

Segments dorsally smooth except for a very distinct transverse sulcus near the middle of the posterior subsegment, beginning on the fifth segment and not distinct on segments 18–20.

Lateral carinae distinct on all the segments except the first and the last two; carinae of second segment somewhat oblique, extending considerably below the lateral corners of the first segment, their posterior corners produced somewhat more than on other segments; posterior corners of carinae of all segments distinctly, though slightly, produced beyond the posterior margin; carinae defined above by a distinct groove, while below they are distinct only in front; the poriferous face is flattened and strongly deflected so that the pores face nearly laterad; on anterior segments the pores are located about halfway between the line of the transverse sulcus and the posterior margin; on posterior segments they are gradually nearer to the posterior corner, which becomes more pointed and produced to the nineteenth, where the carina is obsolete and the pore is located in a small depression.

Transverse sulcus deep, very distinct and abrupt on the anterior side, not crenulate.

Last segment smooth, tapering gradually to the narrow truncate apex which bears four setiferous punctations of which the lower pair is much larger and farther apart than the upper.

Anal valves sparsely rugulose, apparently smooth and shining; two pairs of fine bristles borne on broad rounded prominences, both distinct from the prominent thin margins.

Preanal scale subtriangular, the apex rounded.

Sterna with a distinct conic process at the base of each leg; these processes decrease in size cephalad; sternum of fourth pair of legs with a small process the shape of which can not be seen without injury to the dried specimen.

Legs subgranular, moderately hirsute, the hairs more numerous and longer distad; anterior legs of male subcrassate and more densely hirsute, the two distal joints with broad pads of dense hairs; these pads decrease caudad and are lost at about segment 15. No other modifications of the male legs could be made out.

Copulatory legs closely similar to those figured by Pocock for the next species; more slender, the two apical divisions longer and less strongly curved, the four proximal processes not evident.

Color of dried specimen, dark brown, probably nearly black in life; clypeus, all the margins of first segment, posterior margin of all other segments, carinae, ventral surface, except a large spot below the carinae in front, and legs, dull yellowish; in life these parts may have been bright yellow or red, from the analogy of the related Liberian species, *H. laetus* Cook.

Length about 24 mm.; width 2.5 mm.; length of antenna nearly 5 mm.; of leg of segment 14 nearly 7 mm.

This description was taken from the dried male specimen, No. 250 of the Berlin Museum, the true type of the species. It was collected in Sennar by Hartmann.

From an alcoholic specimen found later it appears that the processes of the sternum of the fourth pair of legs are very slightly developed, consisting merely of rounded prominences. This individual was collected with the type and bears the same number in the Berlin Museum.

HABRODESMUS FLAVOCINCTUS (Pocock.)

Tetracentrosternus flavocinctus Pocock, Ann. and Mag. Nat. Hist. (6), XVII, p. 438, pl. XVIII, fig. 5, 1896.

This species may, it would seem, be safely referred to the present genus. From the figure of the copulatory legs it appears to occupy a position intermediate between the preceding and the following species. The measurements are given as 27 mm. by 4.3 mm. It is to be presumed that this refers to the females, which in the present genus are always distinctly more robust than the males and have shorter legs.

HABRODESMUS MASSAI, new species.

To be distinguished from all previously described species by the subdentate posterior margins of the segments and the strongly contracted copulatory legs.

Head scarcely wider than the first segment; vertex smooth, the sulcus very distinct; clypeus sparsely hirsute, the hairs rising from slight punctations; labrum scarcely emarginate, the teeth distinct.

First segment subelliptic-reniform as in *H. hartmanni*, laterad with a narrow, though distinct, raised margin; lateral corners even more rounded than in *H. hartmanni*.

Segments smooth with a velvety appearance, scarcely shining, marked only by the transverse sulcus which is located slightly behind the middle

of the subsegment; the sulcus begins on the fifth segment and is obsolete on the seventeenth; it is much shorter and less distinct than in *H. hartmanni*, where it reaches nearly to the carinae, in *H. massai* only about halfway; posterior margin on each side subdentate with two or three broad, slightly projecting teeth; the middle of the margin is smooth, and there is a smooth space next the carina.

Lateral carinae distinctly more developed than in *H. hartmanni*, poriferous carinae thickened caudad, slightly more prominent laterad below the pore than above; pores facing nearly directly laterad, located somewhat in front of the posterior margin of the segments.

Last segment as in *H. hartmanni*; margins of anal valves less prominent and compressed.

Sterna rather sparsely hirsute, with a distinct, though not deep, transverse sulcus; conic processes very small, obsolete except on posterior segments; males with a short, broad process between the bases of the fourth pair of legs; this process ends in two rounded-conic, strongly chitinized knobs.

Legs moderately hirsute with rather short hairs; anterior male legs scarcely crassate, the pads of dense hairs as in *H. hartmanni*, perhaps slightly less developed.

Copulatory legs rather short, the apical process strongly curved near its base so that the apex lies almost in contact with a broad expansion from the anterior side of the leg near the base of the apical process; flagellum distinct only from near the end of the terminal process, which bears distally several sharp spines.

Color in alcohol nearly black, the margins of the first segment, the carinae of the anterior segments, the posterior part of the carinae of other segments, the posterior margins of all the segments; the last half of the last segment, the ventral surface and basal joints of the legs, yellowish.

Length about 28 mm.; width 3.5 mm.; length of antenna 6.5 mm.; of leg of sixteenth segment, 7.5 mm.

A single male specimen, No. 1356 in the Berlin Museum, labeled, "*Ost-Afrika, M'Karamo am Pangani Massai Nyeka.*"

HABRODESMUS ACULEATUS (Peters).

Strongylosoma aculeatum PETERS, Monatsber. K. Akad. Wiss., Berlin, Phys.-Math, Klasse, February 5, 1855, p. 81.

Habrodesmus aculeatus (PETERS) COOK, Proc. U. S. Nat. Mus., XVIII, p. 98, 1895.

This species was described from a single female specimen, from which little can be added to the brief descriptions cited above. An identification ought scarcely to be attempted until material can be had from the type locality. This is far distant from any of the places in which *Habrodesmus* has been collected, and *aculeatus* may easily prove to be generically distinct. The habit is somewhat different from that of the species of *Habrodesmus*, more notably in that the carinae are

stronger and more projecting caudad when viewed from the side, though hardly more so than in *H. massai*; the posterior end of the body is more tapering, and the last segment more produced caudad. Finally the whole animal is more slender than the females of the species of *Habrodesmus*. According to Peters, the color pattern was also different from *Habrodesmus* in the absence of transverse yellow bands, and more similar to that of *Scolodesmus*. The greater development of the carinae, however, forbids a reference to that genus. The specimen belongs to the Berlin Museum and was collected at Terra Boror, 18° south latitude, the vicinity of Quilimane.¹

HABRODESMUS NEGLECTUS (Silvestri).

Stongylosoma neglectum SILVESTRI, Ann. Mus. Civ. Genov. (2), XXXV, p. 485, fig. 2, 1895.

The characters given in the description of this species are scarcely more than generic, but from the figures it appears that it may safely be referred to the present genus.

Locality.—Shoa, Abyssinia. The type is in the Genoa Museum.

XANTHODESMUS, new genus.

Evidently closely related to *Habrodesmus*, but distinguishable by the absence of pores from the fifth segment and of a process from the sternum of the fourth pair of legs of males. The copulatory legs are similar to those of *Habrodesmus*, but are divided toward the apex into two curved prongs, a condition not known to exist in any species of *Habrodesmus*. The body is somewhat more slender and the carinae are somewhat less developed than in *Habrodesmus*, but these differences are merely quantitative and would be supposed to have specific value only, were it not for the structural characters mentioned, the constancy of which in other families of the present order is well known. The sternum of the fourth legs in the present genus seems not to be widened or otherwise modified, and is in all respects like that of the fifth pair, both being slightly sulcate longitudinally.

XANTHODESMUS ABYSSINICUS, new species.

Head as wide as the first segment; vertex and clypeus strongly and evenly convex, smooth; sulcus narrow and shallow, though distinct.

First segment evenly convex, a slight transverse depression in front of the posterior margin, stronger laterad; anterior and lateral margins finely raised, but not so broad as in *Habrodesmus massai*.

¹ Since the above was written material from Quilimane has turned up and is here described under *Phacodesmus*. It is by no means impossible that *Ph. longipes* (Attems) is a synonym of the present species, but the type of *aculeatus* is not at hand for comparison.

Second segment with lateral carinae much below the level of the others, longer and somewhat stronger; inferior carina distinct, forming with the somewhat raised margins a distinctly concave, subtriangular lateral surface for this segment; this condition is not distinct from that which appears in the species of *Habrodesmus*, but is more pronounced.

Subsequent segments strongly arched, smooth; transverse sulcus of posterior subsegments deep; sutural constriction deep and long, not crenulated; posterior margin of segment scarcely uneven.

Lateral carinae scarcely projecting beyond the posterior margins, even on posterior segments; poreless carinae distinct as a narrow ridge; poriferous carinae much broader, scarcely more prominent, and appearing less so as they pass more gradually into the general contour of the surface.

Last segment subtriangular, distinctly though narrowly truncate at the apex; somewhat in front of this is a faint corner or tubercle on each side.

Anal valves somewhat rugulose, margins distinct, compressed; setiferous prominences broad.

Preanal scale semicircular, faintly and bluntly apiculate; setiferous tubercles distinct, close to the apex.

Sterna narrow, sparsely hirsute, not sulcate.

Legs slender, sparsely hirsute; the anterior with distinct pads of dense hairs on the inferior face of the distal joints, as in *Habrodesmus*.

Copulatory legs shaped much as in *Habrodesmus*, rather slender: no process from near the middle of the last joint, which is divided at apex into two slender subconnivent, subequal prongs.

Color pattern probably much as in the species of *Habrodesmus*: the single dried specimen is chestnut brown, lighter below and with a narrow pale band on the posterior margin and carinae of each segment.

Length of broken specimen about 20 mm.; width 2.4 mm.; antennae and legs bent or broken; probably slightly shorter proportionally than in *Habrodesmus hartmanni*.

Locality.—Abyssinia; a single male specimen collected by Steudner at Keren is in the Berlin Museum, No. 374.

CNEMODESMUS Cook.

Cnemodesmus Cook, Proc. U. S. Nat. Mus., XVIII, p. 97, 1895.

Body rather small and slender, somewhat depressed, not constricted behind the first segment.

Carinae distinct and distinctly produced on all segments, but not so prominent as in *Phaeodesmus*.

Sterna armed only with slight, rounded prominences at the bases of the legs; sternum of fourth legs with a rather broad, thin-edged, truncate and slightly notched process, the lateral sides of which are distinctly sloping.

Legs long and slender, but more robust than those of the other

genera of the group; anterior legs somewhat crassate, especially the third joint of legs 4-6, which bears in addition a subconic, truncate, oblique process, on which is located the aperture of the duct of an internal gland; two distal joints of anterior legs of male with cushions of dense hairs.

Copulatory legs comparable to those of *Habrodesmus*, that is with a very slender and a broader prong.

Distinct from all known African genera in the form of the third joint of legs 4-6. In this respect its nearest relative is *Phaeodesmus*, and the characters of the carinae support this view. The copulatory legs and process of the sternum of the fourth legs of *Phaeodesmus* accentuate the distinctness of the genera.

CNEMODESMUS THYSANOPUS (Cook and Collins).

Paradesmus thysanopus COOK and COLLINS, Ann. N. Y. Acad. Sci., VIII, p. 25, pl. 1, figs. 1-6, 1893.

Cnemodesmus thysanopus COOK, Proc. U. S. Nat. Mus., XVIII, p. 97, 1895.

Locality.—Congo.

Type.—No. 628, U. S. N. M. Collected by the United States Eclipse Expedition to West Africa, 1889 and 1890.

PHAEODESMUS, new genus.

Body rather small, somewhat depressed, very slender, and not constricted behind the first segment.

Carinae more distinct than in the other genera, distinctly produced on all segments into sharply triangular corners, which extend caudad beyond the transverse margin of the segments.

Sterna with conic processes very distinct and narrowly pointed, more prominent than in other genera; sternum of fourth legs with a very prominent, antero-postically flattened, and strongly chitinized, naked process, the lateral sides of which are notched at base, so that the structure in question is broader distad; sternum of sixth legs with process rudimentary.

Legs long and slender; last joint of anterior male legs with pads of dense hairs; third joint of legs 5 and 6 with appressed spiniform processes evidently comparable with those of *Cnemodesmus*, but much smaller and the joint not crassate.

Copulatory legs with two large leaf-like processes projecting mesad from near their middle; distally the legs have two prongs not unlike those of *Habrodesmus*.

Distinct from *Habrodesmus*, which it resembles in habit and development of carinae by the large mesially directed processes of the copulatory legs, and the very prominent and flattened process of the sternum of the fourth legs of the male. The sterna of the posterior pair of legs of all segments behind the eighth are produced into sharp

conic spines, narrower and more pointed than those of other genera, and the carinae are more produced and more acutely pointed than elsewhere, exceeding in this respect *Cnemodesmus*, which considerably surpasses *Habrodesmus*, where the middle segments have the carinae not produced. The presence of processes on the third joints of legs 5 and 6 is another indication of affinity with *Cnemodesmus*.

PHAEODESMUS LONGIPES (Attems).

Orthomorpha longipes ATTEMS, Mitth. Naturh. Mus. Hamburg, XIII, p. 25 (1896).

Head slightly broader than the first segment; vertex even, sulcus fine, broader below; clypeus even, sparsely hirsute with short hairs.

First segment subreniform, the lateral margin raised and defined by a distinct groove.

Second segment slightly broader than the first, as in *Habrodesmus laetus*; its posterior corner produced into a distinct rounded lobe.

Segments dorsally smooth, but scarcely shining, transverse sulcus beginning from the fifth segment; fine, not deep, obsolete from the sixteenth segment.

Lateral carinae distinct, considerably more prominent than in *Habrodesmus laetus*, the corners produced on all segments beyond the posterior margin as a distinct triangular process. Viewed from the side, the carinae appear equally distinct from those of the species mentioned, being narrower and much more produced and pointed. On poreless segments they are much reduced, but still distinctly exceeding the margin, as is also the case on posterior segments, including the nineteenth.

Transverse constriction rather long, distinct and moderately deep, not crenulate.

Last segment smooth to near the apex, where it is abruptly narrowed; apex subcylindrical, truncate.

Anal valves sparsely rugulose, the setae borne on minute tubercles rather remote from the distinctly compressed and rather prominent margins.

Preanal scale subtriangular, rounded, with two small setiferous tubercles distinct from the margin.

Sterna with a distinct, sharply conic process at the bases of the posterior legs of each segment. At the bases of the anterior pair are much smaller processes; sternum of the fourth legs of male with a very prominent, antero-postically flattened process, which is slightly narrowed on the sides at base and has its distal edge strongly chitinized, of a brown color, naked and slightly notched in the middle.

Legs distinctly more slender than those of *Habrodesmus laetus* and somewhat more sparsely hirsute; anterior legs of male with pads of dense hairs; third joint of legs four and five of male with a subappressed, spiniform process from the ventral face of the distal part of the third

joint. This process suggests that of *Cnemodesmus thysanopus*, but is much more pointed. There is also a difference in that the joint affected is crassate in *Cnemodesmus* and the third leg is there also provided with the largest process, while here entirely unarmed.

Copulatory legs with two large subfalcate processes from near the middle; distally the legs cross each other and are divided at apex into two unequal prongs.

Length of male, 22 mm.; width, 2 mm.; length of leg from tenth segment, 4.3 mm.; of antenna, 4.7 mm.

Color of alcoholic specimens rather light chocolate brown, the carinae and under surface pale yellowish; antennae and distal joints of the legs brown.

Locality.—Quilimane, collected by Stuhlmann.

Type.—Hamburg Museum. Through the kindness of Professor Kraepalin I have had the opportunity of studying types of this species. The above description differs in some points from that of Attems, who found the dorsal surface granular, and overlooked the processes of the fourth and fifth legs, and of the sternum of the fourth legs. There is also no distinct constriction of the anterior segments, as in *Scolodesmus*, the relative proportions of the segments being normal, since throughout the present family the fifth segment is abruptly larger than those which precede it.

In the Berlin Museum (No. 557a) is a specimen from Wito (Fischer) which has been reported by Professor Karsch as *Strongylosoma hartmanni*.¹ The specimen is not now available, but drawings of the copulatory legs show that it is closely related, if not specifically identical with the types of *longipes*. This species may also prove to be a synonym of *Strongylosoma aculeatum* Peters.

¹Troschel's Archiv. f. Naturgesch., XLVII, p. 44 (1881).

AMERICAN LEAF-HOPPERS OF THE SUBFAMILY TYPHLOCYBINAE.

By CLARENCE P. GILLETTE,

Professor of Zoology and Entomology, Colorado Agricultural College.

THIS subfamily comprises the lowest, and also the most beautiful and fragile, of the species included in the family Jassidae of the order Hemiptera. On account of the very small size of most of the species and the difficulty with which they are preserved in suitable condition for study, the group has been much neglected by students of entomology in this country. Mr. Van Duzee, in his Catalogue of the Described Jassoidea of North America, lists thirty-five species in this subfamily, and Berg, in Hemiptera Argentina, described three species from South America, while Doctor L. Melichar, in Cicadinen von Mittel-Europa, lists seventy-three species. Although the present paper fully doubles the number of species known to occur in the Americas, it is evident that the study of the Typhlocybinæ on this side of the Atlantic is only fairly begun.

The attempt is here made to get together the scattered descriptions of American species, to give a fairly complete bibliography of American literature on the group, to straighten out the synonymy among the species, and to describe such new forms as have come to hand, so that others may be helped in working up such material as they possess. No attempt has been made to give a complete bibliography of other than American writings, but in every case all references are given that have come to my notice.

Classification.—It will be noticed that certain genera recognized by late European writers are not recognized in this paper. *Erythria* is united with *Dieraneura*, and *Zygina* and *Zyginella* with *Typhlocyba*, because the characters separating these genera seem to me not to be of generic importance. *Chlorita* and *Kybos* are put under *Empoasca* because *Empoasca* has precedence and covers both of the former, and because the characters separating the genera are not constant. Among the species described in this paper there can be found every possible gradation between the *Chlorita* and *Kybos* type of vertex, and the difference in elytral venation is often found in a single species and even in single individuals.

Important characters.—The characters in the Typhlocybinae are fewer and less constant than those of higher forms. The most constant seem to be those of the form of the face and vertex and genital pieces, and of the form and venation of the wings and elytra.

Acknowledgments.—Although I shall mention, in connection with each species, the names of those who have sent me specimens, I feel that special mention should be made of the large number of specimens sent me for study by the United States National Museum, by the Illinois State Laboratory of Natural History, and by Cornell University. Special acknowledgments are also due Mr. E. P. Van Duzee, who has sent me much American material and who kindly loaned me his private collection of European species.

CHARACTERS DISTINGUISHING THE TYPHLOCYBINAÆ.

The Typhlocybinae are readily separated from all other Jassoidea by the four longitudinal veins or sectors of the elytra, which run to the cross-nervures forming the apical cells without branching, so that there are no anteapical cells, and by the lack of supernumerary cells in the posterior wings.

ANALYTICAL KEY TO THE AMERICAN GENERA OF TYPHLOCYBINAÆ.

- A. Sectors of posterior wings ending in a marginal vein.
 - B. Elytra with an appendix, beyond the clavus.....*Alebra*.
 - BB. Elytra without appendix.
 - C. Two apical cells in posterior wing*Dicranoura*.
 - CC. One apical cell in posterior wing*Empoasca*.
- AA. Sectors of posterior wings ending in wing margin, no marginal vein.
 - Sectors 1 and 2 uniting so that only three veins extend to the margin.. *Typhlocyba*.
 - All four sectors extending to the wing margin.....*Eupteryx*.

Genus ALEBRA Fieber.

ANALYTICAL KEY TO THE AMERICAN SPECIES OF THE GENUS ALEBRA.

- A. Vertex broadly rounded, hardly at all produced.
 - B. Entirely yellow, or whitish and yellow.....*albostrigata*.
 - BB. Yellow, with a broad dorsal stripe blackish.
 - C. Face broader than long.....*dorsalis*.
 - CC. Face longer than broad.....*fumida*.
 - BBB. Elytra deep smoky, marked with red.....*robusta*.
- AA. Vertex much produced.
 - B. Color light yellow; three dark spots on inner margins of elytra....*trimaculata*.
 - BB. Color yellow, two broad transverse black bands on elytra.....*bifasciata*.
 - BBB. Light yellow, marked above with white and golden yellow, the latter margined with black on elytra.....*curvilinea*.

ALEBRA CURVILINEA, new species.

General color pale yellow, marked above with white and golden, the latter, upon the elytra, margined with black. Length, 3 mm.

Face very long and narrow, one-third longer than broad; clypeus

exceeding the genae by about one-third its length, color sordid white. Vertex rather strongly produced, whitish in color, very narrow between the eyes, which are large. Pronotum a little broader than the head, strongly produced anteriorly, yellow on the anterior and white on the posterior half. Scutellum yellowish brown, paler across the middle. The extreme bases of the elytra are white, just beyond the white base of either elytron is an oblique golden-yellow stripe margined with a narrow black line posteriorly; following this is a rather broad milky white line which rises on the inner margin near the base of the elytron and forms two arcs, the first extending to the costal margin and returning to the inner margin at the tip of the clavus, the second arising at tip of the clavus, extending to near the costal margin and returning to the inner margin near the tip of the elytron. Within the large arc is a large golden area, palest at the center; another smaller spot of the same color lies in the angle formed by the union of the two arcs. Abdomen above and below yellow. Feet entirely yellow. (See Fig. 1.)

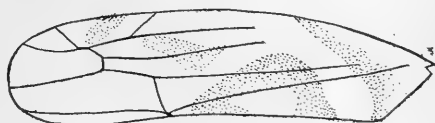


FIG. 1.—ELYTRON OF ALEBRA CURVILINEA.

Described from one male and one female, the former taken in January and the latter in April by Mr. H. H. Smith at Chapada, Brazil.

ALEBRA BIFASCIATA, new species.

Color yellow, with two broad transverse bands of black on the elytra. Length, 3 mm.

Face light yellow, unicolorous; clypeus long and considerably exceeding the genae, entire length of face exceeding the breadth by about one-third of the latter. Head small, distinctly narrower than the pronotum; vertex yellow, without markings, strongly produced, eyes large and black. Pronotum entirely yellow and but little longer than the vertex. Scutellum entirely black, except the extreme apex, which, in three examples, is whitish. Elytra yellowish, with a broad black or smoky band at their base and another at the cross-veins; extreme tips hyaline or nearly so. (See Fig. 2.) Abdomen entirely yellow, or with the terminal segments of the tergum black. Last ventral segment of female moderately produced and entire. Legs entirely pale yellow.



FIG. 2.—ELYTRON OF ALEBRA BIFASCIATA.

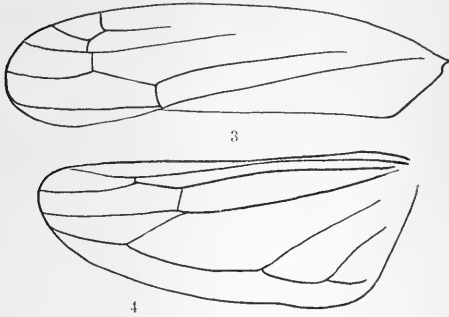
In two of the males the dark basal band of the elytra does not quite reach the costal margins.

Described from four males and one female taken by Mr. H. H. Smith at Chapada, Brazil.

ALEBRA TRIMACULATA, new species.

Color light yellow, three dark spots on the inner margins of the elytra. Length, 3.25 mm.

Face pale yellow, unicolorous, length about once and a half the breadth; clypeus very long, much exceeding the genae. Head, thorax, and pronotum yellow, immaculate; compound eyes dusky, with a greenish tinge; vertex rather strongly produced; head distinctly narrower than the pronotum. The dark spots on the elytra are arranged as follows: The first is on the inner margin of the clavus and about one-third of the length of the clavus from its base, the second is also on the inner margin just before the inner cross-nervure and opposite the tip of the clavus, and the third,



FIGS. 3 and 4.—ELYTRON AND WING OF *ALEBRA TRIMACULATA*.

which is not as dark as the others, lies just beyond the outer cross-nervure near the apex of the elytron. Abdomen and all beneath pale yellow. Last ventral segment with the posterior angles broadly rounded and with a slight scoop-shaped tooth on the middle of the posterior margin. (See Figs. 3 and 4 for wing venation.)

Described from a single female taken by Mr. H. H. Smith in April at Chapada, Brazil.

ALEBRA ROBUSTA, new species.

Beneath yellow; vertex and pronotum yellow marked with red; elytra deep smoky marked with red. Length, 3.25 mm.

Face very pale yellow, almost white; length about five-fourths of the breadth; clypeus moderate in length but considerably exceeding the genae. Vertex pale yellow, with three red spots, one at the extreme apex and two back of this between the compound eyes, but little produced, narrow; compound eyes large. Pronotum hardly broader than the head and marked with four red lines, one on either side extending back from the compound eyes, and two parallel ones upon the dorsum. Scutellum reddish brown, indistinctly marked with whitish lines and spots, blackish near the apex, but the extreme apex light yellow. Elytra deep smoky, with a broken yellowish oblique line on the clavus, a similar reddish line on the inner sector, and a broad outer margin to the first cross-nervure varied with blotches of reddish yellow and reddish brown. Abdomen blood-brown above, pale yellow beneath. Legs entirely pale yellow. (For form of vertex and pronotum and for venation of elytron, see Figs. 5 and 6.)



FIG. 5.—VERTEX AND PRONOTUM OF *ALEBRA ROBUSTA*.

Described from a single male taken by Mr. H. H. Smith in the month of April at Chapada, Brazil.

ALEBRA DORSALIS, new species.

Entirely yellow beneath, mostly deep smoky or blackish above back of the vertex. Length, 4 mm.

Face remarkably short and broad, the breadth exceeding the length by about one-sixth of the latter; the clypeus broadly rounded below, and hardly exceeding the genae, broader near the apex than at the base. Vertex broadly rounded, slightly produced, yellow, with a slight dusky coloration posteriorly. Pronotum short and broad, a little narrower than the head, deep smoky or blackish in color, except at the sides back of the compound eyes where it is yellow. Scutellum concolorous with the pronotum, and without markings except the extreme apex, which is yellowish. Elytra yellowish hyaline on the outer half, the inner half and entire apex deep smoky. Tergum black with the lateral margins of the segments deep yellow, all beneath yellow.

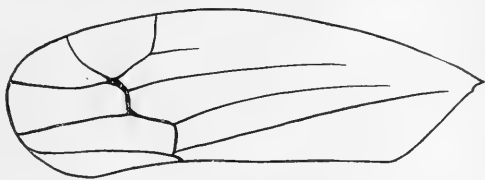


FIG. 6.—ELYTRON OF ALEBRA ROBUSTA.

Described from one male taken by Mr. H. H. Smith, in the month of April, at Chapada, Brazil.

ALEBRA ALBOSTRIELLA Fallen.

Cicada albostriella FALLEN, Hemiptera Sueciae-Cicadariae, p. 54, 1829.

Typhlocyba albostriella FLOR, Rhyn. Livl., pp. 373, 382, 1861; varieties *fulveola*, *elegantula*, *Wahlbergi*, *discicollis*, and *fasciata*, *ibid.*, p. 384.

Alebra albostriella FIEBER, Kat. d. eur. Cicad., p. 14, 1872; varieties *elegantula*, *discicollis*, *fulveola*, and *Wahlbergi*, *ibid.*, p. 14.—MAYR, Rhyn. Triol., II; Hemip. hom. (Cicad.), p. 23, 1880; Tab. d. Cicad. v. Centraleuropa, p. 36, 1884.—PUTON, Cat. d. Hemipteres, p. 86, 1886; varieties *elegantula*, *discicollis*, *exima*, *fulveola*, and *Wahlbergi*, *ibid.*, p. 86.—MELICHAR, Cic. v. Mittel-europa, p. 317, 1896.—WOODWORTH, Psyche, V, p. 76, 1888.

Typhlocyba aurata, *pallida*, and *binotata* WALSH, Proc. Bost. Soc. Nat. Hist., p. 315, 1864.

Alebra aurea, *pallida*, and *binotata* WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 309, 1894.

Erythroneura mali PROVANCHER, Pet. Faune Ent. Can., III, p. 298, 1890.

According to Fallen this species is described as follows:

Cicada albostriella lutescens, thoracie lineis tribus elytorumque duabus albis, pedibus pallidis.

Mas. & Fem. Colore similes. In Ostrogothia a D. Zetterstedt inventa. Statura *Cic. variate*. Longit. 2 lin.—Caput immaculatum. Thorax untrinque striga laterali & media dorsali, quae scutellum transit, alba pulchre picta. Elytra pellucida lutescentia: striis duabus albis magisque pellucidis a basi fere ad apicem ductis. Abdomen supra nigricans, subtus pallidum. Pedes in exsiccatis albidus.

Fig. 7 shows form of vertex and pronotum, and Figs. 8 and 9 the venation of elytron and wing.

This species, on account of its wide distribution and great variety of forms, has been described, as indicated above, under no less than seven different names in Europe and four in this country. Walsh's *aurea* is identical with *fulveola* H-S., and his *pallida* is like the *albostricella* of Fallen. These are the only two varieties that I have seen from this country. It is possible that Walsh's *binotata* may be a good species, but it hardly seems possible, as the only difference between this and *aurea* is its paler yellow color and a little dusky marking.



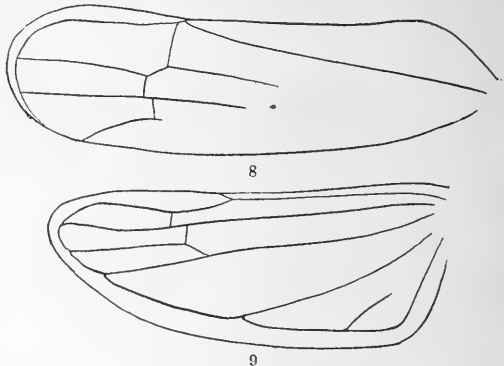
FIG. 7.—VERTEX AND PRONOTUM OF ALEBRA ALBOSTRICELLA.

This seems a rather rare species in this country. I have seen but nineteen specimens in all, and twelve of these were in one sending from Mr. Otto Heidemann.

I have received specimens of this species as follows: From Professor J. B. Smith, two specimens, labeled "Washington, D. C., 2-6, '93;" from Professor G. C. Davis, two specimens, one taken on pear and one on cherry at the Michigan Agricultural College; one from Mr. C. F. Hart, taken in Illinois; from Mr. E. P. Van Duzee, two, taken at Hamburg, New York, sweeping ferns and rank weeds; from Mr. Otto Heidemann twelve, eleven of which were marked "Washington, D. C.," and one "Rock Enon Spr., Va." Walsh's specimens were taken at Rock Island, Illinois, and Provancher's in Canada.

ALEBRA FUMIDA, new species.

Yellowish below, dark smoky above; length 3.75 mm. Face entirely yellow or slightly washed with smoky above; length of front 0.9 mm., breadth 0.8 mm.; the clypeus is pointed at the tip, broadest a little below the middle, and is a little more than one-third the length of the front. The genae are narrow, deeply incurved beneath the eyes, scarcely visible against the lorae, broadened beneath the lorae where they meet the clypeus at its broadest part, some distance from the apex. Antennae yellow, a little paler than the face. Vertex concolorous with the face, without markings, except a dark median line, not perceptibly longer at the middle than at the eyes, ocelli wanting. Pronotum varying from yellow washed with smoky brown on the middle and posterior portions to dark smoky throughout; width, one and six-



FIGS. 8 AND 9.—ELYTRON AND WING OF ALEBRA ALBOSTRICELLA.

the clypeus at its broadest part, some distance from the apex. Antennae yellow, a little paler than the face. Vertex concolorous with the face, without markings, except a dark median line, not perceptibly longer at the middle than at the eyes, ocelli wanting. Pronotum varying from yellow washed with smoky brown on the middle and posterior portions to dark smoky throughout; width, one and six-

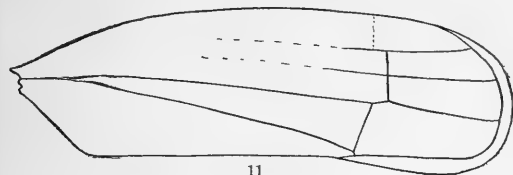
sevenths times the length, and its length just twice the length of the vertex; posterior margin a little concave. Scutellum usually a little darker than the pronotum, the transverse groove black; elytra deep smoky to blackish, the color deepest on clavus and near the tips. Tergum, smoky brown, with the apical margins of the segments yellowish; ovipositor, yellowish; sheaths, smoky brown; venter, yellow; pygofer, infuscated. Legs yellow throughout with claws blackish.

Type.—No. 3411, U.S.N.M.

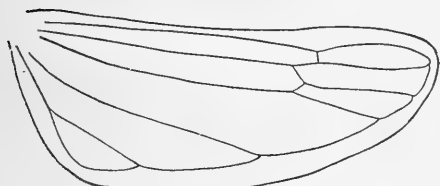
Described from four females and one male, all from Cornell University and labeled "Ithaca, N. Y.,



FIG. 10.—VERTEX AND PRONOTUM OF ALEBRA FUMIDA.



11



12

FIGS. 11 and 12.—ELYTRON AND WING OF ALEBRA FUMIDA.

July 31, '94." (See Figs. 10, 11, 12.) I do not feel at all certain that the above may not prove to be another of the many varieties of *albostriella* when a larger series of this species has been studied, as the principal differences seem to be in coloration.

Genus DICRANEURA
Hardy.

Only two American species in this genus have been reported up to the present time. From the material in hand, I am able to recognize a good number of both of these and to add eight others, seven of which are new.

ANALYTICAL KEY TO THE AMERICAN SPECIES OF THE GENUS DICRANEURA.

- A. Elytra with a deep triangular apical cell on costal margin.
- B. Elytra covered with red spots of varying size.....*maculata*.
- BB. Elytra whitish, unicolorous, or with two longitudinal sanguineous lines on each, without black spot.....*cruentatus*.
- BBB. Elytra with orange markings and with a black spot in the middle apical cell.....*unipuncta*.
- BBBB. Elytra largely colored with red and with a black spot in the inner apical cell.....*l-rivata*.
- AA. Elytra with apical cell on costal margin lanceolate or wanting.
- B. Elytra milky white, nervures indistinct.....*communis*.
- BB. Elytra yellowish or pinkish.
- C. Vertex and pronotum with two reddish longitudinal lines; very slender species with strongly produced vertex.....*abnormis*.
- CC. Vertex and pronotum without red lines.
- D. Elytra with large median red spot or band.....*cockerellii*.
- DD. Elytra without transverse red markings.
- E. Length under 3 mm.....*kunzei*.
- EE. Length 3 mm. or more.
- F. Venter yellow.....*fiberi*.
- FF. Venter nearly or entirely black.....*carneola*.

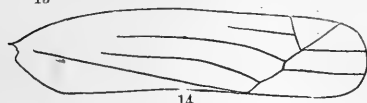
DICRANEURA MACULATA, new species.

Ground color very pale yellow, almost white, spotted above on vertex, pronotum, scutellum, and elytra with red, and on the face with blackish. Length, 3 mm.

Vertex strongly produced, almost acute at apex, the angle slightly less than a right angle; a transverse red line on the extreme apex, and a broad red band beginning at either eye extends to near the middle line on either side, and then is deflected back to the posterior margin, where the two halves coalesce. Face pale yellow; a red line starting at either eye runs above the antennae and then is bent upward, meeting its mate at an acute point a little below the margin of the vertex; above this line and on a level with its highest point on either side of the front is a dark dot, and there is a row of about seven transverse dark dashes on either side of the front below the red line, and also a conspicuous dark spot on the gena below the compound eye on either side. The pronotum has a broad red band which starts on



13



14



15

FIGS. 13, 14 and 15.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF DICRANEURA MACULATA.

to near the posterior margin, when it crosses the middle line of the pronotum, so that the posterior margin and a large blotch on the middle anteriorly are whitish without red markings. The scutellum is slightly washed with a pinkish coloration, and the tip is red. On the clavus of the elytra are four red blotches in a line, the largest being near the base and the smallest at the extreme tip; there are also a

few small red dots along the claval suture anteriorly; on the corium are about four large red spots and numerous minute red dots. The red spots are, one close to the base of the wing and not very large, a large elongate spot back of it extending toward the third spot on the clavus, another on the middle of the corium just anterior to the spot at the tip of the clavus, and a fourth on the middle of the costal margin. The red dots are scattered almost the entire length of the corium, but are most abundant in the region of the cross nervures. The cross nervures run very diagonally from the tip of the clavus toward the tip of the elytron, the first apical cell on the costal margin being short and triangular and coming far short of the apex of the elytron. In the wing the second inclosed apical cell is unusually small. Feet very pale yellow; tips of tarsi and spots at the base of the posterior tibial spines blackish. (See Figs. 13, 14, 15.)

Type.—No. 3412, U.S.N.M.

Described from one male sent from the Illinois State Laboratory of Natural History. This is a very beautiful species, and quite unlike any other that I have seen in its coloration.

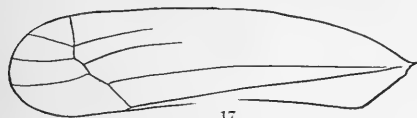
DICRANEURA CRUENTATA, new species.

Color very pale yellow, with pronotum, scutellum, and elytra marked with sanguineous. Length, 2.75 mm.

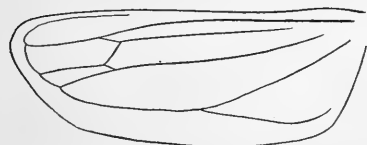
Face pale yellow, without markings, sutures rather indistinct, antennae concolorous with the face. Vertex of the same color as the face, except that it is usually darker and may or may not have a sanguineous blotch on the middle, considerably produced, apex moderately rounded, the angle somewhat less than a right angle. Pronotum three-fourths broader than long, less than once and a half the length of the vertex, a little concave posteriorly, with a sanguineous line on either side extending from the inner angle of the eye in a straight line to the basal angle of the scutellum, leaving the lateral margins and a large rectangular area on the disk pale yellow. Scutellum entirely sanguineous. Elytra pale yellow, translucent, with a bright red dash of greater or less extent on the clavus, and another along the inner sector on the corium, beginning at about the middle of the wing and extending nearly or quite to the cross veins. Venation of elytron very similar to that of *maculatus* as seen in the illustration. There is also a more or less intense smoky decoloration of the elytron in the region of the cross veins. Tergum and venter pale yellow, feet whitish.



FIG. 16.—VERTEX AND PRONOTUM OF *DICRANEURA CRUENTATA*.



17



18

FIGS. 17 and 18.—ELYTRON AND WING OF *DICRANEURA CRUENTATA*.

The sanguineous markings vary from bright blood red to very pale, and in some specimens they are entirely wanting. The red dashes on the elytra are present in most of the specimens I have seen. (See Figs. 16, 17, 18.)

Type.—No. 3413, U.S.N.M.

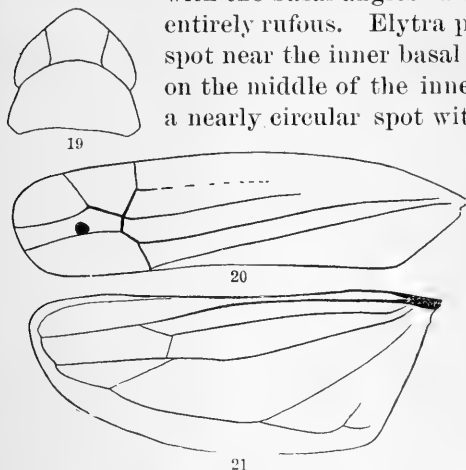
Described from fifteen specimens from Cornell University,

marked "Ithaca, N. Y., Aug. 28, '94," one specimen from Mr. Clermont Livingston, taken on Alder, at Corfield, Vancouver Island, and nine specimens taken by myself among dry leaves in the foothills near Fort Collins, Colorado, April 9. None of the specimens from the foothills show red markings on pronotum or scutellum and only about half have the red dashes on the elytra. The smoky coloration upon the two outer sectors of the elytron just before the cross-nervures and upon the inner cross-nervure is perfectly constant in the above mentioned specimens.

DICRANEURA UNIPUNCTA, new species.

Color yellow, marked with fuscous and orange above. Length, 3.25 mm.

Face about one-fifth longer than broad, quite narrow below, clypeus very narrow, general color uniform light to sordid yellow. Vertex moderately produced, its angle a right angle, fully two-thirds as long as the pronotum, the width of the head hardly two and one-half times the length of the vertex, with or without two longitudinal orange-colored stripes. Pronotum slightly less than twice as wide as long, pale yellow in color, and with or without four narrow longitudinal orange lines above. These lines are sharply defined in two specimens, but in the others they are faint or entirely wanting. Scutellum pale yellow with the basal angles rufous, or, in one specimen, almost entirely rufous. Elytra pale yellow, a large round orange spot near the inner basal angle, another semicircular spot on the middle of the inner margin of the clavus, making a nearly circular spot with its mate, and a long orange-



FIGS. 19, 20, and 21.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF DICRANEURA UNIPUNCTA.

colored line just outside the clavus and extending from near the base of the clavus to its tip; the apical nervures are lemon-colored bordered with smoky, and near the center of the middle apical cell is a black spot which is very conspicuous. For the venation see Fig. 20. In one specimen the orange-colored spots on the clavus have run together and all the orange coloration is weak and obscured with fuscous. Abdomen in the females golden yellow above and below, in a single male, entirely dark smoky except the tips of the segments and at the sides. Feet uniform pale yellow. (See Figs. 19, 20, 21.)

Type.—No. 3414, U.S.N.M.

Described from three females and one male from the United States National Museum, one of which is labeled "Coquillett, Collector, Calif., through C. V. Riley," and three are labeled "Coquillett, Los Angeles, Calif."

DICRANEURA COMMUNIS, new species.

Sordid milky white, pronotum vertex and scutellum slightly yellowish, without distinct markings above. Length, 3.75 mm.

Face very pale sordid yellowish, unicolorous, entire front hardly longer than broad; clypeus a little more than one-third the length of the front, broadest below the middle, somewhat constricted near the base, rounded at the apex; lorae as long as the clypeus and as broad as

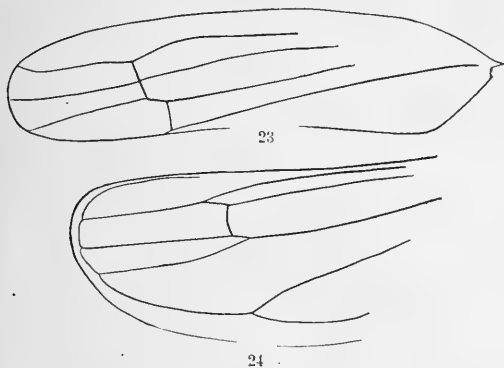
the base of the clypeus; genae rather broad beneath the lorae but not attaining the tip of the clypeus. Vertex concolorous with the face, without markings, the anterior angle a right angle and rather acute. Pronotum a little paler than the vertex except upon the middle where it is somewhat darker, a little more than once and a half as broad as long and fully once and a half the length of the vertex a little concave, behind. Scutellum whitish, or yellowish white, with the transverse groove short and black. Elytra dull milky white, subopaque, nervures indistinct, unicolorous throughout, with three long narrow apical cells as shown in the illustration. Tegum black, venter black to the last segment, which is whitish, with the tip corneous, pygofers whitish, pectus black, feet whitish throughout. (See Figs. 22, 23, 24.)

Types.—No. 3415, U.S.N.M.

Described from two specimens from the Illinois State Laboratory of Natural History; one swept from rye, April 22, and one at light, April 30, Nos. 14873 and 17904; one specimen from Cornell University marked "Ithaca, N. Y., 31 July, '94;" four specimens from Professor G. C. Davis taken at Michigan Agricultural College between April 21 and May 20; seven specimens from the collection of Mr. C. F. Baker, all taken at Lausing, Michigan, on grass, between April 28 and June 6; one specimen taken by the writer in miscellaneous sweepings along the river at Fort Collins, Colorado. Males and females.



FIG. 22.—VERTEX AND PRONOTUM OF DICRANEURA COMMUNIS.



FIGS. 23 and 24.—ELYTRON AND WING OF DICRANEURA COMMUNIS.

DICRANEURA ABNORMIS Walsh.

Chloroneura abnormis WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 316, 1864.

Dicraneura abnormis WOODWORTH, Psyche, V, p. 213, 1889.

Walsh describes this species as follows:

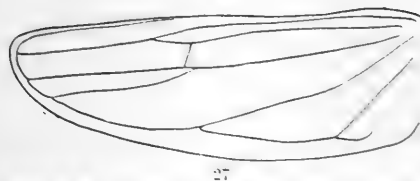
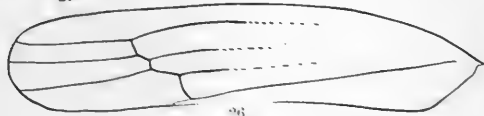
Pale dull green, front of head forming an angle of about 80°, with the apex rounded; antennae and eyes fuscous; vertex and thorax with two sanguineous vittae, more or less obsolete. Abdomen black, except the tips of the joints; the last joint almost entirely greenish. Tips of tarsal joints dusky. Elytra, towards the base, subopaque, dull greenish; at tips, subhyaline; an obscure sanguineous vitta on the anal vein, and another parallel with it halfway to the costa, both sometimes obsolete. Wings whitish, subopaque, with the tips of the costal veins fuscous; the cross vein forming a salient angle, and emitting from its apex an additional vein, as in *Typhlocyba*. Length to tip of wings, three-twentieths of an inch. (See Figs. 25, 26, 27.)

I have several specimens from the Illinois State Laboratory of Natural History, all taken September 13 in general sweeping, No. 15418. Others have been received from the private collection of Mr. C. A. Hart, taken in Illinois: from Mr. Th. Pergande, marked "D. C.;" and from the United States National Museum, marked "Texas, Injuring wheat."

VARIETY RUFULA, new variety.

Colors above pale yellow and reddish. Breadth, $\frac{2}{3}$ mm.: length, 3.5 mm.

Face long, pale yellow, or yellow slightly washed with reddish. Vertex rather strongly produced and pointed, the angle distinctly less than a right angle, two-thirds the length of the pronotum, but little less than half as long as the breadth of the head, yellow with two longitudinal reddish lines extending from the hind margin to near the anterior. Pronotum two-thirds as long as broad, yellow on the lateral and anterior margins, on



FIGS. 25, 26, 27.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF *DICRANEURA ABNORMIS*.

the middle and posterior portions red. Scutellum mottled with red and yellow, the red predominating. Elytra very long and slender, pale yellowish and finely spotted with red to the cross-veins, beyond the cross-veins transparent. Abdomen blackish above, yellow beneath, tip of the ovipositor infuscate. Feet entirely light yellow.

Described from a single female from the United States National Museum labeled "Coquillett, Los Angeles, Calif."

A mutilated specimen probably belonging with this variety and labeled "Placer Co., Calif., Aug.," differs in having the vertex a little shorter and in having the red coloration of the elytra evenly diffused over the basal two-thirds, except that the veins are yellow.

Additional specimens may show that this variety is worthy of specific rank, but I do not think such will be the case.

DICRANEURA COCKERELLII Gillette.

Dicraneura cockerellii GILLETTE, Psyche, VII, Supp., p. 14, 1896.—COCKERELL Bull. 19, N. M. Exp. Sta., p. 114, 1896.

General color light straw yellow, a bright red band crossing the elytra before the middle. Length, 3 mm.

Head: Vertex strongly produced and almost acute in front, the angle being somewhat less than a right angle, as long as the pronotum; color

straw yellow, without distinct markings, in some specimens washed with dilute sanguineous with light spots on the posterior margin next the eyes. Pronotum: The breadth is twice the length, moderately concave behind, color like that of the vertex, and, when washed with sanguineous, there is a distinct whitish spot on the middle of the anterior margin next the vertex. Scutellum without distinct markings and agreeing with the vertex and pronotum in color. Elytra pale straw yellow crossed by a narrow band of bright cherry red varying some in depth of color, but plainly discernible in all mature specimens. The band crosses just before the middle of the clavus, and that portion of the band that is above the claval suture is pushed forward so that only about half of its width comes against that portion which is upon the corium; just beyond the cross nervures is a jet black spot lying in the inner apical cell. The venation of the wing is peculiar in that the posterior apical cell is very small. All beneath pale yellow. (See Figs. 28, 29, 30.)

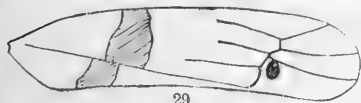


FIG. 28. VERTEX AND PRONOTUM OF DICRANEURA COCKERELLI.

Types.—No. 3416, U.S.N.M.

Described from twenty-five specimens, male and female, sent me by Professor T. D. A. Cockerell, who took them at Las Cruces, New Mexico.

Since publishing the above description I have seen a number of specimens from the United States National Museum labeled "Coquillett, Los Angeles, Calif." Professor Cockerell reports this species as abundant on grapevines in New Mexico.



29



30

FIGS. 29 and 30.—ELYTRON AND WING OF DICRANEURA COCKERELLI.

DICRANEURA KUNZEI, new species.

Elytra and most of pronotum greenish; vertex and scutellum yellow. Length, 2.5 mm.

Face yellow above, but dusky below. Vertex moderately produced and rather bluntly rounded, its length

hardly more than one third of the width of the head, without distinct markings. Pronotum greenish, with the anterior border and the lateral margins yellowish; twice as broad as long and one and a half times as long as the vertex. Scutellum yellow, without distinct markings. Elytra yellowish green, semi-transparent, outer apical cell lanceolate. For venation of elytra and wing see Figs. 32 and 33. Tergum black, venter blackish with the margins of the segments yellow, in one specimen the yellow color predominates below. Feet sordid or greenish yellow. (See Figs. 31, 32, 33.)

Types.—No. 3417, U.S.N.M.

Described from two males and one female taken by Doctor R. E. Kunzé at Tucson, Arizona, between April 11 and 15.

DICRANEURA CARNEOLA Stål.

Typhlocyba carneola STÅL, Stett. Ent. Zeit., XIX, p. 196, 1858.

Notus carneolus FIEBER, Kat. eur. Cicad., p. 14, 1872.

Dicraneura carinata WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 311, 1894.

The following description is from Stål:

Dilute carnea, vertice scutelloque in pallide flavescens migrantibus; tegminibus apicem versus decoloribus, subcarneo-venosis, abdome nigro, ano, pedibus, fronte incisusisque ventris tenuissime pallide flavescens. Male. Long. $3\frac{1}{2}$. Lat. $\frac{3}{4}$ mm. Tab. I, fig. 7. Sitka.



31



32



33

Tegmina cellulis apicalibus 4 elongatis instructa, intermediis 2 subparallelis, quarum anteriore posteriore, paululum longiore, basi truncatis; marginale antica prope basin nonnihil angusta, postica elongato-triangulari. Alae marginate; anterioris venis 3 instructae, quarum 2 anticis pone medium ad unam confluentibus, posteriore pone medium furcata. (See Figs. 34, 35, 36.)

Stål's type was taken at Sitka, Alaska, and he seems to have described from a single male specimen.

FIGS. 31, 32, and 33.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF DICRANEURA KUNZELI.

I have a single male from Mr. C. Livingston, taken on Vancouver Island, in general sweeping, that answers the description perfectly. I have sixteen specimens from Mr. C. V. Piper, taken at Pullman, Washington, in the month of June in general sweeping that are identical with the Vancouver Island specimen, except that they vary greatly in the depth of the rosy coloration of the pronotum and elytra. In most of the specimens this coloration is very slight. Doctor R. E. Kunzé has also sent me a good number of specimens of his collecting at Tucson, Arizona. None of the Arizona specimens have the bright rosy coloration.

DICRANEURA FIEBERI Löw.

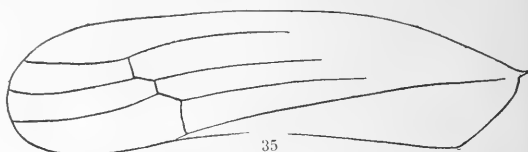
Dicraneura fieberi MELICHAR, Cicadinen von Mittel-europa, p. 325, 1896.

I do not have access to the original description of this species, but have a number of European specimens in my collection sent me by Mr. E. P. Van Duzee, who obtained his specimens from Lethierry, and I find no difference whatever in the specimens from the two countries.

This is a yellow species, without markings and $3\frac{1}{2}$ mm. in length. It will be readily separated from the other species of the genus by the



34



35



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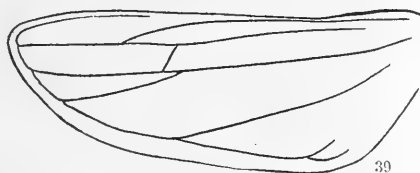
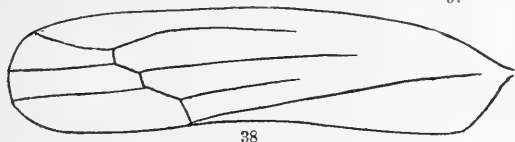
FIGS. 34, 35, and 36.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF DICRANEURA CARNEOLA.

foregoing synopsis and the drawings. (See Figs. 37, 38, 39.) American specimens have been received as follows: From Illinois State Laboratory of Natural History, a good number of specimens taken in general sweeping near Champaign, Illinois; from Iowa Agricultural College, specimens taken at Ames, July 26; from Mr. Samuel Henshaw one specimen marked, "From grass, Cambridge, Mass.;" from Mr. Otto Heidemann, a number of specimens marked, "Washington, D. C.;" from Cornell University, a good number of specimens marked "Ithaca, 25 July," and "Ithaca, 28 Aug.;" from Professor J. B. Smith one specimen marked "N. J., 7 20;" from F. F. Crevecoeur, three specimens taken at Onaga, Kansas.

DICRANEURA QUADRIVITTATA, new species.

Ground color pale yellow, heavily marked with red above. Length, 2.5 mm.

Face very much depressed, so that its line is almost parallel with the line of the vertex and pronotum, very short below the eyes, as broad as long, clypeus small, color a reddish yellow. Vertex moderately produced, its angle a right angle, its length about four-fifths the length of the pronotum and breadth of the head two and one-half times the length of the vertex; the anterior portion and a rather broad median line are yellow, the basal portion outside of the yellow line is bright red. Pronotum twice as broad as long, the colors light yellow and red, the latter color predominating and showing as four broad longitudinal stripes above; on either side there is



FIGS. 37, 38, and 39.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF *DICRANEURA FIEBERLI*.

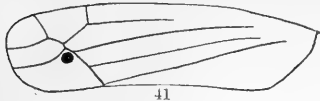
another short red line back of the eyes. Scutellum entirely red. Elytra whitish, marked with red; a large red vitta occupies nearly the whole of the anterior two-thirds of the corium; below this, beginning on the costal margin near its base and running parallel with the red line on the clavus, is another red line somewhat interrupted at the middle; back of these red lines, on the middle of the elytron, are two red spots, one extending in from the costal margin and another, the larger one, inside of this but not reaching to the inner margin; beyond these spots the veins of the elytron are orange bordered with smoky. At the base of the inner apical cell, at the end of the second sector, is a small black spot. Venter smoky yellow; feet light yellow, the tibiae slightly tinged with reddish. (See Figs. 40, 41, 42.)

Type.—No. 3418, U.S.N.M.

Described from a single male from the U. S. National Museum labeled "L. J. Bah, 4/1, 1879, Schwarz."



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42

FIGS. 40, 41, and 42.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF DICRANURA QUADRIVITTATA.

Genus EMPOASCA Walsh.

On account of feeble structural characters, a large number of similar species and many inadequate descriptions, I have found the genus *Empoasca* a difficult one to work with. Many of the species are extremely abundant in individuals and are widely spread geographically. It is a genus containing many species in both North and South America. Several species are reduced to synonyms in this paper, and a further study will probably reduce others.

ANALYTICAL KEY TO THE AMERICAN SPECIES OF THE GENUS EMPOASCA.

- 1A. Vertex not produced, or very slightly so.
- B. Elytra with smoky or black coloration only.
- C. Prevailing color green.
- D. Dark dorsal stripe on thorax and elytra.....*smaragdula*.
- DD. Elytra with two and pronotum with one transverse dark stripe...*trifasciata*.
- C. General color yellow.
- D. Unicolorous smoky yellow.....*clypeata*.
- DD. Mostly smoky to entirely blue-black above.
- E. Yellow beneath, length about 5 mm.....*livingstonii*.
- EE. Black beneath, length 3 mm.....*nigra*.
- BB. Elytra tinged with smoky and with narrow orange lines, vertex yellow, length 3 mm.....*pulchella*.
- BBB. Elytra without distinct dark coloration.
- C. Sides of last ventral segment of female incised.
- D. Length 5 mm.....*aurcoviridis*.
- DD. Length 4.25 mm.....*smaragdula*.
- CC. Last ventral segment of female produced but entire on the posterior and lateral margins.
- D. Claval suture of elytra blue, a black spot before the cross-veins...*splendida*.
- DD. Claval suture of elytra pale, deep yellow each side.....*albolinea*.
- DDD. Unicolorous, no line on claval suture.....*obtusa*.
- CCC. Last ventral segment of the female notched at the tip.
- D. A broad U-shaped notch.....*pergandii*.
- DD. Notch otherwise formed.
- E. Length over 4 mm.....*incisa*.
- EE. Length under 4 mm.
- F. Notch broad, but shallow, basal margin straight.....*denticula*.
- FF. Like the preceding, except that the notch has a broad, blunt tooth extending into it from the base.
- G. Tooth very short, vertex slightly produced.....*atrolabes*.
- GG. Tooth reaching nearly to posterior margin of the notch without black spot on elytra.....*unicolor*.

¹The description of *Empoasca salinarum* Berg, does not enable me to include this species in the table. I have copied the description in full and placed the species last.

- AA. Vertex distinctly and rather strongly produced, not evenly rounded.
- B. Last ventral segment of female incised or notched posteriorly.
- C. Without black spot before cross-veins of elytra. *unicolor*.
- CC. With black spot on elytra before cross-veins.
- D. Pronotum mostly bright orange, claval sutures blue. *similis*.
- DD. Golden green without bright orange coloration. *atrolabes*.
- BB. Last ventral segment of the female entire on hind margin.
- C. Pronotum bright orange and blue, claval suture blue. *splendidus*.
- CC. Pale longitudinal orange stripes on elytra, length under 3 mm.
- D. Venter and pronotum golden yellow spotted with white and green. *americana*.
- DD. Very pale green, elytra faintly striped with pale orange, no black on tergum. *radiata*.
- DDD. Tergum more or less black.
- E. Elytra subhyaline, length under 3 mm. *nigroscuta*.
- EE. Robust, elytra milky subopaque, length under 3 mm. *robusta*.
- CCC. Greenish, yellowish or whitish species, nearly unicolorous.
- D. Scutellum and spot at tip of clavus blackish. *nigroscuta*.
- DD. Yellowish or greenish with smoky band across the middle of the elytra. *birdii*.
- DDD. Without conspicuous dark markings.
- E. General color whitish, length 3.75 mm. *pallida*.
- EE. General color greenish or yellowish.
- F. Length exceeding 3.75 mm.
- G. Golden coloration on vertex, pronotum, scutellum and tergum. *snowi*.
- GG. Without the golden coloration of the preceding species. *pura*.
- FF. Length less than 3.75 mm.
- G. Elytra flecked with small dusky spots. *tessellata*.
- GG. Color green, nervures of elytra and line on pronotum pale. *alboneura*.
- GGG. Color green, face very tumid, length 2.5 mm. *tumida*.
- GGGG. Face one-third longer than broad. *viridescens*.
- GGGGG. Face only about one-fifth longer than broad.
- H. With six or eight white spots on anterior margin of pronotum. *mali*.
- HH. With three white spots or none on pronotum. *flavescens*

EMPOASCA SMARAGDULA Fallén.

Cicada smaragdula FALLÉN, Hemiptera Sueciae, p. 53, 1829.—ZETTERSTEDT, Ins. Lapp., p. 298, 1840.—SAHLBERG, Cicadariae, p. 159, 1871.

Typhlocyba smaragdula FLOR, Rhynch. Livl., II, p. 393, 1861.—KIRSHBAUM, Die Cicad. d. gegend v. Wiesbaden und Frankfurt, Wiesbaden, p. 178, 1868.

Kybos smaragdulus FIEBER, Verh. Zool. bot. Gesell. Wien., XVI, p. 508, 1866; Kat. eur. Cicad., p. 14, 1872.—PUTON, Cicad. d. Hemip., p. 87, 1886.—EDWARDS, Trans. Ent. Soc. London, p. 84, 1888.—WOODWORTH, Psyche, V, pp. 76, 212, 1888, 1889.—VAN DUZEE, Psyche, V, p. 241, 1889; Trans. Am. Ent. Soc., XXI, p. 311, 1894.—MELICHAR, Cicadinen von Mittel-europa, p. 327, 1896.

Empoasca smaragdula GILLETTE & BAKER, Bull. 31, Colo. Ag. Exp. Sta., p. 110, 1895.

I do not possess a copy of Fallén's paper in which this species was described, but the following is a copy of that description as given by Fallén in Hemiptera Sueciae:

Mas. ♂ Fem. colore similes. In Alnetis Vestrogothiae sat frequens; D. GYLLENHAL; in fruticibus Gyllebo Scaniae raro nobis obvia. Longit. 2½ lin.—Cic. Flavescens longior et robustior, at Cic. virescente angustior. Tota saturate viridis unicolor. Post mortem autem caput imprimis et scutellum saepius pallescunt. Elytra viridi-aurata, apice aureo-valde nitentia. Pedes virides.

Fallén also gives a brief characterization of this species in connection with the preceding description in the following words:

C smaragdula saturate viridissima, immaculata, capite scutelloque pallidioribus: elytris hyalinis aureo-nitidissimis. (See Figs. 43, 44, 45.)

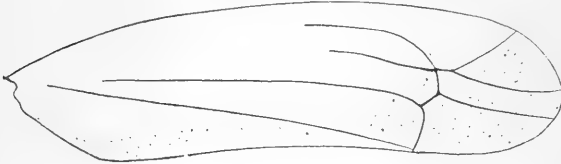
Mr. Van Duzee reports this species as occurring in Canada, New England, west to Colorado and California.

The only American specimens that I have seen came from the mountains of Colorado and were taken by Mr. Baker at Steamboat Springs and by myself at Leadville and on Park Hill, east of Estes Park. The specimens taken by Mr. Baker were from willows.

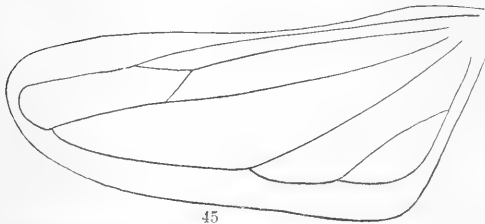
This species is very close to *aureoviridis* Uhl. *Smaragdula* is the more slender species and the last ventral segment in the female is more strongly produced and sharper pointed than in *aureoviridis*. The latter species is also more golden in color and in no case, that I have seen, does it have the smoky dorsal line that is so common in *smaragdula*. This dark line is not mentioned in the above description, but all of the twelve specimens in my collection from Europe have it; less than half of those from Colorado are so marked.



43



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FIGS. 43, 44, and 45.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF *EMPOASCA SMARAGDULA*.

Since writing the above I have taken a good number of specimens of this species, with the dark dorsal stripe very pronounced, from *Crataegus rivularis* at Cimarron, Colorado, August 22, 1896.

EMPOASCA TRIFASCIATA, new species.

Pale green, with three transverse smoky bands above. Length, 4 mm.

Face golden yellow above, shading into green on the clypeus, with a broad whitish median stripe; face fully as broad as long. Front with sides nearly parallel, two-thirds longer than broad between the eyes, very obtusely rounded above. Clypeus about one-third longer than broad, a little less than one-half the length of the front, broad at the base, constricted at the upper one-third, rather blunt at the apex. Genae appearing as a mere line past the lorae but nearly attaining the tip of the clypeus; genae, lorae and clypeus pale green. Vertex slightly longer at the middle than at the eyes, very obtusely rounded in front,

color golden yellow, paler on posterior margin, having a slender dark median line, ocelli pits large and pale in color, but no ocelli; eyes very black and large, shortest distance between the eyes 1.7 times the length of the vertex at the middle. Pronotum twice the length of the vertex and nearly twice as wide as long; anterior two-thirds golden yellow, the remainder black. Scutellum bright green at tip but somewhat smoky on posterior portion. Elytra pale green, a deep smoky transverse band at the middle of the clavus, not quite attaining the costal margin, the apical area deep smoky on inner half, second apical cell with a short peduncle. Tergum washed with golden yellow, venter pale green, tips of pygofer and ovipositor deep green. Legs pale green with tips of tibiae and tarsi deep blue-green.

Type.—No. 3419, U.S.N.M.

Described from a female from Professor W. A. Snow marked "From electric light, Douglas Co., Kans.," from two females and one male from Mr. C. A. Hart, taken at Champaign, Illinois, and bearing the number 544, and a good number of both sexes from Ames, Iowa, taken by Mr. E. D. Ball, July 12, on cottonwood. Possibly a variety of *obtusa*.

EMPOASCA CLYPEATA Gillette & Baker.

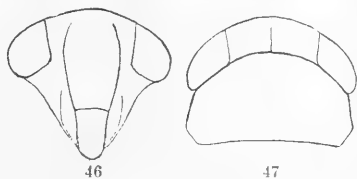
Empoasca clypeata GILLETTE & BAKER, Bull. 31, Colo. Agr. Exp. Sta., p. 108, 1895.

Male: Clypeus one-half longer than broad, basal suture straight; lorae as in *T. sanguinea*; genae very narrow, attaining the clypeus as a very narrow line, lateral margins nearly straight; front nearly twice as long as its greatest width between the eyes, twice the length of the clypeus, superior angle very broad and obtusely rounded. Face and vertex finely shagreened. Disk of vertex flat, sloping, scarcely longer on the middle than next the eye. Pronotum slightly wrinkled on posterior two-thirds, glabrous in front, slightly more than twice as broad as long, anterior margin broadly rounded, posterior margin concave, posterior angles sharply rounded, sides long. Scutellum normal, transverse suture straight. Color yellowish; in light specimens, face, vertex, pronotum, and scutellum yellowish, concolorous; in dark specimens front with a medium white line, pronotum dusky on posterior half, scutellum with basal angles and transverse groove dark; elytra in light specimens yellowish subhyaline, in dark specimens shaded into deep smoky subhyaline; venter and legs entirely pale yellow, sometimes tibiae and tarsi slightly smoky.

Length, 4.5 mm. Described from six males. (See Figs. 46, 47.)

Type.—No. 3420, U.S.N.M.

Estes Park, July 10 (Gillette). Steamboat Springs, July 10 on willow (Baker).



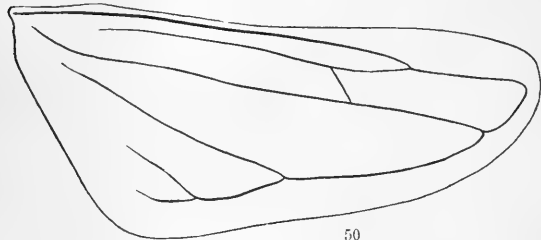
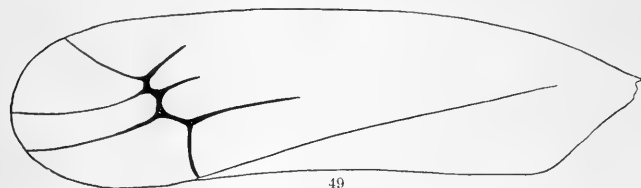
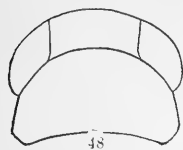
FIGS. 46 and 47.—FACE AND VERTEX AND PRONOTUM OF *EMPOASCA CLYPEATA*.

This form is closely related to *obtusa* and may prove to be only a variety of that species.

EMPOASCA LIVINGSTONII, new species.

Color deep smoky to black. Length, 4.25 mm.

Face pale yellow, genae whitish, a more or less distinct white line down the middle of the front; the breadth of the face equal to the length. Vertex concolorous with the face, or with a little dusky coloration above in darkest specimens, not at all produced. Pronotum twice as broad as long and a trifle more than twice as long as the vertex; color, smoky brown to blackish, with a subobsolete pale line along the middle. Scutellum concolorous with the pronotum, a little paler on the middle, the transverse groove black. Elytra unicolorous, deep smoky to blackish, translucent, nervures distinct at the crossveins but soon fading out when traced toward the body, only three complete apical cells; wing venation



normal, nervures dusky. Abdomen more or less black above, yellow below. Feet entirely pale yellow, except in one very black specimen, which has the tibiae of the hind pair blackish. (See Figs. 48, 49, 50.)

Cotype.—No.

FIGS. 48, 49, and 50.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF EMPOASCA 3421, U.S.N.M.
LIVINGSTONII.

Described from

three males and one female taken by Mr. C. Livingston during August and September at Corfield, Vaucouver Island.

Since writing the above description I have received three specimens, that are more yellowish in color, from the U. S. National Museum and which were marked "Easton, Wash., Koebele." This species is also closely related to *obtusa*.

EMPOASCA NIGRA Gillette & Baker.

Empoasca nigra GILLETTE & BAKER, Bull. 31, Colo. Ag. Exp. Sta., p. 108, 1895.

Male: Clypeus about one-half longer than broad, basal suture straight; lorae as in *T. sanguinea*; genae suddenly broadening close to eye, lateral margin almost straight, attaining the clypeus in a very

narrow line; front nearly one-half longer than broad, once and two-thirds the length of clypeus, superior angle broadly obtusely rounded. Face coarsely and obsoletely shagreened. Disk of vertex sloping, with a slight median depression on the posterior half opening into a slight depression on the anterior margin of the pronotum, length at the middle slightly more than next the eyes. Pronotum opaque, on anterior third smooth, on posterior two-thirds indistinctly transversely rugose; slightly less than twice as broad as long, anterior margin broadly rounded, posterior margin somewhat concave, posterior angles sharply rounded. Scutellum opaque, with a median pit just in front of the transverse groove, posterior half irregularly wrinkled. Color black; antennae whitish; ocelli surrounded by a narrow pale margin; elytra black; posterior third fading into smoky subhyaline; anterior tibiae, and all the tarsi, smoky.

Length, 2.75 to 3 mm. Described from five males. (See Figs. 51, 52.)

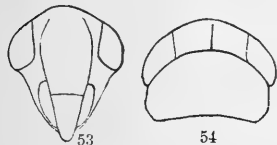
Type.—No. 3422, U.S.N.M.

Mountains southwest of North Park, July 10, on *Artemisia tridentata* (Baker).

EMPOASCA PULCHELLA Gillette & Baker.

Empoasca pulchella GILLETTE & BAKER, Bull. 31, Colo. Ag. Exp. Sta., p. 109, 1895.

Female: Clypeus a third longer than wide, basal suture straight; lorae long and narrow, scarcely grooved, attaining the end of the clypeus; front two-thirds longer than broad, nearly twice the length of the clypeus, superior angle obtusely rounded. Face and vertex without sculpturing, opaque. Disk of vertex scarcely longer on the middle than at the sides. Pronotum twice as wide as long, front margin broadly rounded, hind margin decidedly concave, posterior angles broadly rounded, sides rather short, without distinct sculpturing but with two small pits near the median line, one-fourth of the distance back from the anterior margin. Scutellum broader than long, transverse groove black. Last ventral segment with the hind margin deeply and broadly notched, posterior angles rounded. Color steel blue, varied with smoky and orange; head pale orange, genae and a large triangular mark on front extending onto and across vertex medially, ivory white; disk of vertex with a black median line on posterior two-thirds; ocelli rufous and distant from the eyes; pronotum pale blue, washed with white and pale orange on anterior and lateral margins; scutellum orange with whitish mottling; elytra subhyaline, smoky at base across median portion, and at tip, forming three broad indistinct transverse bands, clavus and corium posteriorly, each with a pale orange stripe,



FIGS. 53 and 54.—FACE, AND VERTEX AND PRONOTUM OF EMPOASCA PULCHELLA.



FIGS. 51 and 52.—FACE, AND VERTEX AND PRONOTUM OF EMPOASCA NIGRA.

veins whitish apically; last ventral segment almost entirely whitish, pygofers rufous below; legs sordid white.

Length 3 mm. Described from one female. (See Figs. 53, 54, 55, 56.)

In mountains southwest of North Park, July 10, on *Artemisia tridentata* (Baker).

EMPOASCA AUREOVIRIDIS Uhler.

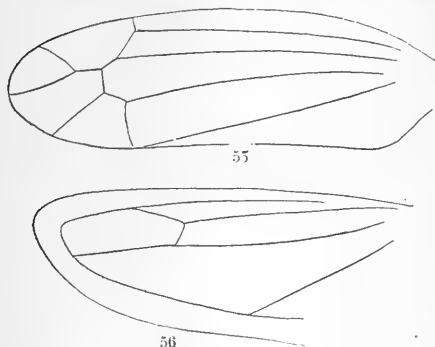
Typhlocyba aureoviridis UHLER, Bull. U. S. Geol. and Geog. Surv., III, p. 474, 1877.

Empoasca aureoviridis WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans.

Am. Ent. Soc., XXI, p. 310, 1894.—GILLETTE & BAKER, Bull. 31, Colo. Ag. Exp. Sta., p. 108, 1895.

Dr. Uhler's description is as follows:

Long and slender, vivid yellowish green, the hemelytra translucent, exquisite golden green, plainly blackish on the apical margin. Head broad; hardly tumid, sublunate, wider than the pronotum, rich yellowish green on the vertex and front; the latter with a pale stripe down the middle, and a short one on the inner margin next the eye; cheeks deeper green; eyes narrow, as seen from above; antennae long, pale green at base, fuscous beyond. Pronotum smooth, yellowish green, moderately long, arcuated in front, and a little convex; each side and middle just behind the head with a pale round spot; lateral margins hardly reflexed, slightly prominent, a little obliquely arcuated. Beneath and legs green,



FIGS. 55 and 56.—ELYTRON AND WING OF EMPOASCA PULCHELLA.

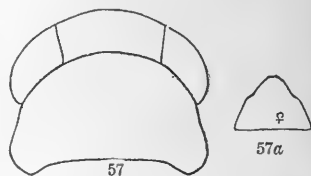
the nails and pulvilli black. Scutellum with a broad, paler green line along the middle; hemelytra narrow, yellowish-green golden; the apex with the four cells, of which the middle one is long, narrow, and almost straight, the two outer ones triangular, and the one next outside the middle obtriangular. Wings hyaline, highly iridescent, and with a bright golden tinge. Ovipositor projecting beyond the long valvular genital segment.

Length to tip of ovipositor 3-4 mm.; to tip of hemelytra 5-5½ mm. Width of pronotum 1½ mm. (See Figs. 57, 57a.)

This brightest of our green *Typhlocybas* was found in large numbers at Denver and Clear Creek Canyon, upon the leaves of willows August 7 to 18.

This species is close to *obtusa* but is more robust, the vertex is not produced, but evenly rounded, and the last ventral segment of the female is sinuate at the sides posteriorly.

I have found this species quite abundant on willows near Fort Collins, at Palmer Lake, and on Marshall Pass, Colorado. Those from the last-named place were taken August 23, and are more or less smoky in color, some being nearly black above.

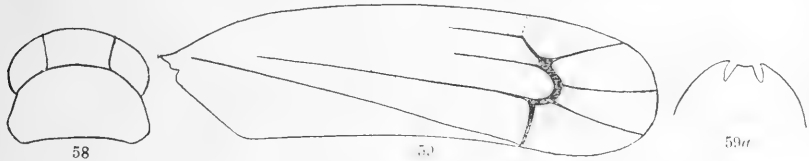


FIGS. 57 and 57a.—VERTEX AND PRONOTUM, AND LAST VENTRAL SEGMENT OF FEMALE OF EMPOASCA AUREOVIRIDIS.

EMPOASCA UNICOLOR, new species.

Color varying from yellowish to greenish, without conspicuous markings, 3.5 mm. long.

Face yellow above, without markings, shading into green below, the length exceeding the breadth by about one-fifth, clypeus exceeding the lorae by about one-third its length, considerably constricted below its base and rather pointed. Vertex almost entirely yellow in some specimens but, in all, a median pale stripe and a pale or bluish blotch next each eye are more or less plainly visible. In some specimens there are also a pair of green dots a little before the middle of the vertex and rather near the median pale line. The vertex is not at all produced, its length is contained in the length of the pronotum almost exactly twice, and in the breadth of the head about 3.7 times. Pronotum slightly broader than the head, twice as wide as long, yellowish in color but more or less tinged with green posteriorly and, in most specimens, a small white spot can be seen on the middle of the anterior margin. Scutellum deeper yellow than the pronotum and with a pale or bluish blotch just before the apex, which, in some cases, extends for-



FIGS. 58, 59, and 59a.— VERTEX AND PRONOTUM, ELYTRON, AND LAST VENTRAL SEGMENT OF FEMALE OF EMPOASCA UNICOLOR.

ward to the margin of the pronotum. Elytra a golden green, the coloration stopping a little before the cross-veins, the tips slightly smoky. Abdomen yellowish above and below, the last ventral segment of the female having two deep oblique notches or slits on the posterior margin inclosing a stout blunt tooth between them. Legs greenish yellow, tarsi blue. (See Figs. 58, 59, 59a.)

Type.—No. 3423, U.S.N.M.

Described from a large number of specimens from Salineville, Ohio, sent by Cornell University, a small number of specimens from Michigan Agricultural College, taken by Professor Davis, July 15, on apple trees, and a good number taken by myself from *Crataegus coccinea* in Horse-tooth Gulch, near Fort Collins, August 16. I have also seen specimens from the U. S. National Museum, labeled "D. C., 6-19, on grape."

EMPOASCA SPLENDIDA, new species.

Colors, blue, yellowish brown, and orange. Length, 3.5 mm.

Face as in the preceding species (*unicolor*). Vertex a little produced, reddish orange-yellow anteriorly and deep blue posteriorly (in

a faded specimen the colors are yellow and pale bluish). Length of vertex contained about one and two-thirds times in length of pronotum and three and one-third times in the width of the head. Pronotum as wide as the head and scarcely twice as wide as long, anterior two-thirds reddish orange and the posterior one-third blue in color. Scutellum yellowish brown without markings. Elytra concolorous with the scutellum with a rather broad deep-blue line extending along the



FIG. 60.—VERTEX AND PRONOTUM OF EMPOASCA SPLENDIDA.

claval suture and a rather broad costal margin of a fainter blue color, tips of elytra nearly hyaline, a velvety black spot just before the cross-nervure of the inner apical cell. Abdomen above and below yellowish, with genital organs somewhat greenish, last ventral segment of female almost truncate posteriorly and entire. Last ventral segment of male rather deeply notched. Legs yellowish with the tips of the tibiae

and the tarsi deep blue. (See Fig. 60.)

Type.—No. 3424, U.S.N.M.

Described from two females and one male collected by Mr. F. C. Pratt, at Lakeland, Maryland.

EMPOASCA ALBOLINEA, new species.

Color yellowish, more or less tinged with green, a pale line along the claval suture of the elytra, length 3.5 mm.

Face yellowish, shading into greenish below, a median white line extending to the clypeus, a white spot at the upper end of each of the lorae and two oblique white dashes just below the crest of the front, diverging toward the antennae. In some specimens these white markings are partly lacking. The length of the face equals the breadth; the clypeus exceeds the genae but little and is rounded below. Vertex yellow, in some specimens distinctly tinged with green, with a narrow median and two oblique pale lines or dashes plainly showing in the best-marked specimens, but wanting in others; but very little produced in front, its length contained in the length of the pronotum almost exactly twice, and in the width of the head nearly four times. Pronotum yellow with a median stripe and the hind margin pale; there is also a distinct white spot on the middle of the anterior margin, and another on either side back of the compound eye. These last spots are quite small in some specimens, but they are present in all; the width is hardly equal to that of the head, and is considerably less than twice the length. Scutellum yellow, slightly green toward the apex, and in some specimens there is a pale stripe through the middle. Elytra pale yellow to the tip of the abdomen; hyaline beyond, and with a conspicuous whitish line along the claval suture. Abdomen yellowish or greenish yellow above and below, the last ventral segment of the

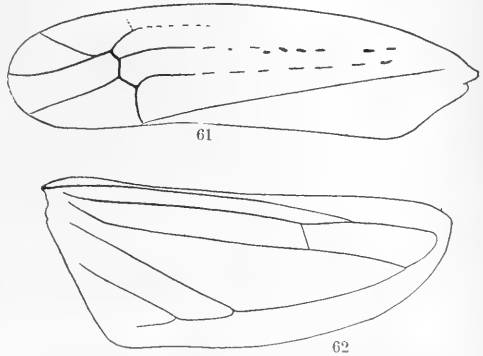
female considerably produced posteriorly and entire. Legs yellowish to greenish, the tips of the tibiae and the tarsi always bluish-green. (See Figs. 61, 62.)

Type.—No. 3425, U.S.N.M.

Described from numerous specimens from the Illinois State Laboratory of Natural History; from Th. Pergande, taken in Virginia; from Professor W. A. Snow, taken at electric light in Douglass County, Kansas. The Illinois specimens bear numbers 18520, 18526, and 18590. Mr. Hart writes me that those of the last number were taken on willow.

EMPOASCA OBTUSA Walsh.

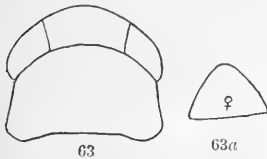
Empoasca obtusa WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 316, 1864.—WOODWORTH, Psyche, V, p. 213, 1889.—OSBORN, Proc. Ia. Acad. Sci., I, Pt. 2, p. 12, 1892.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 310, 1894.—GILLETTE & BAKER, Bull. 31, Colo. Exp. St., p. 110, 1895.



FIGS. 61 and 62.—ELYTRON AND WING OF *EMPOASCA ALBOLINEA*.

Walsh's description is as follows:

Pale grass-green. Front of head forming a very obtuse angle, with the apex rounded off. Each ocellus surrounded by a fuscous spot. Eyes and tips of tarsal joints fuscous; elytra greenish subhyaline; tips hyaline. Triangular cell peduncled. Wings hyaline. Length to tip of wings three-sixteenths of an inch.



FIGS. 63 and 63a.—VERTEX AND PRONOTUM AND LAST VENTRAL SEGMENT OF FEMALE OF *EMPOASCA OBTUSA*.

The above description is too meager to separate this species from *aureoviridis* Uhler. The specimens of the latter species that I have examined are more robust than those of *obtusa*; the vertex also is evenly rounded, not at all produced, and in the females the last ventral segment is produced and sinuate at the sides, posteriorly, as shown in Figs. 57, 57a. In *obtusa* the length hardly exceeds 4 mm. the vertex is distinctly, but not strongly produced, and the last ventral segment is produced and entire at the sides posteriorly. (See Figs. 63 and 63a.)

I have received specimens from Illinois State Laboratory of Natural History taken near Champaign, Illinois, and numbered 18529 and 18590, those of the latter number being from willow; from Mr. C. A. Hart, specimens taken near Champaign, Illinois, and numbered 544, 547 and 553; from Mr. Otto Heidemann, labeled "Washington, D. C.;" and from the U. S. National Museum labeled, "Ia., Gillette."

I have repeatedly taken this species on willow near Fort Collins and have specimens taken by Mr. Baker near this place on alfalfa, and at Steam Boat Springs in general sweeping, and by Master Carlos Stannard at this place in general sweeping.

A number of specimens from Mr. C. A. Hart are under size, being only about 3.75 mm. in length but I can find no other differences upon which to separate these small individuals from others.

It is possible that on receiving more material from the northwest this species will be found to be synonymous with *pura* (Stål).

EMPOASCA PURA Stål.

Typhlocyba pura STÅL, Stett. Ent. Zeit., XIX, p. 195, 1858.

Chlorita pura FIEBER, Kat. d. eur. Cicad., p. 14, 1872.—PUTON, Cat. d. Hemip., p. 87, 1886.

Empoasca pura WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., p. 310, 1894.

Stål describes this species as follows:

Dilute subolivaceo-flava; abdomine pallide virescente, tibiis apicem versus tarsisque prasinis; tegminibus flavescente-hyalinus, basi et apicem versus subdecoloribus, areolis apicalibus 4, secunda (a commissura) parallela, tertia apicem versus latoire. ♂ Long. 3 $\frac{1}{2}$, Lat. $\frac{3}{4}$ mm., Tab. I, fig. 5. Sitka.



FIG. 64.—VERTEX AND PRONOTUM OF EMPOASCA PURA.

Tegminia abdomine duplo fere longiora, apice rotundata, areolis, apicalibus elongatis 4, quarum 1 (a commissura) elongato-triangulari basi reliquis latiore, 2 parallela. 3 basi secunda nonnihil angustiore, apicem versus sensim nonnihil latiore. Alae dilute lacteae, subvitreae, posterius ab apice limbatae, in parte antica venis 3 parallelis instructae, quarum 2 anticis magis approximatis, pone medium ad unam confluentibus. (See Fig. 64.)

I have seen but one specimen that I could refer to this species and that is in the collection of Mr. C. F. Baker, and was taken by Mr. Clermont Livingston at Corfield, Vancouver Island, upon marsh grass in the latter part of August.

While in general appearance this insect resembles *obtusa*, it has a much more produced vertex and the outer apical cell of the clytron is not pedunculated as it is in all the specimens of *obtusa* that I have seen. The last ventral segment is produced and entire as in *obtusa*. A large series might connect these forms, but I do not think it probable.

EMPOASCA DENTICULA, new species.

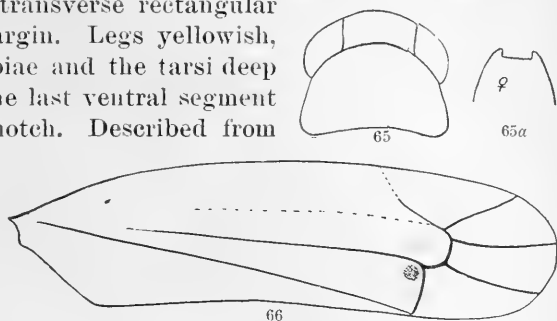
Pale yellowish green, vertex broadly rounded. Length, 4 mm.

Face pale yellowish, shading into greenish below in some specimens, without distinct markings; clypeus exceeding the genae by about one-third of its own length, rather narrow, and almost exactly one-third of the entire length of the face; the length of the face hardly exceeding the width. Vertex evenly rounded, not at all produced, and yellowish in color. Pronotum distinctly broader than the head and less than twice as wide as long, with or without indistinct whitish markings on a yellow or greenish yellow field. Scutellum yellowish or greenish, with

a pale longitudinal median stripe. Elytra greenish or yellowish subhyaline, the apical cells rather short and none of them pedunculated. In the only female specimen there is a dark spot just before the cross-nervure at the base of the anal apical cell. Wing venation normal. Abdomen yellowish above, greenish beneath, last ventral segment of female with a shallow transverse rectangular notch on the hind margin. Legs yellowish, with the tips of the tibiae and the tarsi deep blue. In the males the last ventral segment has a deep V-shaped notch. Described from one female and three males. (See Figs. 65, 65a, 66.)

Cotype.—No. 3426, U.S.N.M.

One male and one female were taken by the writer at Colorado Springs, August 3, and one male at Fort Collins, June 11. One male was taken by Mr. C. F. Baker, July 15, on Four-mile Hill, near Steamboat Springs, Colorado. All taken in general collecting.



FIGS. 65, 65a, and 66.—VERTEX AND PRONOTUM, LAST VENTRAL SEGMENT OF FEMALE, AND ELYTRON OF *EMPOASCA DENTICULA*.

EMPOASCA PERGANDEI, new species.

This species differs but slightly from the preceding (*denticula*) and as follows: The length is 3.75 mm.; there is considerable whitish mottling on the pronotum; the white line on the scutellum is broad and very distinct; the color of the basal angles of the scutellum and of the pronotum are distinctly yellowish, and the last ventral segment of the female has a U-shaped notch instead of a rectangular one. (See Fig. 67.)



FIG. 67.—LAST VENTRAL SEGMENT OF FEMALE OF *EMPOASCA PERGANDEI*.

Type.—No. 3427, U.S.N.M.

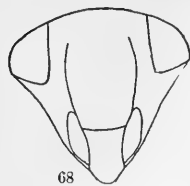
Described from a single female sent me by Mr. Theo. Pergande and labeled "F. Hills, Mass., July 4th, '90."

EMPOASCA INCISA, new species.

Color, golden green. Length, 5 mm.

Face light green, shading into rather deep green on the clypeus and deep golden yellow above; the eyes are margined with white opposite the ocelli, the ocelli are each located on a white spot and there is a median white line on the front; there are some transverse whitish markings upon the front, but these are rather indistinct. The face is as broad as long; the clypeus is about one-fourth longer than broad, broadly constricted at the middle and rounded at the apex. Vertex golden yellow, slightly tinged with green, not at all produced. Pronotum golden yellow before, shading into greenish posteriorly, with a median and two lateral white spots near the anterior margin; width

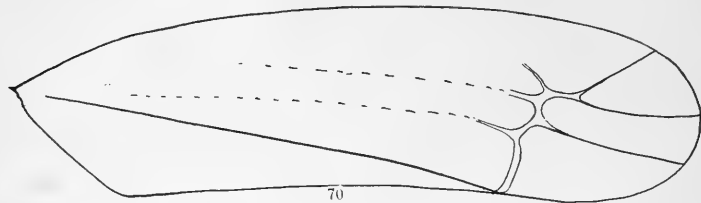
about one and three-fourths the length. Elytra yellowish subhyaline, sectors obsolete except near the cross-veins, first apical cell open posteriorly and the second one pedunculate. Wing normal, rather slender toward the apex. Scutellum with basal angles golden yellow, the median portion whitish and the apex green. The abdomen is mostly



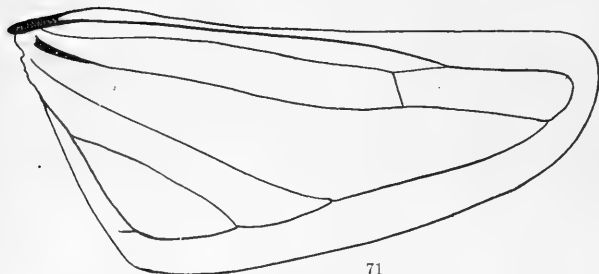
68



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70



71

FIGS. 68, 69, 70 and 71.—FACE, VERTEX, AND PRONOTUM, ELYTRON, AND WING OF *EMPOASCA INCISA*.

yellow above, but is stained with green on some of the segments, the venter is pale green, the ovipositor is rather deep green, and the sides of the pygofers are yellow. The last ventral segment is strongly produced, with two deep, oblique incisions from the posterior margin, leaving a

large quadrangular tooth, rounded posteriorly. The femora are light green and the tibiae and tarsi deep bluish-green.

Type.—No. 3428, U.S.N.M.

Described from a single female taken

by the writer in Estes Park, Colorado, August 6. (See Figs. 68, 69, 70, 71.)

This species is readily separated from *aurcoviridis* Uhler by the incisions of the last ventral segment of the female.

EMPOASCA ATROLABES, new species.

Color, greenish golden with more or less deep blue. Length, 3.5 mm.

Face yellow, shading into greenish on cheeks and clypeus, marked between the eyes with bluish, front long and narrow, clypeus exceeding the genae by about one-third its length, total length of the face about one-fifth more than the total breadth. Vertex evenly rounded, slightly, or not at all produced, eyes greenish to infuscate, in none of the specimens black, a greenish median line and a similar, rather indistinct, oblique line near each compound eye. Pronotum fully twice the length of the vertex and a little less than twice as broad as long, yellow on the anterior half and greenish to bluish on the posterior half, in one specimen almost uniformly yellowish, entirely without pale or bluish lines or spots. Scutellum unicolorous, yellow. Elytra a beautiful

golden yellow to the cross-veins, the tips slightly smoky: with one exception the claval suture and the costal margins of the elytra are distinctly bluish, and in the brightest specimens this color is very beautiful. The first and fourth (outer and inner) apical cells are large and subtriangular, and the second and third are four-sided; just before the base of the fourth cell is a distinct black spot; the nervure running to the costal margin and forming the base of the first costal cell is rather indistinct near the margin. Tergum greenish yellow and, in some specimens, partly black, venter greenish yellow, last ventral segment of female considerably produced and with a nearly rectangular notch posteriorly, the hind edges of which are somewhat produced so that the notch is a little wider before than behind. Feet greenish yellow, the lower portions of the tibiae and the tarsi indigo blue. (See Figs. 72, 73, 74, 75.)

Type.—No. 3429, U.S.N.M.

Described from numerous examples of both sexes sent me by Professor G.

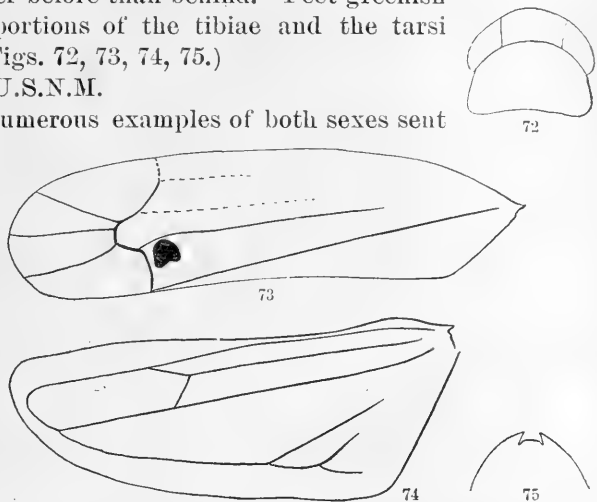
C. Davis and which were labeled "Mich. Ag. Coll., 7-5-'92, 297;" "8-9-'92, 387;" "8-15-'92, 395." I have since taken a number of specimens from hazelnut, *Corylus rostrata*, near Palmer Lake and near Golden, Colorado, July 18 and August 12, and from *Alnus viridis* and *Crataegus rivularis*, at Cimarron, Colorado, August 22.

Professor Herbert Osborn writes me that in their studies upon the *Jasside*, he and Mr. Ball have found that the last ventral segment of the female in some species of *Athysanus*, at least, is often notched during copulation. This notched last ventral segment is the chief character separating *atrolabes* from *splendida* and it is possible that the two forms may prove to be of one species when more material has been examined.

EMPOASCA MEXICANA, new species.

Color golden, marked with white and green. Length, 2.75 mm.

Face yellow above, greenish below, without distinct markings; length of face exceeding the breadth by one-third of the latter, clypeus exceeding the genae by one-third of its length. Vertex rather strongly produced, yellow, with a median whitish line and four spots of the same color, two of the spots being on the anterior margin and two near the

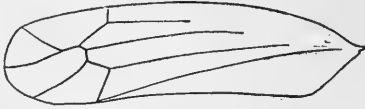


FIGS. 72, 73, 74, and 75.—VERTEX AND PRONOTUM, ELYTRON, WING, AND LAST VENTRAL SEGMENT OF FEMALE OF EMPOASCA ATROLABES.

posterior margin, and about midway between the compound eyes on the median line. Pronotum not broader than the head, one and one-half times as long as the vertex and one and three-fourths times as broad as long. The color is yellow, somewhat washed with green and with three white spots, one at the middle of the anterior margin and one back of each compound eye; in one specimen a whitish line extends from the first of these spots to the scutellum. Scutellum yellow with the apex and a median longitudinal line white, and a large spot near each basal angle green. Elytra with most of the clavus, a line below the claval suture and a broad costal margin golden yellow, apex hyaline, the apical nervures milky. Wing venation normal. Abdomen greenish yellow



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FIGS. 76 and 77.—VERTEX AND PRONOTUM, AND ELYTRON OF EMPOASCA MEXICANA.

above and below, the pygofers rather deep green, last ventral segment of female moderately produced and evenly rounded. Legs yellowish with tips of tibiae and tarsi blue. In some specimens the white markings are faint and the green of the scutellum entirely wanting. (See Figs. 76, 77.)

Type.—No. 3430, U.S.N.M.

Described from five females collected near Vera Cruz, Mexico, by Rev. H. Th. Heyde.

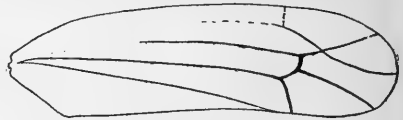
EMPOASCA RADIATA, new species.

Color pale yellowish green, with more or less distinct longitudinal markings. Length, 2.75 mm.

Face pale yellowish green above, the clypeus deeper green, face fully one-fourth longer than broad, clypeus fully one-third the length of the face, rather pointed below and exceeding the genae by nearly one-third its length. Vertex considerably produced, its length being contained in the breadth of the head two and one-half times, and in the pronotum one and one-half times; the color is pale yellowish or greenish, and there are three distinct longitudinal paler stripes upon it in the better marked specimens, but in some these stripes are obsolete. Pronotum scarcely wider than the head, distinctly less than twice as wide as long; the color is very pale green and yellow, there being in the best marked specimens one median and two lateral greenish lines, and two dorsal and two lateral orange yellow lines. The orange coloration is rather dilute and in some of the specimens is wanting. Scutellum pale greenish. Elytra dilute milky, the nervures whitish and having about three more or less distinct dilute orange colored lines, one on either side of the claval suture and



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79

FIGS. 78 and 79.—VERTEX AND PRONOTUM, AND ELYTRON OF EMPOASCA RADIATA.

another on the middle of the corium. Abdomen greenish yellow above and below, last ventral segment of female slightly produced and entire posteriorly. Legs whitish with the tips of the tibiae and the tarsi blue. (See Figs. 78, 79.)

Type.—No. 3431, U.S.N.M.

Described from four females and a male taken by the writer, three in Horsetooth Gulch, June 15, and two specimens taken on Bald Mount, east of Estes Park, August 1, all in Colorado.

EMPOASCA ROBUSTA, new species.

Small pale yellowish species, rather robust. Length, 2.75 mm.

Face smoky ivory-white, without distinct markings, hardly longer than broad, clypeus but little exceeding the genae. Vertex considerably produced, rounded in front, its length equal to one-third the width of the head, and three-fifths as long as the pronotum; eyes light brown, ocelli deep reddish brown. Pronotum about three-fourths broader than long, whitish or yellowish white with two more or less distinct lemon-yellow longitudinal lines, and outside of these, back of the compound eyes, slight spotting of the same color. In one specimen this lemon-yellow coloration is almost entirely wanting. Scutellum pale on the middle with the lemon-yellow coloration on the tip and base. Elytra whitish subhyaline to near the cross-veins, slightly smoky on the cross-veins, immediately before the cross-veins and beyond them transparent, the basal portion of the elytra slightly washed with lemon-yellow, which in some individuals is distributed in about three or four rather distinct longitudinal lines. Tergum mostly black; venter yellow, with pygofers a little greenish. Feet yellow, with the tibiae and tarsi of the second and third pairs greenish.

Type.—No. 3432, U.S.N.M.

Described from four female specimens from the U. S. National Museum labeled "Nevada Co., Calif., Sep.," collected by A. Koebele.

EMPOASCA NIGROSCUTA Gillette & Baker.

Empoasca nigroscuta GILLETTE & BAKER, Bull. 31, Colo. Ag. Exp. Sta., p. 108, 1895.

Female: Clypeus minutely transversely rugose, one-half longer than wide, basal suture straight, apex rather pointed; lorae two-thirds as long, and one-half as wide as clypeus, distant from tip of clypeus; genae narrow, a deep sunken furrow beneath the eyes extending to the lorae, not attaining tip of clypeus, outer margin nearly straight, very narrow below lorae; front smooth, nearly twice longer than wide, one and three-fourths the length of the clypeus, superior angle somewhat greater than a right angle, rather sharply rounded. Disk of vertex smooth, once or one and a half times as long on middle as next eyes. Pronotum very minutely transversely wrinkled on posterior three-fourths, anterior margin broadly rounded, hind margin nearly straight, sides short.

Scutellum broader than long, transverse groove slightly curved backward. Last ventral segment with hind margin nearly truncate. Color pale yellow marked with smoky; face and vertex pale yellowish, posterior one-half of latter with a median black line; pronotum pale yellow on anterior and lateral margins, remainder darker; scutellum black, basal angles sometimes yellowish; elytra yellowish, subhyaline, apex smoky, clavus with a large deep smoky blotch at tip; venter blackish, last segment yellow; tergum blackish, with tips and lateral margins of segments more or less yellowish; prosternum black; legs pale yellow.

Length, 3 mm. Described from two females. (See Figs. 80, 81, 82.)

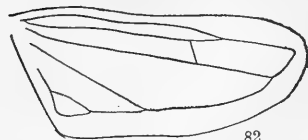
The types were taken by myself at Dolores, Colorado, June 18, and a single specimen has been received from Mr. Heidemann, labeled "Wasatch, Ut., 6-27." I have recently taken a large number of specimens (August 21) at Cerro Summit, Colorado, on Sage-brush, *Artemisia tridentata*, where it was associated with var. *Typhlocyboids* Gillette & Baker.



80



81



82

FIGS. 80, 81, AND 82.—VERTEX AND PRONOTUM, ELYTRON AND WING OF *EMPOASCA NIGROSCUTA*.

VARIETY TYPHLOCYBOIDS Gillette & Baker.

Empoasca typhlocyboids GILLETTE & BAKER,
Bull. 31, Colo. Agr. Exp. Sta., p. 110, 1895.

Male: Clypeus subacute at apex, one fifth longer than broad, basal suture straight; loræ one-half as wide and two-thirds as long as clypeus; genæ narrow, not attaining tip of clypeus, furrow shallow, outer margin slightly concave over coxæ, slightly convex along loræ; front one-fourth longer than broad, nearly twice the length of clypeus, superior angle broadly rounded. Face and vertex nearly smooth. Length of vertex at middle nearly one and a half that next the eyes. Pronotum slightly less than twice as broad as long, posterior two-thirds minutely transversely rugose, front margin broadly rounded, hind margin concave, posterior angles broadly rounded. Scutellum broader than long, transverse groove straight. Color pale bluish or yellowish green; face and vertex pale yellow; pronotum pale yellow or bluish green, with front and lateral margins yellowish, hind margin sometimes whitish; disk of pronotum sometimes with three faint longitudinal orange lines; scutellum yellowish, sometimes posterior angles bluish, elytra milky subhyaline, clavus with two faint longitudinal orange marks, another near tip, a faint broken longitudinal orange line on corium, veins whitish toward apex; abdomen pale greenish yellow; legs pale yellow at base shading into deep blue at tips.

Length 2.5 mm. Described from three males.

Cotype.—No. 3534, U.S.N.M.

Steamboat Springs, July 12, on *Artemisia tridentata* (Baker).

I took this variety in large numbers from sagebush, *Artemisia tridentata*, August 21, at Cerro Summit, Colorado. It is identical with *nigroscuta* except in coloration.

EMPOASCA PALLIDA, new species.

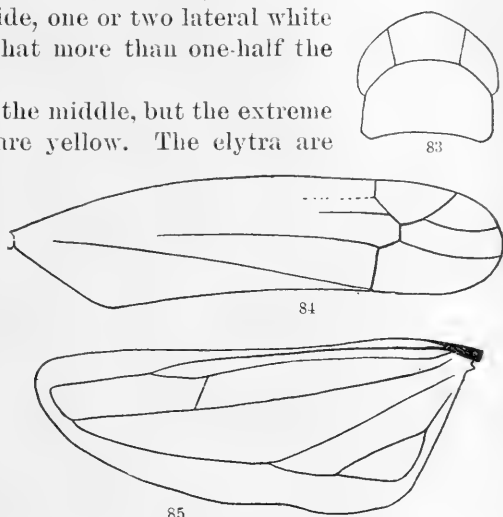
A slender species, color very pale yellow, almost white, 3.75 mm. long. Face but slightly longer than broad, front pale yellow, mottled with ivory white, the genæ and the clypeus nearly all white.

Vertex hardly produced, its length equal to one-third the breadth of the head and to three-fifths the length of the pronotum; it is yellowish in color with a median whitish line, and on either side of this an oblique whitish line, broadest at the posterior edge of the vertex; the compound eyes are rather faintly but distinctly greenish in color. The pronotum is whitish, tinged with yellowish, and with one median and, on either side, one or two lateral white spots; the length is somewhat more than one-half the breadth.

The scutellum is white on the middle, but the extreme tip and the basal angles are yellow. The elytra are whitish, subopaque to near the cross veins, beyond the cross veins transparent. Abdomen above and below yellowish white with the last ventral segment and the pygofers greenish. Legs whitish with tips of tarsi fuscous and a faint tinge of green on the tibiæ and tarsi. (See Figs. 83, 84, 85.)

Type.—No. 3435, U.S.N.M.

Described from five females and two males from the U. S. National Museum and labeled from "Cotton, N. Car., June, '79."



FIGS. 83, 84 and 85.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF *EMPOASCA PALLIDA*.

EMPOASCA SNOWI, new species.

Colors green and yellow, form slender, length 4 mm.

Face yellow above, green below; on the upper portion there are numerous greenish white spots of irregular shape and a whitish median line, somewhat interrupted above, extending to the clypeus. In one specimen the light markings are rather indistinct. Length of face slightly exceeding the breadth, clypeus one-half the length of the front and but little exceeding the genæ. Vertex yellow anteriorly and greenish posteriorly and with two small green spots, one on either side of the median line and about equally distant from each other and from the compound eyes. Vertex moderately produced and a little less than

one-half as long as the pronotum; the total width of the head three and a half times its length. The pronotum is yellowish in color, with three white spots on the anterior margin. In one specimen there is an additional smaller white spot between the middle and lateral ones on either side. Scutellum yellow, with a rather broad, pale median stripe. Elytra semitransparent, with a slight golden color, marginal veins green, third apical cell pedunculate. Abdomen golden yellow above, pale green below, pygofer deep green, last ventral segment moderately produced and rounded. Legs yellow near the body, tibiae and tarsi blue. (See Figs. 86, 87.)

Type.—No. 3436, U.S.N.M.

Described from two female specimens sent me by Professor W. A. Snow, and labeled "Magdalena Mts., N. M., Aug. '94. Snow."

EMPOASCA TESSELLATA Fieber.

Chlorita tessellata FIEBER, Kat. enr. Cicad., p. 14, 1872.—PUTON, Cat. d. Hesp., p. 87, 1886.

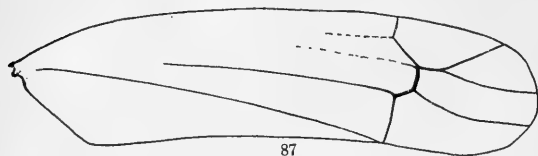
Empoasca aspersa GILLETTE & BAKER, Bull. 31, Colo. Ag. Exp. Sta., p. 107, 1895.

I do not possess Fieber's description of this species, but I have a specimen from Staudinger & Bang Haas that seems identical with species taken here in Colorado and which were described in the above publication as *E. aspersa*. I have also sent Colorado specimens to Doctor Melichar, of Vienna, who assures me that I am correct in

considering the Colorado specimens identical with *tessellata* Fieber.

The following is the description as given for *aspersa* Gillette & Baker.

Female: Clypeus one-third longer than broad, basal suture straight; lorae half as broad and two-thirds as long as the clypeus; genae long and narrow, moderately furrowed beneath the eyes, the furrow extending to the lorae, outer margin somewhat concave; front two-thirds longer than broad, twice as long as the clypeus, superior angle little more than a right angle and broadly rounded. Face and vertex without sculpturing, the latter glabrous. Disk of vertex one and a half as long on the middle as next the eyes; pronotum slightly less than twice wider than long, front margin broadly rounded, hind margin slightly concave, disk very finely longitudinally aciculate. Scutellum broader than long, transverse groove straight and black. Last ventral segment with the hind margin evenly rounded and the posterior angles sloping. Color greenish; face yellowish green, front more or less distinctly marked with a pale median line and with transverse concentric pale lines; vertex and pronotum whitish or pale yellowish green, with about four more or less distinct deeper yellowish



FIGS. 86 AND 87.—VERTEX AND PRONOTUM, AND ELYTRON OF EMPOASCA SNOWII.

green and variously bent, nearly longitudinal lines, sometimes orange on the former and dusky on the latter; scutellum with basal angles dark or yellowish green, median portion whitish mottled with greenish; elytra greenish, hyaline at tip, nervures whitish, basal two-thirds finely spotted with dusky green; tergum black with more or less of sides and apical margins yellowish; venter pale green, pygofers darker; legs pale greenish shading to bright blue at tips. Length 3 mm.

Male: Markings which in the female are dark yellowish green are dusky here.

Described from six females and two males. (See Figs. 88, 89, 90, 91.)

Fort Collins, on *Bigelovia*, September 27 (Gillette). In mountains southwest of North Park, July 10, and at Steamboat Springs, July 12, on *Artemisia tridentata* (Baker).

I have also received specimens from the U. S. National Museum marked "Los Angeles Co., Calif., Mar.," and from Mr. Heidemann one specimen labeled "Wasatch, Ut., 6-27."

EMPOASCA ALBONEURA, new species.

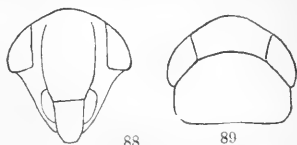
Robust, color pale greenish yellow. Length, 3 mm.

Face yellow, lorae and clypeus greenish, sometimes more or less washed with greenish on front, about one-sixth longer than broad, genae nearly attaining the tip of the clypeus, which is one-half longer than broad; antennae greenish. Vertex one-third longer at the middle than at the eyes, somewhat pointed in front; color greenish yellow, marked with a median light line, an elongate light spot either side near the compound eyes and close to the posterior border, and another on the crest of the vertex on either side in front of a dark

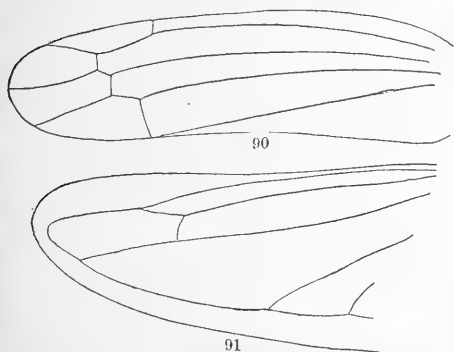
green spot. Pronotum yellow on anterior and green on posterior margin, marked with a median white line and a light spot on either side next the eyes. Scutellum yellow, with a median white line. Elytra greenish subhyaline tinged with yellowish, the tips smoky, and all the nerves pale. Venter and pygofers greenish; legs greenish or yellowish, the tibiae and tarsi deep blue.

Type.—No. 3437, U.S.N.M.

Described from fifteen females and nine males taken at the Missis-



FIGS. 88 and 89.—FACE AND VERTEX AND PRONOTUM OF EMPOASCA TESSELLATA.



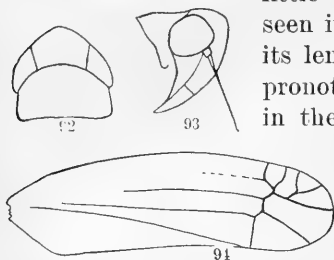
FIGS. 90 and 91.—ELYTRON AND WING OF EMPOASCA TESSELLATA.

Mississippi Agricultural College by Professor H. E. Weed in July and September; two specimens from Virginia sent me by Mr. T. H. Pergande, and seven specimens from Colorado, as follows: Five specimens near Fort Collins sweeping native plants between June 11 and July 24, one specimen at the same place on plum September 31, and one specimen taken by the writer at Leadville, at an elevation of 10,000 feet, August 23, on native plants. I have also received specimens from Mr. Heide-
mann marked "D. C.;" and from the U. S. National Museum, marked "Va.," "Los Angeles, Calif., Coquillett," "Nevada Co., Cal., Sep.," "Horace, Ks, July 28," and "Neb."

EMPOASCA TUMIDA, new species.

Color greenish-yellow or yellowish-green, face very tumid. Length, 2.50 mm.

Face varying in color from almost entirely yellow, the clypeus only being green, to almost entirely green with the upper portion of the front yellow; length but very little exceeding the breadth, clypeus but little exceeding the genae; front very tumid, as seen in Fig. 93: Vertex considerably produced, its length being contained in the length of the pronotum less than one and one-half times and in the breadth of the head less than two and



FIGS. 92, 93, and 94.—VERTEX AND PRONOTUM, SIDE OF HEAD, AND ELYTRON OF *EMPOASCA TUMIDA*.

one-half times; color yellow to greenish, with a median and two lateral longitudinal pale lines which are rather indistinct in the greener specimens. Pronotum not wider than the head, less than twice as wide as long, pale green in color with five whitish spots on the anterior margin, and in the best-marked specimen there are three illly defined pale lines which are the continuations of the pale lines of the vertex. Abdomen yellowish-green above and below, the last ventral segment in the female slightly produced and rounded posteriorly. Legs yellow with the tarsi bluish-green. In two specimens the basal segments of the tergum are largely black. (See Figs. 92, 93, 94.)

Type.—No. 3438, U.S.N.M.

Described from three females, all taken by the writer in Colorado—two in Horsetooth Gulch, June 15, and one on cultivated plums at Fort Collins, September 31.

EMPOASCA MALI Le Baron.

Tettigonia mali LE BARON, *Prairie Farmer*, XIII, p. 330, 1853.

Empoasca mali OSBORN, *la. Acad. Sci.*, I, Pt. 2, p. 12, 1892.

*Typhlocyba photophila*¹ BERG, *Hemip. Argent.*, p. 273, 1879.

¹ This may prove to be a good species, but I have examined specimens from Brazil in the collection of Mr. H. H. Smith that answer the description of this species, and

Empoa albopicta FORBES, Thirteenth Rep. Ill. St. Ent., p. 181, pl. XIV, 1883; Fourteenth Rep. Ill. St. Ent., p. 117, 1884.—WEED, Insects and Insecticides, p. 99, fig. 45, p. 151, 1891, 1895.

Empoasca albopicta WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 310, 1894.

According to Doctor Le Baron:

This little insect is about one-eighth of an inch long, yellowish green, forehead and crown freckled with white; a series of white spots along the anterior margin of the prothorax; two white stripes on the meso-thorax united in the middle by a transverse stripe, like the letter H; a triangular white spot on the scutellum, with a smaller spot on each side of it; sexual appendages in both sexes ciliated, or bordered with fine fringe. The eyes are pearl white in the living insect, but become brown after death.

Doctor Le Baron mentioned this insect as occurring on apple; Doctor Forbes records it as injuriously abundant on apple, currant, and gooseberry, and Doctor Weed mentions it as occurring upon all these plants and others.

I have received this species as follows: From Professor G. C. Davis, taken in July on beans, potatoes, plum, and wild grapes, near Michigan Agricultural College; from Doctor Forbes (18249 and 16383) on corn, June; from Mr. E. P. Van Duzee, Buffalo, New York, on *Populus monilifera*, May; from Mr. Th. Pergande and also Mr. Otto Heidemann, specimens marked "D. C.;" from Mr. C. A. Hart, Champaign, Illinois, specimens marked 313, 332, 481, 512, 515, and 584; from Professor H. E. Weed, specimens marked "Ag. Coll. Miss., July, '94," and from the U. S. National Museum specimens marked "Mo., May."

This species can nearly always be quickly separated from closely related species by the row of six to eight (not three) white spots on the front margin of the pronotum.

EMPOASCA FLAVESCENS Fabricius.

Cicada flavescens FABRICIUS, Ent. syst., IV, Hafn., 1794.—FALLEN, Hemiptera Sueciae, p. 53, 1829.

Chlorita flavescens FIEBER, Kat. eur. Cicad., p. 14, 1872.—MAYR, Rhyn. Tirol., II, p. 24, 1880.—PUTON, Cat. d. Hemip., p. 87, 1886.—MELICHAIR, Cicadinen von Mittel-europa, p. 326, 1896.

Not having Fabricius's writings, I give the description of this species as quoted by Fallén in "Hemiptera Sueciae:"

Mas. & Fem. colore similes. In gramine mense Jul. & Aug. frequens. In fruticibus frequentior. Parva & angustata, flavissima. Oculi fuscii. Scutellum ad certum

that I am unable to separate from specimens of *E. mali* from the United States. Berg's description is as follows:

"♂ et ♀: Lacte virescenti-aurantiaca, maculis duabus anticis capitis, tibiis apicem versus tarsisque plus minusve viridibus; aut virescenti-flavi, vitta media verticis, lineolis lateralibus aut maculis plurimis parvis disci frontis, maculis sex velocto prope marginem anticum pronoti, vittis duabus vel quattuor partis antice maculisque tribus triangularibus segmentorum abdominis rarissime obsolete viridimaculato aut fasciato; capite antice subrotundato; ocellis distinctis, viridibus aut glaucis; fronte sat magna et convexa; pronoto margine postico late sinuato; scutello apice acuto; tegminibus areolis apicalibus tribus vel quattuor instructis, clavo venis destituo; alis albido-hyalinis.—Long. corp. cum tegm. 2½-3; lat. pron. ½-¾ mm.

"Patria: Corrientes."

luminis situm interdum lutescens. Elytra & alae corpore longiora. Abdominis dorsum raro nigricans. Pedes flavi. Macula elytrorum lateralis rhombea albicans, pro situ luminis, in plerisque individuis conspici potest. Longit-fere 2 lin.

Not. Color variat pro aetate, vel pallide vel saturate flavus. In quibusdam individuis caput quasi angulatum, at obtusissime, extenditur. Nihilo tamen minus a *Cic. pascuella* & *assimili* facile distingui potest.

This is a common and widespread species in the United States, though it has never been recorded here. I have received specimens from Professor Cockerell, marked "Santa Fe, N. M.," from Professor H. E. Weed, marked "Ag. Coll. Miss.," from Mr. MacGillivray, marked "Ithaca, N. Y., August 28," from Professor G. C. Davis, marked "Ag. Coll. Mich.," from Mr. Th. Pergande, marked "Washington, D. C.," from Mr. Otto Heidemann, marked "D. C.," from Illinois State Laboratory Natural History (Doctor Forbes), marked "15433," from Mr. F. F. Crevecoeur, Onaga, Kansas, taken among leaves in timber in early spring; from the U. S. National Museum, marked "Los Angeles Co., Cal.," and "Garden Cy. Kans."

I have taken a number of specimens in general sweeping along the river near Fort Collins, Colorado. The only difference that I find in specimens taken here from those received from the eastern portions of this country and from Europe is that they are all of a rather deep green color, instead of yellow or greenish yellow.

VARIETY *BIRDII* Goding.

Empoasca birdii GODING, Ent. News, I, p. 123, 1890.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 310, 1894.

Doctor Goding describes this variety as follows:

Seen from above, long ovate, bright yellow, varying to green; abdomen deeper yellow and attenuated at the extremity. Head length of pronotum, obtusely rounded in front and convex; eyes purple-black; ocelli nearer the eyes than each other; three pale bands passing along the occiput, one at the center and one at the edge on each side along border of the eyes. Pronotum one and a half times length of scutellum, its posterior border straight, front arched; three large, pale spots on front edge, the mesial one being continuous with the corresponding band on the occiput. Scutellum large, triangular, depressed, having a pale green, broad band on posterior part; apex and base yellow, a dark spot occupying the disc. Abdominal joints gradually decreasing in size; pure yellow. Elytra slightly smoky, with a darker band passing across the center. Wings hyaline and iridescent, in the former the terminal vein is at the margin, while in the latter it has a membranous margin; lower part of tibiae and all of tarsi indigo blue; femora with a row of strong spines. One specimen with all colors much deepened, and some minor differences, may prove to be distinct. Length about 2 mm. to end of hemelytra; breadth one-third the length.

Doctor Goding reports this variety from apple, hop, walnut, beans, and weeds in Illinois.

I have received specimens from Agricultural College, Michigan (Professor Davis), Urbana, Illinois (Doctor Forbes and C. A. Hart), Ithaca, New York (Cornell University), and Ames, Iowa (E. D. Ball).

This is only a color variety of *flavescens*. The smoky markings of

the elytra and, possibly, the more distinct white spots upon the pronotum are all that I find to separate it from the typical form, and these markings are often very indistinct.

EMPOASCA VIRIDESCENS Walsh.

Empoasca viridescens WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 316, 1864.—WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 309, 1894.

Empoasca consobrina WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 316, 1864.—WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 310, 1894.

Walsh's brief description of *viridescens* is as follows:

Pale greenish; front of the head forming a right angle with the apex rounded off; eyes and tips of tarsi fuscous; elytra subhyaline, with a faint greenish tinge, the triangular cell not pedunculated as it is in Fig. V; wings hyaline.

I met with both sexes in southern Illinois. A single female, which occurred at Rock Island, Illinois, varies in being more yellowish than greenish, and in the tips of the ovipositor being fuscous. Length to the tips of the wings not quite an eighth of an inch.

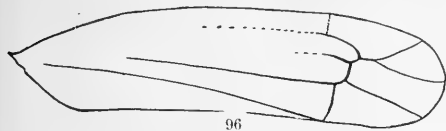
Consobrina was described at the same time as follows:

Differing from the preceding only in being sometimes yellowish, and in the triangular cell in the elytra being always pedunculated. Seven specimens, taken at one time at Rock Island, Illinois, all agree in this particular. Length slightly over one-eighth of an inch. (This is a mere variety of the preceding. I have now all the intermediate grades.)

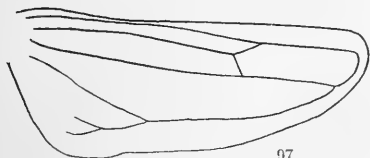
Although it is impossible from the above descriptions to identify this species with certainty, I have two specimens



95



96



97

FIGS. 95, 96, and 97.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF EMPOASCA VIRIDESCENS.

of what I believe to be this species from Doctor Forbes, which were taken in August and September at Champaign, Illinois. In one, the triangular cell of the wing is pedunculate and in the other it is not. I also have a considerable number of specimens from Agricultural College, Mississippi, sent me by Professor H. E. Weed, and others from Ithaca, New York, sent me from Cornell University. The specimens that I have determined as this species may be described as follows:

Color pale green with thorax, vertex and body beneath yellowish. Length slightly over 3 mm.

The face is about one-third longer than broad, front, above the clypeus, almost exactly twice the length of the clypeus. The clypeus is large, pointed below, broadly constricted at the sides near the base, and exceeds the genae somewhat. The vertex is considerably produced and is three-fifths the length of the pronotum; width of the head nearly

three times the length; pronotum hardly less than twice as wide as long. Elytra greenish subhyaline, triangular cell pedunculate or not. Body, below, light yellow; tip of abdomen and lower portion of tibiae and tarsi green. In well-marked specimens there is a white or pale line on the middle of the face, another upon the middle of the vertex and a broader one on the scutellum, which is suddenly widened back of the transverse groove. Aside from these lines there are spots of the same color next the compound eyes on the face, two oblique ones on the crest of the vertex, another near the posterior margin and approximate to the compound eye on either side; on the anterior margin of the pronotum three, one at the middle and one just back of either compound eye. In some specimens the light markings are in part wanting. The middle white spot of the pronotum and the white band on the scutellum are very constant. The markings of the face are most often missing. (See Figs. 95, 96, 97.)

This species is best separated from *flarescens* and *mali* by the long slender face.

EMPOASCA SALINARUM Berg.

Typhlocyba salinarum BERG, Hemiptera Argentina, p. 274, 1879.

Berg, in his Hemiptera Argentina, describes this species as follows:

Female: Capite, fronte, pronoto, scutello, dorso abdominis femoribusque maximam partem saturate aurantiacis, vitta media maculisque duabus antice sublateralibus capitis, lineolis obsoletis brevibus lateralibus capitis, lineolis obsoletis brevibus lateralibus frontis, vitta media pronoti scutellique flavido-albis, marginibus venisque tegminum late viridibus vel glaucescentibus, pedibus, dimidio basali femorum excepto, viridibus; capite subrotundato; ocellis distinctis, fulvis; fronte lineis duabus apicem versus conjunctis obsolete fuscis ornata; pronoto antice obsoletissime albidomaculato, margine postico sat profunde sinuato; tegminibus areolis apicalibus? instructis, clavo venis destituto; alis vitreis. Long. corp. cum tegm. 4; lat. pron. $\frac{3}{4}$ mm.

Patria: Provincia Bonaërensis.

I have not recognized this species in any of the material I have examined.

Genus EUPTERYX Curtis.

Doctor Melichar in his Cicadinen von Mittel-Europa records twenty-two species under this genus. Not a species has been recorded from America to the present time, and it gives me pleasure to be able to report two new species in this paper.

EUPTERYX VANDUZEI, new species.

Color whitish, with head, pronotum, prosternum, and scutellum black or blackish; length 3.75 mm.

Head blackish on posterior portions of vertex and beneath the eyes, shading into pale yellow on the anterior margin of the vertex and the upper portion of the face; clypeus parallel-sided, rather acute at tip; genae rather broad beneath the lorae, vertex considerably produced but not acute at tip. Pronotum deep black, in one specimen whitish on middle of posterior margin and against the tegulae, nearly truncate

posteriorly, about twice the length of the vertex. Scutellum black, sometimes pale at the extreme tip. Elytra milky white, a little smoky near the tip, the costal margin and the veins more or less yellow; apical cells four, triangular one pedunculate, cell upon the costal and also the one upon the inner margin subtriangular. Abdomen and legs very pale yellow or white, with tips of last tarsal joints and sometimes the basal joints of the tergum black. (See Figs. 98, 99, 100.)

Type.—No. 3439, U.S.N.M.

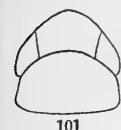
Described from seven females sent me by Mr. E. P. Van Duzee, who took them at Hamburg, New York, July 10, sweeping ferns and weeds.

EUPTERYX FLAVO-SCUTA, new species.

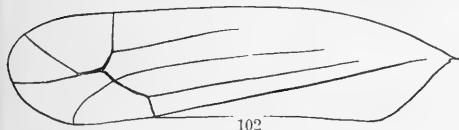
Color, smoky above, yellow beneath; length 3 mm.

Yellow on the face and anterior margin of vertex, the posterior margin of the vertex shading into dark fuscous; vertex

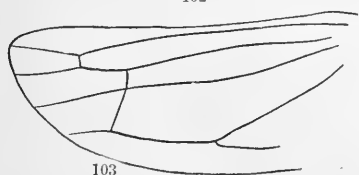
moderately produced and rather broadly rounded. Pronotum distinctly less than twice the length of the vertex, black, with a large yellow rectangular spot on the middle posteriorly. Scutellum with the basal angles dusky and the remaining portion yellow. Elytra smoky, with the costal and inner margins and the veins yellowish; the smoky coloration is deepest at the base, along the middle, and at the apex; venation much as in the preceding species. Tergum, and pygofers below, black, lateral margins of abdominal segments yellow. Entire feet, and thorax below, yellow, except the extreme tips of the last tarsal joints, which are infuscate. (See Figs. 101, 102, 103.)



101



102



103

FIGS. 101, 102, and 103.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF EUPTERYX FLAVOSCUTA.

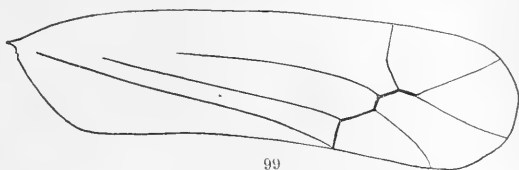
Type.—No. 3440, U.S.N.M.

Described from two female specimens sent me by Mr. Van Duzee, who took them along with those of the preceding species.

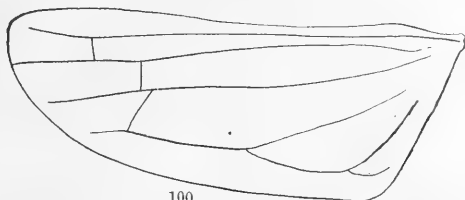
Since writing the above I have received two specimens of this species



98



99



100

FIGS. 98, 99, and 100.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF EUPTERYX VANDUZEEI.

from the U. S. National Museum labeled "Holderness, N. H., 20 11," and two specimens from Mr. Otto Heidemann marked "Washington, D. C."

Three of these specimens differ from the types in that they are more infuscated above, even the scutellum is almost entirely dark.

Genus TYPHLOCYBA Germar.

This genus is represented by a good number of species, both in this country and in Europe, but I was surprised to notice that in a considerable collection of *Typhlocybinae* from South America, collected by Mr. H. H. Smith, there was not a single species of this genus.

The genus is characterized by many species that are beautifully and variously marked with shades of red and black, which has resulted in many synonyms and varieties.

A number of species are common to both Europe and America.

ANALYTICAL KEY TO THE AMERICAN SPECIES OF THE GENUS TYPHLOCYBA.¹

- A. General color above red.
- B. With two black spots on vertex.....*bipunctata*.
- BB. Without distinct markings.
- C. Pale yellow beneath.....*sanguinea*.
- CC. Orange beneath.....*coccinea*.
- AA. General color of head and thorax yellow; elytra more or less colored with sanguineous or blood brown.
- B. Elytra blood red to near the cross veins.
- C. Head and thorax yellow.....*tunicarubra*.
- CC. Head and pronotum marked with red.....*crevecoeurii*.
- B1. Elytra yellow, banded with dark blood brown across their middle, the band becoming black on the costal margin.....*tricolorata*.
- B2. Elytra blood red to cross veins, their tips, costal margin, and spot on middle of inner margin yellow.....*hartii*.
- B3. Scutellum entirely bright red and a large spot of the same color on the middle of the elytra.....*rubroscuta*.
- B4. Elytra finely flecked with red, the extreme tip of the scutellum jet black.
trifasciata.
- B5. Elytra with two oblique red lines, one on the clavus and one on the inner sector.....*obliqua*.
- B6. Elytra with a conspicuous black spot, which has a red margin, on the corium at the middle of the claval suture.....*illinoisensis*.
- B7. Elytra with zigzag red lines or red spots or, in smoky species, with blood-brown or yellowish markings.....*comes*.
- C. A narrow pale median line, continuous on vertex, pronotum, and scutellum; also a pale line or dash either side of this on vertex and pronotum.....*vulnerata*.
- CC. Not like the preceding.
- D. Color almost entirely yellow, reddish markings on the elytra, last ventral segment of the female suddenly produced posteriorly and notched at the tip.....*dentata*.

¹ *Typhlocyba centralis* Berg is not included in the table. It is the last species given in the text.

AAA. General color pale yellow, no sanguineous markings above.

B. Elytra banded transversely with blackish.

C. Posterior and lateral margins of pronotum black.....*tricincta*.

CC. Posterior and lateral margins of pronotum not black.....*querci*.

BB. Elytra not transversely banded with blackish.

C. Internal margins of elytra blackish.....*commissuralis*.

CC. Internal margins of elytra not black.

D. Elytra with a transverse row of dark blotches before the cross veins.

E. Apical nervures infuscate at their outer ends.

F. Length 3.25 mm., without black spot on anterior margin of pronotum.
tenerrima.

FF. Length 3.75 mm., with black spot on anterior margin of pronotum.
ulmi.

EE. Apical veins of elytra not infuscate.....*querci*.

DD. Elytra without transverse row of dark blotches before the cross veins.

E. Last ventral segment of female truncate and slightly notched posteriorly.

flaromarginata.

EE. Last ventral segment of female produced and entire.

F. Length 5 mm.....*albicans*.

FF. Length about 3.5 mm.

G. Color pale yellow to whitish.....*rosa*.

GG. Color golden yellow to cross veins of elytra.....*lethierryi*.

TYPHLOCYBA BIPUNCTATA, new species.

Color red, vertex with two black spots; length 2.25 mm.

Face short and broad, very tumid, bright red with lighter blotches above, paler red beneath where it is indistinctly transversely marked with pale lines, clypeus black. Vertex red with two conspicuous black spots a little before the middle surrounded by a narrow band of pale yellow; length about one-third greater at the middle than at the eyes. Pronotum red with four small pale spots on the anterior margin, posterior margin straight. Scutellum red with a black spot on each basal angle and with pale coloration margining these spots and upon the apex. Elytra red with a line on claval suture and one on the corium beneath white, beyond cross nervures smoky subhyaline, nervures red. Basal portion of abdomen blackish above and below, apical portion yellow, tip of ovipositor red, last ventral segment of female considerably produced. Feet smoky yellow.

Type.—No. 3441, U.S.N.M.

Described from a single female taken by Doctor R. E. Kunzé at Tucson, Arizona, April 4, in general collecting.

Since writing the above, I have received an additional female from Doctor Kunzé, taken at the same place, April 30. It differs from the type in being nearly a half millimeter longer and having smoky-brown coloration in place of the red.

TYPHLOCYBA COCCINEA Fitch.

Empoa coccinea FITCH, Homop. N. Y. St. Cab. Nat. Hist., p. 63, 1851; reprint in Lintner's 9th Rep., Ins. N. Y., p. 403, 1893.

Typhlocyba coccinea WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 313, 1894.

This species is described by Doctor Fitch as follows:

Scarlet red, immaculate, pectus and venter orange, elytra brownish pellucid. Length 0.10 inch.

Taken on pines. No. 829 ♂.

This is a species that I have not seen, and I do not know that there is a determined specimen in existence. It could undoubtedly be obtained with little trouble from pines, and would be readily recognized by its scarlet color without markings.

TYPHLOCYBA SANGUINEA Gillette & Baker.

Typhlocyba sanguinea GILLETTE & BAKER, Bull. 31, Colo. Agr. Exp. Sta., p. 112, 1895.

Near *coccinea*. Female: Clypeus one-half longer than broad, basal suture straight; lorae very long and narrow, a half longer than clypeus, reaching half the distance between the base of clypeus and antennae; genae long and narrow, lateral margin concave, slightly grooved along sides of lorae. Front nearly twice longer than wide at widest place between the eyes, two and one-fifth times as long as clypeus, superior angle greater than a right angle, very obtusely rounded; face and anterior half of vertex very finely rugose; length at middle of vertex one-fourth more than at the eyes. Pronotum glabrous with obscure transverse wrinkles on posterior one half, four-fifths broader than long, anterior margin broadly rounded, posterior margin distinctly concave, sides normal; scutellum broader than long; last ventral segment with hind margin strongly produced, very slightly notched at apex. Color pale yellow; face tinged with sanguineous above; vertex, pronotum, except at sides, and scutellum bright sanguineous; elytra hyaline, veins very light yellow; vertex at sides and tergum tinged with sanguineous; legs unicolorous.



FIG. 104.—VERTEX AND PRONOTUM OF TYPHLOCYBA SANGUINEA.

Length 4 mm. Described from one female. (See Fig. 104.)

The type specimen was taken by the writer at Manitou, Colorado, September 29, on *Salix*.

TYPHLOCYBA TUNICARUBRA, new species.

Color pale yellow and bright red, form robust. Length 3.75 mm.

Face very pale yellow, almost white, a trifle broader than long, genae nearly attaining the tips of the clypeus, superior angle obtuse and more than a right angle. Vertex, pronotum, and scutellum light yellow; vertex one-third longer at middle than at eyes, distance between the eyes one-half more than the length at the middle, pronotum two and one-third times as long as vertex and a little less than twice as wide as long, almost truncate behind, posterior angle one-fourth broader than anterior. Compound eyes yellowish, slightly infuscate. Elytra bright red to cross veins, tips yellowish subhyaline. Tip of wing broad.

Basal segments of tergum somewhat infuscated, remainder of tergum and all below light yellow.

Type.—No. 3442, U.S.N.M.

Described from two females sent me by Professor G. C. Davis. The pins bear labels which read, "Mich. Ag. Coll., July 15, '91. Ac. 445 Sp.?"

This species stands very close to highly colored forms of *3-fasciata* Say, but in the latter species the coloration is in the form of spots of varying size, while in *tunica rubra* the color is solid with no indication of spots.

TYPHLOCYBA TRICINCTA Fitch.

Erythroneura tricincta FITCH, Homop. N. Y. St. Cab. Nat. Hist., IX, p. 63, 1851; Trans. N. Y. St. Agr. Soc., XVI, pp. 392, 436, 1856; reprint in Lintner's 9th Rep., Ins. N. Y., p. 403, 1893.—WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 317, 1864.

Typhlocyba tricincta WOODWORTH, Psyche, V, p. 213, 1889.—PACKARD, Forest Insects, p. 218, 1890.—WEED, Insects and Insecticides, p. 84, fig. 2, 1891; p. 134, fig. 2, 1895.—OSBORN, Proc. La. Acad. Sci., I, Pt. 2, p. 11, 1892.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 313, 1894.—GILLETTE & BAKER, Bull. 31, Colo. Agr. Exp. Sta., p. 113, 1895.

Doctor Fitch describes this species as follows:

Pale yellow with three broad bands, the anterior velvet black, occupying the thorax and basal half of scutell; the middle bright ferruginous ending outwardly in black, forward of the middle of the elytra, the posterior dusky brown on the apex. Length 0.12 inch.

Var. a. Anterior band sanguineous. (See Fig. 105).

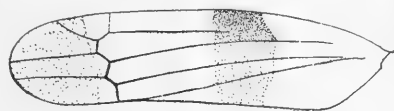


FIG. 105.—ELYTRON OF TYPHLOCYBA TRICINCTA.

Doctor Fitch took this species upon raspberry and currant bushes and grapevines, and in his later writings was inclined to think it only a variety of *vitis*.

I have taken the species at Ames, Iowa, on grapevines, and at Fort Collins, Colorado, on grass. I have received it from others as follows: From the private collection of Mr. C. A. Hart, Nos. 32, 514, 547, 562, and 565, all from Illinois; also a number of specimens taken by Mr. Hart at Havana, Illinois, on grape vines; from Iowa Agricultural College, specimens taken at Ames, Iowa, July 1; from Mr. Otto Heidemann, specimens marked, "Marsh Hall, Md.;" from Mr. F. F. Crevecoeur, specimens taken among leaves in the timber at Onaga, Kansas, in early spring; from the U. S. National Museum, specimens marked, "Mo., Riley, Grape, Sep. 12," and from Professor H. E. Weed, specimens marked, "Ag. Coll. Mo."

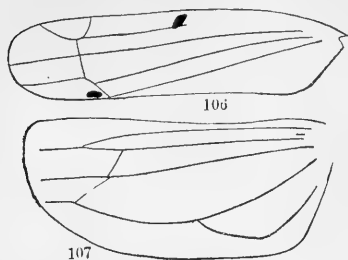
Doctor Packard, in "Forest Insects," mentions this insect as injuriously abundant upon elm trees.

Although this species is often abundant upon grapevines along with *comes* and its varieties, it seems to me to be a very distinct and well marked species.

TYPHLOCYBA HARTII, new species.

Colors light yellow and bright red, length 2.9 mm.

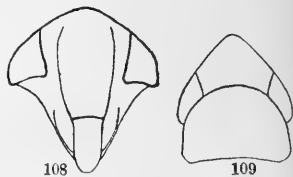
Face pale yellow to ivory white, more or less streaked with red across the upper portion; a little longer than wide, the clypeus only about one-fourth of the entire length of face, genae nearly attaining the tip of the clypeus. Vertex ivory white with a row of four spots between the compound eyes, the two end spots touching the eyes and smaller than the two middle spots, which are quite large; the two spots on the



FIGS. 106 and 107.—ELYTRON AND WING OF
TYPHLOCYBA HARTII.

same side run together in some of the specimens, and in one the large spot also extends to the middle line of the vertex at the posterior margin, making a continuous arc from the eyes. These spots may be bright red or only reddish yellow. Vertex considerably produced, rather pointed and almost exactly in a right angle; length at middle one-half greater than at the eyes, distance between the eyes one-fifth greater than the

length at middle. Pronotum one and a half as long as the vertex and nearly twice as wide as long, a broad median red stripe forked before, the forks joining a large spot on either side just behind the eye, and which does not extend to the posterior margin of the pronotum. Scutellum with broad median stripe, and all back of the transverse groove ivory white, basal angles more or less reddish. Elytra bright red to near cross veins, with a narrow yellowish costal margin and a large semicircular spot of the same color on the middle of the inner margin of the clavus, making a large circular spot when the elytra are closed; tips of elytra yellowish white. Abdomen above pale yellow with the apical margins of the segments in some cases reddish. All below pale yellow, except tips of tarsi, which are infuscated. (See Figs. 106, 107.)



FIGS. 108 and 109.—FACE, AND VER-
TEX AND PRONOTUM OF TYPHLOCYBA
RUBROSCUTA.

Described from five females and four males sent me from the Illinois State Laboratory of Natural History, bearing the numbers 14873, 14877, 17867, and one specimen from the private collection of Mr. Hart bearing the number 466. Mr. Hart writes me that those bearing the first two numbers were taken from rye, April 22 and 23, at Champaign, Illinois, and those bearing the number 17867 were taken at the same place and date among leaves.

This is a very pretty little species, and I take pleasure in dedicating it to Mr. C. A. Hart.

TYPHLOCYBA RUBROSCUTA, new species.

Color whitish, marked with bright red, compound eyes black: length 3.25 mm.

Face nearly, or quite, as broad as long, sutures very indistinct, color yellowish brown to reddish, a rather broad yellow band on the edge of the vertex between the eyes. Vertex mostly pale yellow, but the extreme tip and a spot approximate to each compound eye at the hind margin are usually red. It is strongly produced and rather acutely pointed, its length being contained in the length of the pronotum only about one and one half times. Pronotum varying in color from yellow, tinged with red, to bright red with a large yellow spot on the middle of the anterior margin; it is but little wider than the head and considerably less than twice as wide as long. Scutellum uniformly red, or with a rectangular median portion that is paler in color than the rest. Elytra very pale yellow with a broad transverse red band which does not attain the costal margins. There is also a little red coloration on the costal margin near the base and on the cross nervures. Abdomen pale yellow, the tips of the segments sometimes pinkish, tip of the ovipositor black, last ventral segment of female with a rather strongly produced tooth on the middle of the posterior margin. Legs pale yellow, usually more or less strongly tinged with pinkish. (See Figs. 108, 109, 109a, 110, 111.)

Type.—No. 3443, U.S.N.M.

Described from a large number of males and females taken in February among leaves in the timber at Onaga, Kansas, by Mr. F. F. Crevecoeur.

I have also received a single specimen from Champaign, Illinois, sent me by Mr. C. A. Hart, who writes that it was taken among leaves April 23.

TYPHLOCYBA TRIFASCIATA Say.

Tettigonia trifasciata SAY, Jour. Acad. Nat. Sci. Phila., IV, p. 343, 1825; reprint, Compiled Writings, II, p. 259, 1891.—SIGNORET, Ann. Soc. Ent. de Fr., 3 ser., p. 805, 1855.

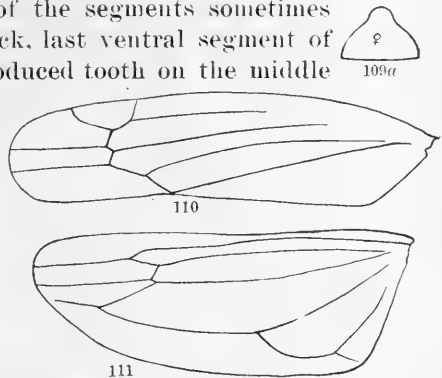
Typhlocyba trifasciata WOODWORTH, Psyche, V, p. 213, 1889.—OSBORN, Proc. Ia. Acad. Sci., I, Pt. 2, p. 11, 1892.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 313, 1894.

Say's description is as follows:

Pale yellowish white; elytra irrorate with reddish and somewhat trifasciate with dusky.

Inhabits Missouri.

Body pale yellowish white; head with two or three obsolete dull sanguineous



FIGS. 109a, 110, and 111.—LAST VENTRAL SEGMENT OF FEMALE, ELYTRON, AND WING OF TYPHLOCYBA RUBROSCUTA.

spots on the vertex in the form of curves or circles; eyes dusky; thorax, a dull sanguineous line abbreviated before, and an obsolete curve at the anterior angle; hemelytra whitish, irrorate with sanguineous; a dilated, brownish, interrupted, subbasal band; an obsolete interrupted band behind the middle, upon the posterior costal termination of which is an abbreviated sanguineous line, and an oblique blackish band near the tip; a large quadrate white immaculate spot on the middle of the costal margin; humeral base white, immaculate; tergum dusky at base; feet white.

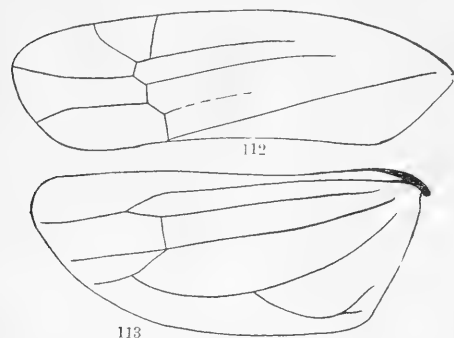
Length to tip of the hemelytra one-eighth of an inch.

The spots of the head and thorax are sometimes hardly discernible, and the intermediate band is often so faint and interrupted as to be overlooked. (See Figs. 112, 113.)

I have received specimens of this species as follows: From Professor H. E. Weed, marked "Ag. Coll. Miss., Oct. 22, '94;" from Illinois State Laboratory of Natural History, marked 13572 and 17398, those of the latter number taken on grapes; from the private collection of Mr. C. A. Hart, specimens bearing the numbers 462, 550, 562, and 566, all taken in Illinois; also from Mr. Hart a number of specimens that he took on grape at Havana, Illinois; from Mr. F. F. Crevecoeur, a number of spec-

imens taken by himself in early spring among leaves in the timber at Onaga, Kansas; from the U. S. National Museum specimens labeled "Mo. Riley."

This is a very pretty species that varies to a considerable extent in its markings. The three dusky fasciae are very distinct in some specimens and almost wanting in others; some have almost none of the red coloration, while others are highly colored upon the elytra



FIGS. 112 and 113.—ELYTRON AND WING OF TYPHLOCYBA TRIFASCIATA.

with sanguineous. In all the specimens that I have examined the tip of the scutellum has been jet black.

TYPHLOCYBA OBLIQUA Say.

Tettigonia obliqua SAY, Jour. Acad. Nat. Sci. Phila., IV, p. 342, 1825; reprint, Compiled Writings, II, p. 259, 1891.

Erythronera obliqua FITCH, Homop. N. Y. St. Cab. Nat. Hist., p. 63, 1851; Trans. N. Y. St. Agr. Soc., XVI, p. 435, 1856; reprint in Lintner's 9th Rep., p. 403, 1893.—WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 317, 1864.—PROVANCHER, Pet. Faune Ent. Can., III, p. 340, 1890.

Typhlocyba obliqua WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 312, 1894.—GILLETTE & BAKER, Bull. 31, Colo. Agr. Exp. Sta., p. 112, 1895.

The original description by Say is as follows:

Body yellowish white with two sanguineous lines, connivent upon the head and scutel; hemelytra white, with the two sanguineous lines. Inhabits the United States.

Body pale yellowish white; head with two dilated sanguineous lines, connivent

before; antennæ, seta as long as the head and thorax, dusky; thorax with two sanguineous lines; scutel with two lines and tip sanguineous; hemelytra whitish, an oblique line from the base slightly refracted on the thinner margin, and terminating behind the middle of the margin; an oblique longitudinal line on the disk, a more abbreviated, obsolete, subcostal line, and a costal line from the base to the middle of the edge, sanguineous; feet whitish; tail rosaceous. Length rather more than one-tenth of an inch. Found at Engineer Cantonment, and is also common in Penn.

In the Transactions of the New York State Agricultural Society mentioned above, Doctor Fitch speaks of this insect as follows:

A very small white leaf hopper 0.12 (inch) long, its head and thorax with two bright blood-red or orange stripes and three short oblique ones on the wing covers, the outer one placed on the shoulder, the middle one on the disk, and the inner one ending on the middle of the inner margin. This is common, particularly upon the bushes of the wild currant, but occurs on various other shrubs and trees throughout the year. It is subject to considerable variations, the stripes being sometimes of a pale yellow color, and one or another of them wanting. Commonly three black or dusky dots may be seen on the wing covers in an oblique row forward of the membranous tips. (See Figs. 114, 115.)

This is one of the grape-infesting species and is commonly taken along with *comes* and its varieties.

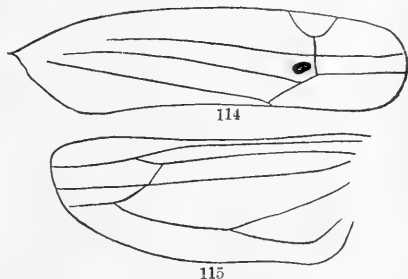
I have received specimens as follows: from Th. Pergande, labeled, "D. C. On Oak;" from Mr. Otto Heidemann, labeled "D. C.;" from Professor G. C. Davis, labeled "Ag. Coll. Mich., on Apple, July 15;" from Illinois State Laboratory of Natural History, taken at Champaign, Illinois, in general sweeping; from Mr. C. A. Hart, labeled 32, 335, 448, 449, 474, 512, and 535; from the U. S. National Museum, labeled, "Calif.," "D. C.," "Ia.," "Me.," and "Mo.;" and from Mr. F. F. Crevecoeur labeled, "Taken among leaves in timber near Onaga, Kansas."

I have taken this species in general sweeping near Fort Collins, along the river and in the foothills, and also at Canyon City, Colorado, on plum and at Manitou, Colorado, on oak.

I find the following very well marked varieties in this species which have not been characterized. Some of these may prove to be worthy of specific rank, but I do not feel safe in so placing any of them at present.

Variety dorsalis, new variety has the red markings so run together as to form a continuous red or dark (sometimes almost black) dorsal stripe the entire length of the insect. This is a common variety that I have seen from many localities.

Variety nœvus, new variety has the typical red lining, but the scutellum and hind margin of the pronotum are more or less black. This is



FIGS. 114 AND 115.—ELYTRON AND WING OF TYPHLOCYBA OBLIQUA.

a rather common form also; they were specially common in the lot of specimens from Mr. Crevecoeur mentioned above.

Type.—No. 3444, U.S.N.M.

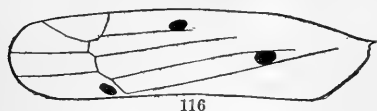
Variety fumida, new variety is more or less dusky throughout, the deepest dusky coloration being a broad smoky transverse band upon the cross nervures of the elytra.

Type.—No. 3345, U.S.N.M.

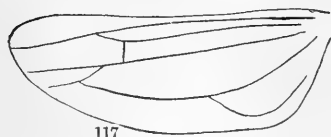
There were a large number of this form in the lot sent me by Mr. Crevecoeur from Onaga, Kansas, and I also have a few specimens that are not so well marked from Mr. C. A. Hart. The specimens from Mr. Hart were taken near Champaign, Illinois, and differ from the others in having the red coloration almost evenly diffused over the vertex, pronotum, scutellum, and anterior two-thirds of the elytra. It would be hard to recognize this form as belonging to *obliqua* were it not for the short clypeus, strongly contracted at the base, and the very oblique direction of the inner cross nervure of the elytron, which are peculiarities of this species.

TYPHLOCYBA ILLINOIENSIS, new species.

Color whitish, with eyes and three spots on elytra black, and red spots on head, pronotum, and scutellum; length 3 mm.



116



117

FIGS. 116 and 117.—ELYTRON AND WING OF
TYPHLOCYBA ILLINOIENSIS.

This species is whitish or pale yellow throughout, except the eyes and the red and black spots, which are distributed as follows: In well-marked specimens there is a bright red spot on the vertex, one on the pronotum, one on the tip of the scutellum, a few very minute ones on the bases of the elytra, and one on the mesopleura. In

pale specimens all of these may be absent or appearing as pale yellow spots, the one on the scutellum being the most constant. Each elytron has three distinct black spots, one midway near the costal margin, one at the base of the inner apical cell, and one between the third transverse vein and the claval suture, nearer the base of the wing than to the transverse nerves. This last spot is usually the largest and is surrounded by a halo of red or yellow. The legs are whitish, with the tibiae and tarsi more or less tinged with pinkish in most specimens. The tergum is also often tinged with reddish. (See Figs. 116, 117.)

Type.—No. 3446, U.S.N.M.

Described from six specimens from Illinois, eleven from Mississippi, and one from Michigan, males and females. The Illinois specimens are from the State Laboratory of Natural History, and bear the numbers 17399 and 17397. I am informed by Mr. Hart that those bearing the former number were taken on grapevines, the others in general sweep-

ings. Those from Mississippi were sent me by Professor H. E. Weed, who took them on October 8 and 23. The specimen from Michigan was taken by Professor G. C. Davis August 12. Mr. Heidemann has also sent me a specimen marked "D. C.," and I have specimens from the U. S. National Museum marked "On Vogellein-grape."

TYPHLOCYBA COMES Say.

Tettigonia comes SAY, Jour. Acad. Nat. Sci. Phila., IV, p. 343, 1825; reprint, Compiled Writings, II, p. 259, 1891.

Typhlocyba comes WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am.

Ent. Soc., XXI, p. 312, 1894.—MARLATT, Yearbook, U. S. Dep. Agr., p. 400, 1896.

Erythroneura vitifex FITCH, Trans. N. Y. St. Agr. Soc., XVI, p. 392, 1856.

Typhlocyba vitifex WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am.

Ent. Soc., XXI, p. 312, 1894.—MARLATT, Yearbook, U. S. Dep. Agr., p. 400, 1896.

This is one of the most common, and, in its markings, one of the most variable of all the *Typhlocybas*, and has been described no less than eight times under different names. Fitch's *Erythroneura vitifex* seems to have been completely covered by Say's description of *comes*, so I have not retained the name as representing a variety at all distinct from what Say described.

Say's description is as follows:

Pale yellowish, with sanguineous spots.

Inhabits Missouri.

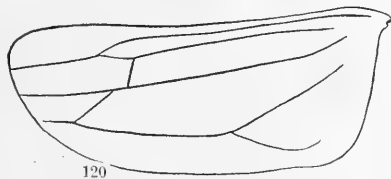
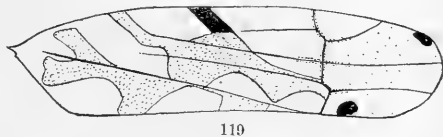
Body pale yellowish; head, a transverse sanguineous line, profoundly arcuated in the middle, and a smaller transverse spot before; eyes fuscous; thorax with three sanguineous spots, the lateral ones smaller, and the intermediate one arcuated; scutellum, a sanguineous spot at tip; hemelytra yellowish white spotted with sanguineous; spots arranged two at base,

of which the outer one is small and the inner one elongated and abruptly dilated on the inner side at tip; two upon the middle, of which the outer one is elongated in a very oblique line; two behind the middle, of which the inner one is obliquely elongated, and the outer one smaller and interrupted; and a transverse linear one near the tip, ramose upon the nervures; feet whitish.

Length to the tip of the hemelytra one-ninth of an inch.

The line and spot on the head and the spots of the thorax are sometimes obsolete, but always visible, and the latter are sometimes connected by curving toward the anterior edge of the thorax. The spots of the hemelytra are also sometimes slightly interrupted, or connected into four oblique bands. (See Figs. 118, 119, 120.)

Outside of Colorado I have received this species from the following localities and persons: Arizona (Toumey), District of Columbia (Pergrande), Illinois (Forbes and Hart), Iowa (Osborn and Ball), Maryland (Pratt, F. C.), Michigan (Davis), Mississippi (Weed, H. E.), Ohio (Comstock), New York (Comstock), Vancouver Island (Livingston).



FIGS. 118, 119 and 120.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF TYPHLOCYBA COMES.

In Colorado I have taken this species near Fort Collins and Canon City, at the former place on Virginia creeper and wild grape, at the latter on cultivated plum. The specimens taken from Virginia creeper were few in number and resembled var. *ziczac* as closely as typical *comes*; the specimens from plum were exceedingly abundant so as to do considerable injury to the foliage. I have also a single specimen that I swept from dwarf oaks, *Quercus undulata*, at Manitou, this State. Mr. Pergande's specimens were from oak and grape; those from Professor Forbes bear the numbers 14877 and 17867. Mr. Hart writes that the former lot were taken from rye and the latter among dried leaves.

VARIETY BASILARIS Say.

Tettigonia basilaris SAY, Jour. Acad. Nat. Sci. Phila., IV, p. 344, 1825; reprint, Compiled Writings, II, p. 260, 1869.

Erythronoura basilaris WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 317, 1864.—GLOVER, Rep. U. S. Dep. Agr., p. 33, 1876.

Typhlocyba basilaris WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 321, 1894.

Erythronoura affinis FITCH, Homop. N. Y. St. Cab., p. 63, 1851; reprint, Lintner's 9th Rep., Ins. N. Y., p. 403, 1893.

Typhlocyba affinis WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 321, 1894.

I do not consider Fitch's var. *affinis* to be worth retaining as a variety of *basilaris*. The only thing that Fitch gives to separate his *affinis* from *basilaris* is the yellow instead of sanguineous markings. Any of the *Typhlocybas* marked with bright red sometimes occur with faint yellow markings, and in *basilaris* I find all gradations from those marked with bright red to those having the markings so faint as to be hardly discernible.

The original description of *basilaris* is as follows:

Pale yellowish, varied with sanguineous; elytra reddish brown at base.

Inhabits Missouri.

Body pale yellowish; head absolutely varied with sanguineous; eyes dusky or black; thorax dusky behind; anterior margin with four or five obsolete sanguineous spots; scutel dusky reddish brown or sanguineous at tip; hemelytra with a broad band of reddish brown at base; a spot on the middle of the inner margin, then an oblique line, and another oblique line toward the tip, sanguineous; at the inner extremity of the latter is a minute black spot. Length to the tip of hemelytra one-ninth of an inch.

I have received a number of specimens of this variety from the Illinois State Laboratory of Natural History and from the private collection of Mr. Hart, all taken near Champaign, Illinois; a few specimens from Iowa Agricultural College, and a large number of specimens from Mr. F. F. Crevecoeur, taken at Onaga, Kansas, among leaves in the timber in early spring.

VARIETY VITIS Harris.

Tettigonia vitis HARRIS, Encyclopedia Amer., VIII, p. 43, 1831; Ins. Inj. to Veg., 1st ed., p. 184, 1842; 2d ed., p. 198, 1852; 3d ed., p. 22, pl. III, 1862.

Erythroneura vitis FITCH, Homop. N. Y. St. Cab., p. 63, 1851; reprint, Lintner's 9th Rep., p. 403, 1893.—WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 317, 1864; Pract. Ent., II, p. 49, 1867.—GLOVER, Rep. U. S. Dep. Agr., p. 32, 1876.—SAUNDERS, Insects Inj. to Fruit, p. 286, 1883.—UHLER, Stand. Nat. Hist., II, p. 246, 1884.—PROVANCHER, Pet. Faune Ent. Can., III, p. 298, 1890.—COMSTOCK, Manual of Ins., p. 154, 1895.

Typhlocyba vitis WALSH & RILEY, Amer. Ent., I, p. 227, 1869.—RILEY, Trans. Ill. St. Hort. Soc. for 1873-74.—WOODWORTH, Psyche, V, p. 213, 1889.—WEED, Insects and Insecticides, p. 122, 1892.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 311, 1894.

The original description of this variety is as follows:

One-tenth of an inch in length. Of a pale yellow or straw color; there are two little red lines on the head; the back part of the thorax, the scutel, the base of the wing covers, and a broad band across their middle are scarlet; the tips of the wing covers are blackish and there are some little red lines between the broad band and the tips. The head is crescent shaped above and the eyelets are situated just below the ridge of the front. On grape. (See Fig. 121.)

The only specimens that I have seen of this variety from Colorado I took in Clear Creek Canyon, near Golden, on wild grape, July 18, 1896. I have received specimens from Professor Davis taken in Michigan and from Mr. Hart taken in Illinois, and in both instances from grape. Specimens from Mr. Pergande were taken in District of Columbia on *Cereis canadensis*. I also have specimens taken by Mr. E. D. Ball and by myself in Iowa, by Mr. MacGillivray in New York and Professor Weed in Mississippi.

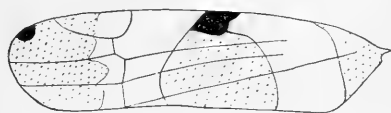


FIG. 121.—ELYTRON OF TYPHLOCYBA COMES VAR. VITIS.

Typical individuals of this variety are so different in their markings from typical *comes* that one would not be inclined at first to think that they could belong to that species, but, structurally, the two forms are alike and one can go from one extreme to the other through *ziczac*, which seems to be an intermediate form. Specimens from Mr. Hart's private collection bear the numbers 345, 476, 535, 550, 562, and 573.

Specimens from Professor Davis were taken from wild grape and the specimens from Mr. Livingston were taken on alder. I do not know the host plants from which others took their specimens.

VARIETY ZICZAC Walsh.

Erythroneura ziczac WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 317, 1864.

Typhlocyba ziczac WOODWORTH, Psyche, V, p. 312, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 312, 1894.

According to Mr. Walsh this variety has the following characteristics:

Pale yellowish. Front of the head in a right angle, with the apex rounded. Eyes dusky; ocelli pale; vertex with two pale sanguineous vitta, generally sub-obsolete. Thorax blood brown, yellowish in front, often with a yellowish vitta, scutel blood-brown, with a yellowish vitta, occasionally entirely yellowish. Abdomen often blood-brown, except at base and tip. Tip of ovipositor and of tarsi dusky. Elytra pale yellowish; on the costal tip a black spot, and on the interior margin,

forming a triangle with the two other spots, a black spot; a blood-brown, irregular, broad stripe, covering the humerus, thence in a zigzag direction to the rhomboidal spot; thence to the spot on the interior margin; thence not quite attaining the terminal dot. Wings hyaline; tips of costal veins often dusky. Length to tip of wings a little over one-tenth of an inch. Occurs abundantly on the grapevine. (See Fig. 122.)

This is a variety of *comes* in which the red lines and spots of the elytra run together and are usually of a dull blood-brown or smoky color, but among the specimens that I have examined there is every possible variation into typical *comes* in one direction and into typical *vitis* in the other.



FIG. 122.—ELYTRON OF TYPHLOCYBA COMES, VAR. ZICZAC.

Mr. Baker and myself have both taken this variety here in large numbers from Virginia creeper and

occasionally on grape; Walsh took his specimens on grape, and Mr. Hart, of Illinois, and Professor Davis, of Michigan, have both sent it to me recorded for grape. I also have specimens from Professor H. E. Weed, of Mississippi, and Mr. E. D. Ball, of Ames, Iowa, but do not know from what plants their specimens were taken.

VARIETY OCTONOTATA Walsh.

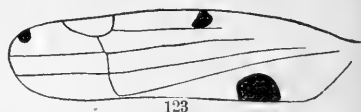
Erythroneura octonotata WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 318, 1864.

Typhlocyba octonotata WOODWORTH, Psyche, V, p. 213, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 312, 1894.

This is another well marked variety of *comes*, differing from the typical form by having the markings, especially upon the posterior half of the wing covers, rather faint and by having a large spot on the middle of the internal margin of the clavus and a broad median stripe on the scutellum black. The spot on the scutellum is sometimes wanting.

This form was described by Walsh as follows:

Whitish. Head as in the preceding (*ziczac*). Thorax a little clouded with fuscous. Abdominal and ventral joints in mature specimens dusky, except at tip. Tips of tarsi dusky. Elytra whitish subhyaline, with the same three spots as in the preceding, and, in addition, one on the inner margin not far from the base; on the cross veins an irregular fuscous band and on the disk a small brown cloud, often obsolete. Length a little over one-tenth of an inch. (See Figs. 123, 124.)



FIGS. 123 AND 124.—ELYTRON AND WING OF TYPHLOCYBA COMES, VAR. OCTONOTATA.

Walsh found this species in small numbers upon grapevines in company with *ziczac*, *vitis*, and *tricincta*.

Mr. C. A. Hart, of Champaign, Illinois, sent me a quantity of *Typhlocybina*, swept from grapevines, in which were a large number of beautiful specimens of this variety, and I also received a considerable

number of pinned specimens from Professor H. E. Weed, taken in Mississippi. I have, besides these, a single specimen taken at Ithaca, New York, by Mr. MacGillivray, and one taken by Professor G. C. Davis at the Michigan Agricultural College.

VARIETY COLORADENSIS Gillette.

Typhlocyba vitifer FITCH, var. *coloradensis* GILLETTE, Bull. 19, Colo. Agr. Exp. Sta., p. 16, 1892.—GILLETTE & BAKER, Bull. 31, Colo. Agr. Exp. Sta., p. 113, 1895.

Typhlocyba coloradensis COCKERELL, Bull. 19, N. M. Agr. Exp. Sta., p. 114, 1896.

Typhlocyba vitis GILLETTE, Bull. 15, Colo. Agr. Exp. Sta., p. 18, 1891.

The form which occurs here, however, differs from the typical *vitifer* by having a large black spot on either side of the scutellum at the base, by having the red line on the middle of the thorax usually not forked in front, and by not having the red on the head in two lines, but in a large blotch more or less spotted with whitish.

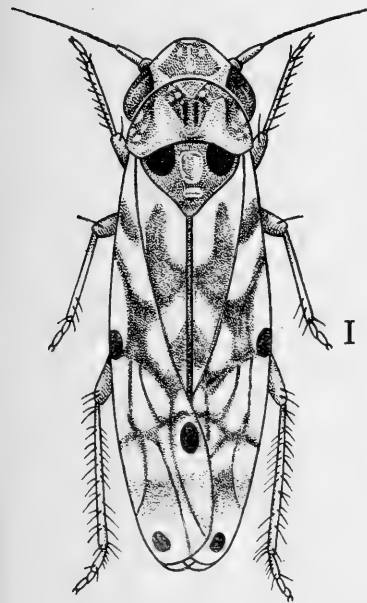
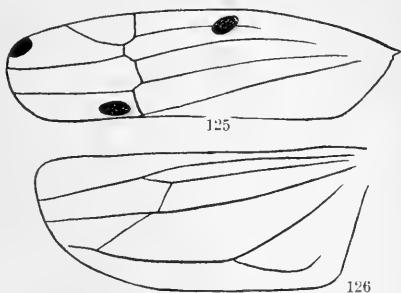


FIG. 127.—TYPHLOCYBA COMES, VAR. COLORADENSIS. (From Bulletin 19, Colo. Exp. Sta., p. 17.)



FIGS. 125 and 126.—ELYTRON AND WING OF TYPHLOCYBA COMES, VAR. COLORADENSIS.

The illustration (Fig. 127) was made from a specimen that most nearly approaches a typical *vitifer* in coloration. It seems that the Colorado form is a very distinctly marked variety, and for it I suggest the name *Coloradensis*. The two spots on the scutellum, which are perfectly constant, will alone separate it from the eastern form. (See Figs. 125, 126, 127.)

Cotype.—No. 3447, U.S.N.M.

This is one of the most beautiful of the numerous varieties of *comes*. I have taken it in several localities in Colorado, and have received it from Professor T. D. A. Cockerell, who took specimens on grape at Las Cruces, New Mexico, from Mr. Vernon L. Kellogg, specimens taken on grape in California, and from the U. S. National

Museum, a large number of specimens bearing the following labels: "Denver, Colo., V. Deviny, July '86, on grape;" "Berkeley, Calif., on grape, May '81;" "Ft. Collins, Colo., on grape, J. Cassidy;" "Bloomington, Nebr., on grape, '88, J. Graf;" "Anthony, N. M., on grape, H. H. Bailey;" "Basco Falls (Kans.), G. Marlat."

This is a very distinctly marked variety and one that seems to be entirely confined to the West. We should not go far wrong in giving it specific rank, but it is so exactly like *comes*, with simply the basal angles of the scutellum blackened, that I have not thought it best to consider it more than a variety of that species.

VARIETIES OF *TYPHLOCYBA COMES* Say.

Typical *comes* (Say).—With zigzag red lines and spots on elytra, but without black markings on the scutellum.

Variety *coloradensis* (Gill).—Like the preceding, with the addition of a large black spot on either basal angle of the scutellum.

Variety *ziczac* (Walsh).—Like *comes*, except that the zigzag line running from the humerus to the inner margin and thence to the cross-nervures of the elytron is broad and smoky or blood brown in color.

Variety *ritis* (Harris).—Mostly red above, with two transverse yellow lines on the elytra, surrounding a large central red or brown spot.

Variety *basilaris* (Say).—The reddish or blood-brown coloration nearly all massed on the basal half of the elytra.

Variety *maculata*, new variety.—Vertex, pronotum, scutellum, and elytra, with small bright red spots.

Type.—No. 3448, U.S.N.M.

Variety *scutelleris*, new variety.—Like *comes*, with scutellum black.

Type.—No. 3449, U.S.N.M.

Variety *S-notata* (Walsh).—Like *comes*, with the sanguineous markings faint beyond middle of clavus, and at this point a rather large black spot on a sanguineous field. Middle portion of scutellum also black.

Variety *rubra*, new variety.—Like *comes*, except that the red markings are so broadened as to nearly unite with one another, giving the entire insect a very red appearance above.

Type.—No. 3450, U.S.N.M.

Variety *infuscata*, new variety.—A broad median black or dark band extending over the vertex, pronotum, and scutellum, including the whole of the scutellum, and thence onto the elytra, where it takes the form of the dark band in *ziczac*, but is even broader. At the tip of the clavus is a dark spot surrounded by a narrow yellow stripe.

Type.—No. 3451, U.S.N.M.

All the above varieties are quite sharply defined, and one who has not specially studied the group would be very likely to consider them different species.

TYPHLOCYBA VULNERATA Fitch.

Erythroncra vulnerata FITCH, Homop. N. Y. St. Cab., p. 62, 1851; Trans. N. Y. St. Agr. Soc., XVI, p. 393, 1856; reprint, Lintner's 9th Rep., Ins. N. Y., p. 162, 1893.—WALSH, Proc. Bost. Soc. Nat. Hist., IX, p. 317, 1864.—PROVANCHER, Pet. Faune Ent. Can., III, p. 299, 1890.

Typhlocyba vulnerata WOODWORTH, Psyche, V, p. 213, 1889.—WEED, Insects and Insecticides, p. 84, fig. 6, 1891; p. 134, fig. 6, 1895.—OSBORN, Ia. Acad. Sci., I, Pt. 2, p. 11, 1892.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 313, 1891.—GILLETTE & BAKER, Bull. 31, Colo. Agr. Exp. Sta., p. 113, 1895.

Dr. Fitch's description of this species is as follows:

Fulvous brown, spotted and lined with whitish; elytra with an abbreviated yellowish-white vitta on the outer margin, interrupted near the middle by an oblique black line, and toward the apex by an oblique sanguineous one; tips dusky, with whitish nervures and spots; a whitish medial line common to the vertex, thorax and scutellum; beneath black, legs pallid. Length 0.12 (inch). (See Figs. 128, 129).

On raspberry bushes, grapevines and other situations where the foliage is dense, often in great numbers.

I have received specimens of this species as follows: From Mr. Pergande, labeled "D. C., on elm;" from Mr. C. A. Hart, taken at Havana, Illinois, on grape, and others taken near Champaign in general collecting; from Professor H. E. Weed, taken at the Mississippi Agricultural College; from Mr. E. D. Ball, taken at Ames, Iowa; from Mr. Otto Heidemann, marked "D. C.;" from the U. S. National Museum, marked "Denver, Colo., on grape, V. Deviny," and "Mo.;" from Mr. F. F. Crevecoeur, Onaga, Kansas, taken among leaves in the spring; from Professor J. W. Toumey, marked "Salt River Valley, Ariz., very bad on grapes."

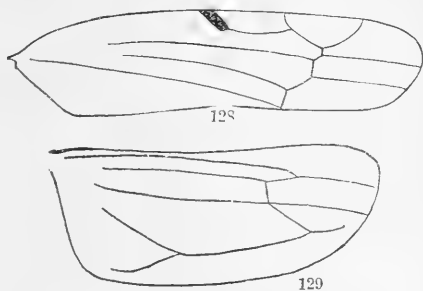
I have taken this insect in Colorado on *Clematis ligusticifolia*, on Virginia creeper, and on grape.

Variety *niger*, new variety.—I have a number of specimens of a very dark, almost black, form of this species. They have been received from the Illinois State Laboratory of Natural History, Cornell University, Mr. E. D. Ball, Ames, Iowa, Mr. Th. Pergande, District of Columbia, and Mr. F. F. Crevecoeur, Onaga, Kansas, and I have also taken this form at Fort Collins, Colorado.

The color above is almost entirely black but the large light colored spot on the middle of the costal margin of the elytron is always present, and nearly always a yellow spot on the inner basal angle of the elytron, and yellow spots or narrow lines in the places of the ordinary light lines of the thorax and vertex, and a median yellow line on the scutellum.

Type.—No. 3452, U.S.N.M.

The specimens sent me by Professor Toumey from Salt River Valley, Arizona, are very light colored.



FIGS. 128 and 129.—ELYTRON AND WING OF TYPHLOCYBA VULNERATA.

TYPHLOCYBA DENTATA, new species.

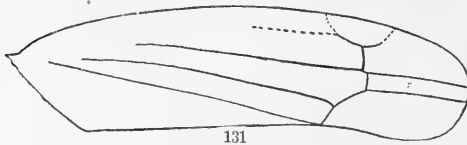
Light straw color marked with orange yellow above; length 3 mm.

Face pale yellow, unicolorous, hardly longer than broad, clypeus unusually small. Vertex moderately produced, one-half as long as the pronotum and a little less than one third as long as the head is broad, concolorous with the face and having two illly defined orange, or lemon colored spots which, in one specimen, extend forward over the crest of

the vertex. Pronotum pale yellow with two rather large and approximate orange-colored spots just before the middle. Scutellum light yellow on the middle but more or less washed with orange on all the angles. Elytra light yellow, subhyaline on the basal portion, transparent beyond the cross veins and with two orange vittæ, one on the clavus and another longitudinal one on the middle of the corium and reaching to the cross veins; there is also a little orange decoloration



130



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FIGS. 130 and 131.—VERTEX AND PRONOTUM, AND ELYTRON OF *TYPHLOCYBA DENTATA*.

on the inner margins of the elytra near the tip of the clavus. Color of venter and feet light yellow. The last ventral segment of the female has a large broad tooth notched at the tip which is different from any other American *Typhlocybid* that I have seen and which suggested the specific name. The orange coloration is quite faint in two of the specimens.

Type.—No. 3453, U.S.N.M.

Described from three females from the U. S. National Museum, marked "Folsom, Calif., Aug. 7, '85." (See Figs. 130, 131.)

TYPHLOCYBA QUERCI Fitch.

Empoa quercii FITCH, Homop. N. Y. St. Cab., p. 63, 1851; reprint, Lintner's 9th Rep., Ins. N. Y., p. 403, 1893.

Typhlocyba quercii WOODWORTH, Psyche, V, p. 214, 1889.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 313, 1894.

This variety is described by Dr. Fitch as follows:

White; elytra pellucid, with three blackish dots in a transverse row behind the middle. Length 0.12 (inch). On oaks, sometimes excessively numerous.

VARIETY BIFASCIATA Gillette & Baker.

Typhlocyba bifasciata GILLETTE & BAKER, Bull. 31, Colo. Agt. Exp. Sta., p. 111, 1895.

Near *tricincta*. Female: Clypeus once and a quarter as long as broad, basal suture straight; genæ long and narrow, with a broad deep groove from eye to clypeus, slightly concave outwardly, broadest at eye, attaining tip of clypeus; loræ as long and somewhat narrower than clypeus; front three-fourths longer than broad between eyes, three times as long as clypeus, superior angle more than a right angle and broadly rounded. Face and vertex very finely and obsoletely punctured, more distinctly on upper part of front. Disk of vertex flat, sloping, slightly less than one-half longer at middle than at eyes. Pronotum slightly less than twice as broad as long at middle, broadly rounded before, slightly concave behind, posterior angles rather sharply rounded, lateral margins long; disk of pronotum with anterior third

smooth, posterior two-thirds very indistinctly transversely rugose; scutellum slightly shorter than pronotum, broader than long, transverse groove straight, black, ends bent backward; last ventral segment with hind margin broadly rounded. Color yellow; face, vertex, and pronotum, light lemon yellow, concolorous; scutellum dark smoky; elytra light lemon yellow, with a broad smoky transverse band just in front of middle, broader on inner margins, another broad smoky band at apex, lighter on middle portion; venter pale yellow; legs pale whitish yellow. Length 4 mm.

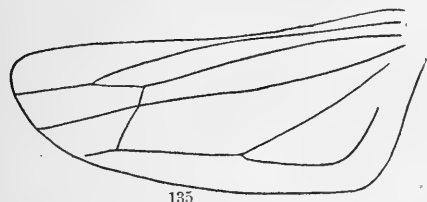
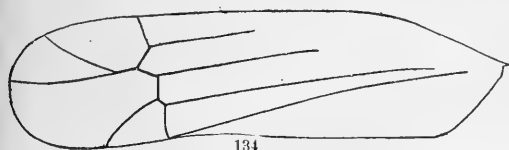
Cotype.—No. 3454, U.S.N.M.

Described from one female, which I took at Minturn, Colorado, August 24. (See Figs. 132, 133, 134, 135.)

I have received specimens from New York (Lintner), Illinois (Forbes), Iowa (Osborn), and from Mr. Th. Pergande labeled, "From oak. D. C.;" from Professor G. C. Davis labeled, "M. A. C., 7 5 '92;" from Mr. Samuel Henshaw labeled, "From balsam, N. C., W. J. P. Coll.," and from Mr. E. D. Ball labeled, "Ames, Ia."



FIGS. 132 and 133.—FACE AND VERTEX AND PRONOTUM OF TYPHLOCYBA QUERCI, VAR. BIFASCIATA.



FIGS. 134 and 135.—ELYTRON AND WING OF TYPHLOCYBA QUERCI, VAR. BIFASCIATA.

narrow costal margin for a short distance.

A specimen received from Professor Davis is interesting on account of the dark band on the middle of the elytra being extended forward to the scutellum, so that the only yellow portion of the basal half of the elytron is a

TYPHLOCYBA CREVECŒURI, new species.

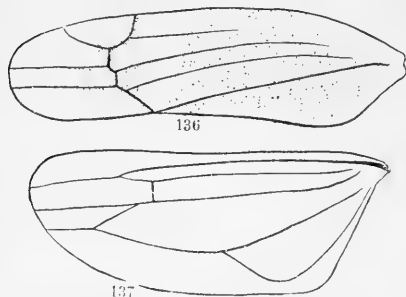
Color light yellow, basal two-thirds of elytra red; length 3 mm.

Face yellowish, suffused with reddish, sutures indistinct. Vertex rather strongly produced and angular, not broadly rounded in front; vertex and pronotum straw yellow, with two broad longitudinal red lines; these lines upon the vertex are so broadened in some specimens as to completely cover it. Scutellum entirely red, or in some specimens almost black; elytra yellow beyond the tip of the clavus, and with more or less yellow on the base of the costal margin, the remainder of the elytra red. In most specimens, however, the middle portion of this large reddish area on the elytra is more smoky than red in color. The inner transverse nervure is very oblique and the middle apical cell is

narrow and parallel-sided, as in *obliqua*. All beneath pinkish yellow. (See Figs. 136, 137.)

Type.—No. 3455, U.S.N.M.

Described from nineteen specimens sent me by Mr. F. F. Crevecoeur, which he took among leaves in timber at Onaga, Kansas, in early spring.



FIGS. 136 and 137.—ELYTRON AND WING OF TYPHLOCYBA CREVECOEURI.

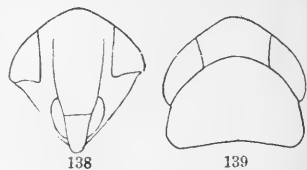
The red lines upon the vertex and pronotum, the very oblique direction of the inner transverse nervure of the elytron, the parallel-sided and very narrow apical cell of the elytron, and the fact that these specimens were taken along with specimens of *obliqua*, led me to suspect that this was only another variety of that species; but *crevecoeuri* is much more robust than *obliqua*, and the characteristic

markings of the former is so constant that I can not but think it a good species.

TYPHLOCYBA FLAVOMARGINATA Gillette & Baker.

Typhlocyba flavomarginata GILLETTE & BAKER, Bull. 31, Colo. Agr. Exp. Sta., p. 111, 1895.

Female: Clypeus a third longer than broad, basal suture straight, sides nearly parallel; lorae and genae as in *bifasciatus*; front three times the length of clypeus, one-third broader than long, superior angle greater than a right angle, broadly rounded. Face, vertex, and pronotum sculptured as in *bifasciata*. Proportions of vertex, pronotum, and scutellum same as in *bifasciata*. Last ventral segment with posterior angles produced, acute, a broad, deep emargination between them, the base of which is notched. Color pale yellow or whitish: face, vertex, and pronotum whitish, concolorous; scutellum whitish, with basal angles darker; elytra whitish subhyaline, nervures lighter, costal and internal margins flavescent, deeper on inner margin; venter and legs pale yellow; pygofers, sheaths of ovipositor, prosternum, and tip of rostrum tinged with flavescent.



FIGS. 138 and 139.—FACE, AND VERTEX AND PRONOTUM OF TYPHLOCYBA FLAVOMARGINATA.

Length 4 mm. Described from three females. (See Figs. 138, 139.)

Cotypes.—No. 3456, U.S.N.M.

The type specimens were taken by myself at Manitou, Colorado, September 29, on oak, and I have since taken the species in considerable numbers at Cerro Summit, August 21, and Cimarron, August 22, and Manitou October 8, in each case from dwarf oaks. All in Colorado.

TYPHLOCYBA ULMI Linnæus:

Cicada ulmi LINNÆUS, Fauna Suecica, p. 900, 1761.—DE GEER, Abh. x. Gesch. d. Ins. etc., p. 189, 1780.—FABRICIUS Ent. Syst., 1803.—FALLEN, Hemiptera Sueciæ, Cicadariæ, p. 49, 1829.

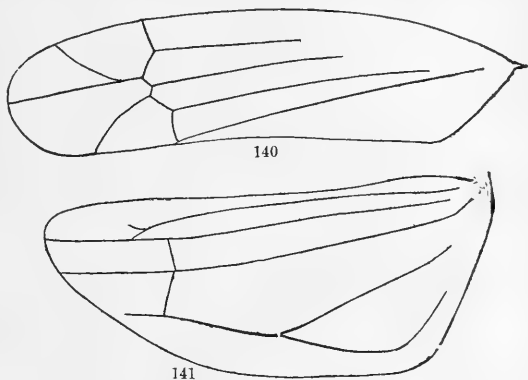
Anomia ulmi FIEBER, Kat. d. eur. Cicad., p. 15, 1872.

Typhlocyba ulmi PUTON, Cat. d. Hemip., p. 88, 1886—MELICHAR, Cic. v. Mitteleuropa, p. 348, 1896.

I do not possess the original description of this species, my specimens being determined by comparison with European specimens loaned me by Mr. E. P. Van Duzee, and others obtained in exchange from Doctor L. Melichar, of Vienna.

The species may be briefly characterized as follows:

Color yellowish; length 3.75 mm.; head rather small, narrower than the pronotum; vertex of female with two black dots on the anterior margin; males and females with a small black spot on the middle of the anterior margin of the pronotum; tergum of abdomen black, with the hind margins of the segments yellow; venter yellow, or yellow and black; elytra somewhat infuscate in the region of the cross nervures and at their tips; feet yellow. (See Figs. 140, 141.)



FIGS. 140 and 141. —ELYTRON AND WING OF TYPHLOCYBA ULMI.

I received a good number of males and females of this species from Doctor Lintner labeled, "Albany, N. Y., 1886," and one specimen labeled "Mass.," also a few examples from Mr. Ball labeled "Ames, Ia., June 19."

TYPHLOCYBA COMMISSURALIS Stål.

Typhlocyba commissuralis STÅL, Stett. Ent. Zeit., XIX, p. 196, 1858.—WOODWORTH, Psyche, V, p. 214, 1869.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 313, 1894.

Kybos commissuralis FIEBER, Kat. d. eur. Cicad., p. 14, 1872—PUTON, Cat. des Hémipt., p. 87, 1886.

Stål's original description of this species is as follows:

Flavo-albida, capite circa oculos scutelloque pallide brunnescentibus, hujus marginibus lateralibus termissime venaque ipsa marginali interna tegminum ultra medium nigricantibus; tegminibus pallidissime flavescentibus, apice subdecoloribus, costa basi fusciscente, areolis apicalibus 4 triangularibus, lateralibus marginem apicalem ipsam hand attingentibus, Ida basi latiuscula, 3-tia basi angulum scutum formante. ♂. Long. $4\frac{1}{2}$. Lat. $\frac{3}{4}$ mm.

T. lineatillæ subsimilis. Tegmina areolis apicalibus 4 instructa, quarum externis apicem hand attingentibus, obtriangularibus, basi latis et ibidem utrimque sub-oblique truncatis, secunda (a commissura) apice omnium latissima, intus sensim

angustata, basi utrimque oblique truncata, tertia triangulari, basi angulum acutum formante. (See Figs. 142, 143, 144.)

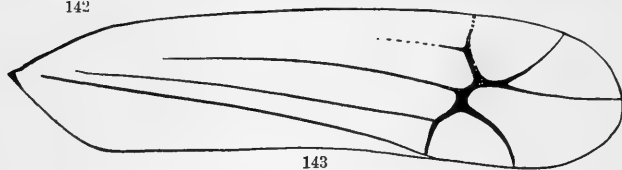
Stål's description was made from a male specimen taken at Sitka, Alaska, and I am not aware that it has ever been reported by anyone since its description.

Mr. Clermont Livingston, of Corfield, Vancouver Island, recently sent a large quantity of insects that he took sweeping various plants, and in the lot were a large number of specimens of *T. commissuralis*. According to Mr. Livingston's notes the specimens of this species were taken from alder, willow, and weeds.

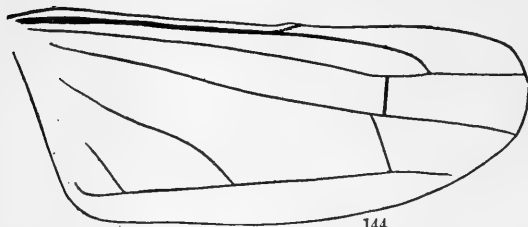
The black commissural line is present in a number of specimens, both male and female, but the greater proportion have no dark marking upon the elytra at all, and resemble *T. rosa* so perfectly that I can separate the species only by the difference in size, *rosa* not exceeding $3\frac{1}{2}$ mm., while *commissuralis* measures from $3\frac{3}{4}$ to nearly 5 mm.



142



143



144

FIGS. 142, 143 and 144.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF
TYPHLOCYBA COMMISSURALIS.

The only other representatives of this species that I have seen were taken by myself at Cimarron, Colorado, August 22, from alder, *Alnus viridis*. They were taken along with numerous specimens of *Empoasca atrolabes* and *E. smaragdula*.

A specimen of *Typhlocyba callosa* Then, sent me by Doctor Melichar seems identical with *commissuralis*, as do examples of *T. cratagi* Douglas, that I have examined from Europe.

TYPHLOCYBA TENERRIMA Herrich-Schäffer.

This is also an European species, the description of which I have not seen. I determined my specimens by comparison with named European specimens sent me by Mr. E. P. Van Duzee, and I also sent specimens to Doctor Melichar, who assured me that my determinations were correct.¹

This is a very slender pale-yellow species, a trifle more than 3 mm. in length. There is a row of dusky blotches on the elytron just before

¹A description in German may be found in Cicadinen von Mittel-Europa, p. 349, by L. Melichar.

the cross nervures, and the extremities of the outer cross nervure and of the inner and outer apical nervures are black; the tip of the ovipositor and the basal portion of the tergum of the abdomen are also black; aside from the dark compound eyes, these are the only markings. (See Fig. 145.)

Specimens of this species were sent me by Professor G. C. Davis. One lot was labeled, "Ag. Coll. Mich., 9/23/92, 460," and another lot, "Ag. Coll. Mich., 9/17/95, on wild grape." I found it rather common on hazelnut (*Corylus rostrata*) in Colorado, in Clear Creek Canon, above Golden, July 18, and in the foothills near Palmer Lake, August 12, 1896.

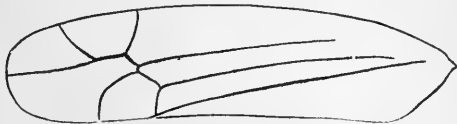


FIG. 145.—ELYTRON OF TYPHLOCYBA TENERIMA.

TYPHLOCYBA LETHIERRYI Edwards.

I have not seen the original description of this species, but determined the specimens that I have by comparison with European specimens loaned me by Mr. E. P. Van Duzee. I also sent specimens to Doctor Melichar, who determined them *T. lethierryi*, so there can be little doubt as to the correctness of the determinations. The species is described by Doctor Melichar along with the preceding.

The species resembles *T. rosæ* very closely, but is sulphurous yellow in color instead of pale yellow or whitish. The color is deepest on the elytra where it stops abruptly at, or a little in front of, the cross-nervures, and the palest yellow is beneath. The dark eyes and black tip of the ovipositor are the only markings. (See Fig. 146.)



FIG. 146.—ELYTRON OF TYPHLOCYBA LETHIERRYI.

7/5/92," and a good number sent me by Mr. E. D. Bell, labeled "Ames, Iowa, June 19, from hard maple."

TYPHLOCYBA ROSÆ Linnaeus.

Cicada rosæ LINNÆUS.

Typhlocyba rosæ TOLLIN, Ent. Zeit. v. Stett., p. 67, 1851.—FLOR, Die Rhyu. Livl., p. 378, 407, 1861.—PUTON, Cat. d. Hémipt., p. 88, 1886.—WOODWORTH, Psyche, V, p. 76, 1888.

Anomia rosæ FIEBER, Kat. der eur. Cicad., p. 15, 1872.

Tettigonia rosæ (HARRIS) HARRIS, Ins. Inj. to Veg., 2d ed., p. 192, 1852; 3d ed., p. 229, 1862.

Typhlocyba rosæ WOODWORTH, Psyche, V, p. 214, 1889.—WEED, Insects and Insecticides, p. 156, fig. 83, 1891; p. 217, fig. 115, 1895.—VAN DUZEE, Trans. Am. Ent. Soc., XXI, p. 313, 1894.—GILLETTE & BAKER, Bull. 31, Colo. Agr. Exp. Sta., p. 112, 1895.—MELICHAR, Cic. v. Mittel-europa, p. 345, 1896.

Erythroneura rosæ PROVANCHER, Pet. Faune Ent. Can., III, p. 299, 1890.

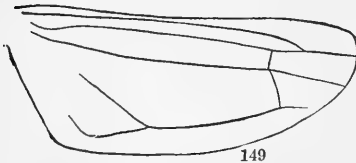
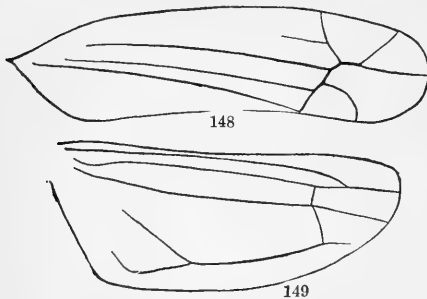
Empoa rosæ COMSTOCK, Manual of Ins., p. 154, 1895.

I do not have access to the description of this species by Linnæus, and so give the following brief characterization by Harris:

On rose. * * * In its perfect state it is rather less than three-twentieths of an inch long. Its body is yellowish white, its wing covers and wings are white and transparent, and its eyes, claws, and piercer brown. The male has two recurved appendages at the tip of its hind body. It may be called *Tettigonia rosa*. (See Figs. 147, 148, 149.)

Doctor Gustav Flor, in Rhynchoten Livlands (Cicadina und Psylloidea),¹ says that this species is sometimes golden yellow in color to near the elytra, and that the males are $2\frac{1}{2}$ and the females $2\frac{3}{4}$ mm. in length. He also says that it is abundant on rose and also upon linden from August to late in October.

This is a very widespread and common species. Specimens in my collection from Europe, and from ocean to ocean in this country, seem to be identical, the chief variation being in size. Specimens that I have studied vary from 3.25 to $3\frac{1}{2}$ mm. in length. The only dark markings that I have seen are those mentioned by Harris in his description, but I find that the males frequently have the upper portion of the face bright orange in color.



FIGS. 147, 148 and 149.—VERTEX AND PRONOTUM, ELYTRON, AND WING OF TYPHLOCYBA ROSAE.

Professor G. C. Davis sent me specimens of this species that he took at the Michigan Agricultural College on apple, plum, tame cherry, currant, and grape. Mr. Pergande sent me specimens that he took in the District of Columbia on apple, and I have received specimens from Mr. Samuel Henshaw, marked "Mass. on rose," and others from the Illi-

nois State Laboratory of Natural History from grape (10819). Specimens sent me from the U. S. National Museum were labeled as follows: "Ft. Collins, Colo., Sep. 4th, on apple, J. Cassidy." "Burlington, Vt., on apple." "Iowa, Gillette." I have specimens from Corfield, Vancouver Island, taken on rose by Mr. Clermont Livingstone, where they are evidently abundant.

I have taken the species in this State at Denver and Fort Collins on apple, at Manitou on oak, and at Fort Collins on cottonwood.

TYPHLOCYBA CENTRALIS Berg.

Typhlocyba centralis BERG, Add. et Emend. ad Hémip. Argent., p. 175, 1884.

According to Berg, the species is described as follows:

♂ ♀: et Dilute flavidi, straminei vel late luridi, vertice pronotoque anterieus interdum punctis duobus fusciscentibus obsolete ornatis; pectore dorsaque abdominis adpartem infuscatis.—Long. corp. 1.5-1.8, cum tegm. 2.5-3; lat. 0.5-0.6 mm.

Vertex obtusissimus, marginibus antico et postico parallelis. Frons sat convexa. Clypeus longus, basin versus nonnihil ampliatus. Ocelli distincti. Pronotum vertice triplo longius, antice admodum productum, postice subrectum, utrimque ante medium fortiter impressum. Scutellum prope basin vel medio impressum, fere bipunctatum. Tegmina hyalina, areolis apicalibus quattuor instructa. Venter flavus; maris segmento ultimo quam pænultimo æquilongo, truncato; femina paullo brevior, medio triangulariter exciso. Pedes flavidi.

Patria: Chaco.

This is a species I have not seen and could not place it with certainty in the synoptic table. The full description is given above.



REVISION OF THE DEEP-WATER MOLLUSCA OF THE
ATLANTIC COAST OF NORTH AMERICA, WITH DE-
SCRIPTIONS OF NEW GENERA AND SPECIES.

PART I.—BIVALVIA.

By ADDISON E. VERRILL,
Professor of Zoölogy in Yale University
and
KATHARINE J. BUSH,
Assistant in Peabody Museum of Yale University.

THIS article is not intended as a review of all the known species found off our coasts. It is preliminary to a much more extensive report, in which full details of the distribution of all the species collected will be given, and for which the detailed tables have been prepared, giving every station for each species, with its position, depth, temperature, character of the bottom, etc.

Many of the larger and more prominent species were described and figured by the senior author several years ago in various papers published in the Transactions of the Connecticut Academy and elsewhere. The smaller and more difficult species were put aside at that time, for more careful study, and are now presented.

The families that are most fully treated in this article are the Lediidæ, Cuspidaridæ, Diplodontidæ, and Pectinidæ. These include a very large number of deep-sea species in every region, and their species are often very difficult to distinguish without long and patient microscopic study and direct comparison of large series of specimens from various localities.

The present article is intended to give some of the results of studies of this kind, made during several years, of the large series of specimens dredged by the United States Fish Commission off our coasts from 1871 to 1887, together with those previously dredged by the senior author in the same region.

In order to avoid, so far as possible, the uncertainty necessarily connected with mere descriptions of these forms, we have had large camera-lucida figures made, as carefully as possible, not only of the new species, but also of some of those previously described from our coast, for comparison. It is, therefore, to be hoped that future investigators may at least be able to understand the characters of the species now recognized by us, whether they agree with our determinations or not.

Although the collections studied are unusually extensive, and the number of stations represented is very large, it is noteworthy that a considerable number of species were met with but once, and sometimes only a single specimen was obtained. This indicates that many additional species of such small deep-sea shells would be discovered in the same region if additional dredgings should be made.

Our investigations have enabled us to add to the fauna nine genera, four subgenera, and about eighty species and varieties, of which about seventy are described as new species and seven as new varieties; of these, twelve species and one variety belong to the southern fauna.

The following list shows the genera in which the new species and varieties are included.¹ The new genera are printed in *italic*:

<i>Martesiella</i> , 1.	Poromya, var. 1.	Bathyarca, 2.
Abra, var. 1.	Cetoconcha, 2.	<i>Bentharca</i> .
Macoma, 1	Cetomya, 1.	Limopsis, 2.
Montacuta, 4, var. 2.	Lyonsiella, 2.	Solemya, 1.
<i>Kelliopsis</i> .	Lyonsia, 1.	Nucula, 1, var. 1.
Cryptodon, 4, var. 1.	Clidiophora, 1.	Leda, 1.
<i>Axinulus</i> , 6.	Kennerlia, 1.	Ledella, 1, var. 1.
Axinopsis, 1, var. 1.	Periploma, 1.	<i>Adranella</i> , 1.
<i>Axinodon</i> , 1.	Limatula, 3.	Microyoldia.
<i>Leptaxinus</i> , 1.	Chlamys, 2.	Yoldiella, 11, var. 1.
Cuspidaria, 8.	Hyalopecten, 1.	Malletia, 2.
Cardiomya, 2.	Camptonectes, 1.	Neilonella, 1.
Halonympha, 1.	Cyclopecten, 2.	Tindaria, 3.
Myonera, 3.		

No attempt has been made to give the complete synonymy and details of the distribution. Such matters have been reserved for the final report on the collections.

Unless otherwise stated, the station numbers are those of the United States Fish Commission and the serial numbers are those of the United States National Museum.

The drawings, with few exceptions, were made by Mr. Alpheus H. Verrill, under the immediate supervision of the authors.

Peabody Museum of Yale University, New Haven, Connecticut, January 25, 1897.

¹Owing to the long delay in the publication of this article, some of the new species and genera have been published elsewhere, so that these numbers are not now strictly correct.

Family PHOLADIDÆ.

MARTESIELLA, new subgenus.

This subgeneric name is proposed for the following species, which differs from *Martesia* in having a well-defined, elongated, median, dorsal plate, posterior to the umbos, in addition to the shield-shaped one over them.

MARTESIA (MARTESIELLA) FRAGILIS, new species.

(Plate LXXIX, fig. 10.)

Shell small, white, thin, fragile, wedge-shaped. The anterior end is very short and broadly rounded, the aperture nearly closed in our largest specimen by a pair of callous plates. The antero-dorsal margin is recurved toward the umbos, but not appressed, and forms a deep, spiral, open cavity. The valves have a very obtuse anterior emargination. A broad and moderately deep sulcus runs from the beak to the ventral margin; in front of this the surface is covered by thin concentric ribs, which curve downward at the sulcus and form a distinct angle in line with the anterior emargination and corresponding with a slight ridge on the surface; these concentric ribs are crossed by fine radiating lines, which produce fine serrations on their edges. Posterior to the sulcus the surface is marked only by irregular lines of growth, which, near it, take the form of more distinct grooves or ridges. The posterior end is prolonged, compressed, and bluntly rounded. The umbonal plate is thick, relatively large, and usually heart-shaped, with the posterior end broader and distinctly emarginate in the middle; the anterior end tapers somewhat and is blunt and angulated, or sometimes subacute. The posterior dorsal plate is long, narrow, and somewhat spatulate or clavate, and stands well in relief above the dorsal margin, with the edges free and the narrow anterior end running under the posterior end of the umbonal plate.

Length of one of the largest specimens, 7 mm.; height, 4.5 mm.; thickness, 4 mm.

Young specimens 3 or 4 mm. in length are relatively shorter and thicker than the larger ones, but even these have the anterior callous pretty well developed; the umbonal plate is usually shield-shaped, the lateral borders emarginate, in contact with the most prominent part of the umbos; the posterior border is distinctly emarginate, and the anterior end has a central point or mucro, sometimes defined by slightly concave posterior edges.

Many live specimens were found in a piece of wood floating near station 2566, N. lat. 37° 23', W. long. 68° 8', 1885.

Family SEMELIDÆ.

ABRA LONGICALLIS (Scacchi), variety **AMERICANA**, new.

(Plate LXXXIII, figs. 6, 7.)

Abra longicallis VERRILL, Trans. Conn. Acad., VI, pp. 224, 278, 1884.

Our specimens differ from the European form described and figured by G. O. Sars¹ in having the posterior lateral tooth less remote and the cartilage-pit or chondrophore longer, the antero-dorsal margin more convex, and the whole shell relatively broader.

A very few specimens were obtained at six stations between N. lat. 39° 49', W. long. 68° 28' 30'', and N. lat. 36° 16' 30'', W. long. 68° 21', in 924 to 2,620 fathoms, 1883-1886.

Family TELLINIDÆ.

MACOMA INFLATA Dawson.

(Plates LXXVII, fig. 1; LXXXVIII, fig. 6.)

Macoma inflata (STIMPSON MSS.) DAWSON, Canadian Naturalist, VI, p. 377, 1872.—VERRILL, Trans. Conn. Acad., V, p. 568, 1882.

A number of live specimens and separate valves were obtained at six stations between N. lat. 47° 40', W. long. 47° 35' 30'', and N. lat. 40° 3', W. long. 70° 31', in 57 to 206 fathoms, 1877-1886. Murray Bay.—Dawson. Gulf of St. Lawrence.—Coll. Whiteaves.

Family PETRICOLIDÆ.

CHORISTODON ? CANCELLATUS Verrill.

(Plate XCVI, figs. 2, 3.)

Choristodon ? cancellatus VERRILL, Trans. Conn. Acad., VI, p. 435, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 58, 1889.

One valve, station 2265, off Chesapeake Bay, in 70 fathoms, 1884.

Family KELLIELLIDÆ.

KELLIELLA NITIDA Verrill.

(Plates XCI, fig. 8; XCIH, fig. 10.)

Kelliella sp. VERRILL, Trans. Conn. Acad., VI, p. 279, 1884; Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.

Kelliella nitida VERRILL, Trans. Conn. Acad., VI, p. 438, 1885.

Comparatively few specimens, at seven stations between N. lat. 39° 5' 30'', W. long. 70° 44' 30'', and N. lat. 38° 20', W. long. 70° 8' 30'', in 1,525 to 2,033 fathoms, 1883-1886.

¹ Mollusca Reg. Arcticæ Norvegiæ, p. 74, pl. 6, figs. 3 a-c; pl. 20, fig. 4, 1878.

Family LEPTONIDÆ or ERYCINIDÆ.

KELLIA SUBORBICULARIS (Montagu).

(Plate XCIV, figs. 3, 4.)

Kellia suborbicularis H. and A. ADAMS, Genera Recent Moll., II, p. 475; III, pl. CXIV, figs. 8 a-c, 1858.—JEFFREYS, British Conchology, II, p. 225, pl. v, fig. 3, 1863; V, p. 179, pl. XXXII, fig. 2, 1869.—GOULD, Rep. on Invert. of Mass., Binney's ed., p. 83, fig. 394, 1870.—TRYON, Amer. Mar. Conch., p. 171, pl. 32, figs. 433, 435, 1873.—G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 67, pl. 19, figs. 14 a-b, 1878.—JEFFREYS, Proc. Zoöl. Soc., London, p. 700, June, 1881.—SMITH, E. A., Report Voy. Challenger, Zoöl. Lamellibranchiata, XIII, p. 201, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 200, pl. LXVIII, fig. 5, 1889.

One fresh specimen, Massachusetts Bay, off Salem, 1877. This species appears to be very rare on the American coast. In its hinge-characters it seems to agree closely with *Bornia Philippi*, 1836.

MONTACUTA BIDENTATA (Montagu).

(Plates XCIII, figs. 7, 8; XCIV, fig. 6.)

Mya bidentata MONTAGU, Test. Brit., p. 44, pl. XXVI, fig. 5, 1803.

Montacuta bidentata FORBES and HANLEY, Hist. Brit. Moll., II, p. 75, pl. XVIII, figs. 6, 6a.

Tellimya bidentata H. and A. ADAMS, Genera Recent Moll., II, p. 478; III, pl. CNV, figs. 2, 2a, 1858.

Montacuta bidentata JEFFREYS, British Conchology, II, p. 208, pl. v, fig. 1, 1863; V, p. 177, pl. XXXI, fig. 8, 1869.—G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 69, pl. 19, figs. 17a-b, 1878.—JEFFREYS, Proc. Zoöl. Soc., London, p. 698, June, 1881.—VERRILL, Trans. Conn. Acad., V, p. 571, 1882.—BUSII, Trans. Conn. Acad., VI, p. 479, 1885; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 590, 1885 Not *Montacuta bidentata* Gould.

Comparatively few specimens have been found in Long Island Sound and at Thimble Island (A. E. Verrill); Provincetown, Massachusetts (S. I. Smith and O. Harger); Vineyard Sound, 1875; Cape Cod Bay, 1879; off Block Island, 1880; Woods Hole, Massachusetts (Gut of Canso, and Naushon Gutters), 1882-83. From low-water to 15½ fathoms. Off Cape Hatteras, North Carolina, in 14 to 48 fathoms, 1883 and 1884.

MONTACUTA BIDENTATA (Montagu), variety TENUIS, new.

(Plate XCII, fig. 7.)

Shell similar to the typical *M. bidentata* in form and size, but relatively more elongated and more nearly elliptical, with the umbos and beaks somewhat less prominent. The surface is covered with fine and pretty regular lines of growth. The teeth in the right valve are strong, nearly equal in length and in the amount of divergence from the dorsal margin. They diverge more strongly and are thicker and more prominent, especially at the inner end, than is usual in the true *bidentata*.

Length of a medium size specimen 4.7 mm.; height, 2.6 mm.

A few separate valves, off Cape Hatteras, North Carolina, in 16 to 17 fathoms, 1884.

MONTACUTA BIDENTATA (Montagu), variety FRAGILIS, new.

(Plate XCII, fig. 8.)

Shell subelliptical, inequilateral, both ends broadly rounded, thin, fragile, covered with delicate lines of growth. The umbos are flattened; beaks but slightly prominent. The teeth in the right valve are smaller and more delicate than in the typical *bidentata*, and diverge but slightly from the dorsal margin, as in that species.

Length, 4 mm.; height, 3 mm.

One specimen (No. 46134), station 816-17, in Narragansett Bay, in 8½ to 10 fathoms, 1880.

MONTACUTA STRIATULA, new species.

(Plate XCIII, fig. 9.)

Shell rather large, thin and somewhat hyaline, compressed, broad-elliptical with both ends well rounded, the anterior much the longer. Antero-dorsal margin nearly straight with a gradual slope; anterior end broadly and regularly rounded, its outline forming nearly the segment of a circle; ventral margin broadly and evenly convex; posterior end bluntly rounded with its dorsal margin slightly concave and sloping rapidly. Umbos not swollen; beaks acute and only a little prominent. Surface covered with fine, regular, concentric, microscopic striae and more distant lines of growth. Interior somewhat shining with inconspicuous muscular scars. Hinge-margin thin, delicate, only slightly thickened. In the right valve there is, on each side of the beaks, a short, rather delicate, elevated, triangular tooth, terminating distally with an abrupt slope; these are nearly equal in size and length, the anterior one being slightly the shorter and more angular. They are separated by a V-shaped notch, the sides of which form nearly a right angle. In the left valve there are two thin, slightly prominent elevations, scarcely worthy the name of teeth, separated by a very wide angle under the beak.

Length of one of the largest specimens, 7 mm.; height, 6 mm.

This species is much larger than any of our other species of this genus, and may possibly prove to be identical with *M. bowmani*, described and figured by Holmes.¹ Owing, however, to the shortness of the description and small size of the figures, this question cannot be definitely decided without a careful comparison with authentic specimens.

A few separate valves were found off Cape Hatteras, North Carolina, in 15 to 48 fathoms, 1883-84.

¹ Post-pleiocene fossils of South Carolina, p. 30, pl. VII, fig. 2, 1860.

MONTACUTA OVATA Jeffreys.

(Plate XCII, figs. 9, 10.)

Tellinya ferruginosa VERRILL, Notice of Recent Add. to Mar. Invert., Pt. 3, Proc. U. S. Nat. Mus., III, p. 400, 1880.

Montacuta ovata JEFFREYS, Proc. Zoöl. Soc., London, p. 698, pl. LXI, fig. 4, June, 1881.—VERRILL, Trans. Conn. Acad., V, p. 571, 1882; VI, p. 279, 1884.

A very few specimens, at four stations, off Newport, Rhode Island, and off Marthas Vineyard, in 100 to 157 fathoms, 1880-81.

MONTACUTA TUMIDULA Jeffreys.

(Plates XCIII, fig. 6; XCIV, figs. 1, 2.)

Montacuta tumidula JEFFREYS, British Conchology, V, p. 177, pl. c, fig. 5, 1869.—G. O. SARS, Mollusca Reg. Arcticae Norvegiæ, p. 69, pl. 19, figs. 18 a-b, 1878.—VERRILL, Trans. Conn. Acad., VI, pp. 225, 279, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 575, 1885.

One live specimen and three valves, at three stations between N. lat. $40^{\circ} 7'$, W. long. $67^{\circ} 54'$, and N. lat. $35^{\circ} 49' 30''$, W. long. $74^{\circ} 34' 45''$, in 843 to 1,091 fathoms, 1883-1886.

MONTACUTA CASTA, new species.

(Plate XCIV, fig. 5.)

Shell small, compressed, oblong-ovate, with the anterior end considerably the longer and both ends about equally rounded. Beaks small, scarcely rising above the margin. Surface covered with fine, regular, microscopic, concentric striæ and distant, raised lines of growth. The antero-dorsal margin is at first a little incurved, then slightly convex, with a gradual slope; the anterior end is obtusely rounded; the ventral margin is broadly and evenly rounded; the posterior end is slightly produced and a little angulated below, in some specimens with the dorsal margin sloping more rapidly than the anterior and slightly incurved near the beaks. The hinge-margin is thin and delicate. In the right valve there are two moderately thick, rather prominent teeth; the one behind the beak is shorter than the other, with a more abrupt posterior slope; they are separated from the slightly thickened margin by a deep groove and from each other by a large notch or angle, the sides of which form an angle of about 90° . On the thickened margin there is a thin, rough, shallow ligamentary furrow both in front of and behind the beaks. In the left valve there is an elongated, thin, and not very prominent, tooth-like elevation on each side of the beak; they are nearly equal in size and separated by a very broad angle.

Length of the largest specimen, about 2.4 mm.; height, about 1.8 mm.

A few separate valves, off Cape Hatteras, North Carolina, in 14 to 17 fathoms, 1884.

MONTACUTA CUNEATA, new species.

(Plates XCI, fig. 4; XCIII, fig. 5.)

Shell small, elongated, wedge-shaped, with a much produced, narrow anterior end, and with the dorsal margins nearly straight, sloping rapidly, and forming an obtuse angle at the beaks, which are decidedly behind the middle, prominent, curved inward. Antero-dorsal margin sloping rapidly, at first nearly straight, becoming a little convex, and curving regularly into the ventral margin, thus forming a somewhat rostrated, narrow, evenly rounded anterior end; ventral margin nearly straight, sometimes with a slight incurvature opposite the beaks; posterior end bluntly rounded, with its dorsal margin nearly straight, sloping about equally with the anterior. The surface is covered with fine, concentric, rather regular lines of growth and microscopic striations. Interior somewhat shining. In the right valve there are two well-defined, prominent, thickened teeth, separated by a large, deep notch under the beak; the anterior one is the larger and is broadly triangular, with a prominent excurved tip, and is separated from the hinge-margin by a deep furrow, which runs obliquely within and below the thickened dorsal margin; the posterior one is set obliquely to the margin, from which it is separated by a well-defined groove. In the left valve there is a wide notch beneath the beak, with a rather inconspicuous, elongated, somewhat thickened anterior tooth-like projection, which continues forward as a thickened inner margin nearly to the end, and a shorter, broad, triangular posterior projection. Color cream-white, sometimes tinged with pink.

Length of the largest specimen, about 3 mm.; height, 1.5 mm.

A few specimens were found off Cape Hatteras, North Carolina, in 15 and 16 fathoms, 1883-84.

MONTACUTA TRIQUETRA, new species.

(Plate XCI, fig. 3.)

Shell small, covered with regular concentric grooves, scarcely compressed, somewhat triangular, with a slightly rostrated, angular posterior end, and a regularly rounded anterior one. Umbos a little swollen, beaks nearly central, pointed and a little prominent. The anterior and posterior dorsal margins form nearly a right angle; the anterior margin is slightly convex and passes gradually into the somewhat bluntly rounded anterior end; ventral margin broadly convex, becoming slightly incurved toward the posterior rostration, which is wedge-shaped, rapidly tapered, with a narrow truncate tip, defined below by a faint, radiating ridge; postero-dorsal margin is nearly straight, and slopes rapidly from the beaks. The surface is sculptured with strongly marked, smooth, rounded, concentric ridges having the upper edge smooth and recurved; these are separated by deep, regular grooves

which appear in some places to extend beneath the upper edge of the ridges; on the umbos and posterior rostrum these ridges and grooves become feeble and irregular, like lines of growth. Internally the surface is white and smooth, with the muscular scars rather strongly marked.

The hinge-margin is rather thick; in the right valve there are two strong, prominent, curved, cardinal teeth, separated by a large, somewhat oblique notch which extends upward into the beak; the posterior tooth is the narrower and more prominent, with the tip curved forward and upward; the anterior tooth is connected, just in front of the beak, by a bridge-like extension to the external margin, leaving between the tooth and the margin a deep submarginal groove; the inner edge of the hinge-margin is a little thickened to form a ridge continuous with the anterior tooth. In the left valve there is a distinct notch under the beak for the cartilage or resilium; in front of this is a prominent, tooth-like thickening of the margin of the shell, the proximal end of which becomes tooth-like, but is continuous with the rest of the hinge-margin; behind the notch there is no tooth and the margin is only a little thickened, without any special prominence.

Length, about 2 mm.; height, 1.4 mm.

Two valves, station 2307, off Cape Hatteras, North Carolina, in 43 fathoms, 1884.

TELLIMYA FERRUGINOSA (Montagu).

(Plate XC, figs. 7, 8.)

Tellimya ferruginosa H. and A. ADAMS, Genera Recent Moll., II, p. 479, 1858.

Montacuta ferruginosa JEFFREYS, British Conchology, II, p. 210, 1863; V, p. 178, pl. XXXI, fig. 9, 1869.

Tellimya ferruginosa G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 70, pl. 20, figs. 1, a-c, 1878.—VERRILL, Trans. Conn. Acad., VI, 225, pl. XXX, fig. 13, 1884.

Montacuta ferruginosa FISCHER, Manuel de Conchyliologie, p. 1027, fig. 775, 1887.

Tellimya ferruginosa DALL, Bull. U. S. Nat. Mus., No. 37, p. 50, pl. XLV, fig. 13, 1889.

A few specimens were found at low-water at Woods Hole, Massachusetts (Gut of Canso), and Gutters of Naushon Island, 1882-83. The figure of the living animal published by Verrill in 1884 has been copied by Dall, Fischer, and others. We now give additional ones.

KELLIOPSIS, new genus.

Type.—*Montacuta elevata* Stimpson.

The shell, in size and form, resembles *Kellia* and *Montacuta*. In both valves there is a small, prominent, anterior tooth and a low, elongated, thickened posterior ridge, scarcely amounting to a tooth. The resilium is large and is attached to an elongated, oblique excavation on the proximal edge of the posterior tooth-like ridge, and also to a triangular pit beneath the beak; it bears a large, elongated, curved ossicle. Soft parts not observed.

This genus appears to be closely allied to *Montacuta*, but differs in not having a definite, raised, posterior tooth; in having a large, elongated posterior cartilage, bearing a large ossicle attached to a special groove along a tooth-like ridge; and in having the structure of the hinge in both valves nearly the same. In the position of the resilium it resembles *Erycina*, but the latter has two large teeth in both valves.

KELLIOPSIS ELEVATA (Stimpson).

(Plates XCIII, figs. 2-4; XCIV, figs. 7, 8.)

Montacuta bidentata GOULD, Rep. on Invert. of Mass., 1st ed., p. 59, 1841. (Not of Montagu.)

Montacuta elevata STIMPSON, Shells of New Eng., p. 16, 1851.

Cyamium elevatum H. and A. ADAMS, Genera Recent Moll., II, p. 477, 1858.

Montacuta elevata GOULD, Rep. on Invert. of Mass., Binney's ed., p. 86, fig. 396, 1870.—TRYON, Amer. Mar. Conch., p. 172, pl. XXXIII, fig. 440, 1873.—VERRILL, Report Invert. Anim. of Vineyard Id., in 1st Rep. U. S. Fish Com., pp. 394, 688, 1874 (auth. cop., p. 418).

Tellimya elevata DALL, Bull. U. S. Nat. Mus., No. 37, p. 50, pl. LXVIII, fig. 6 (as *Montacuta elevata* Stimpson), 1889.

This rare species has been obtained at low-water mark, at Savin Rock, near New Haven, Connecticut (J. E. Todd), 1871; Wellfleet, Massachusetts (Webster), 1879; Woods Hole, Massachusetts (Gut of Canso), 1882; Naushon Island (Gutters and Sheep Pen Cove), 1882; and Narragansett Bay, in 8½ to 10 fathoms, 1880.

Family **DIPLODONTIDÆ**.

Ungulinidæ FISCHER; *Diplodontidæ* + *Cryptodontidæ* Dall.

CRYPTODON Turton, 1822.

Type.—*Cryptodon flexuosus* (Montagu).

The typical species of this genus have no distinct teeth in either valve, but the inner margin of the hinge-plate is more or less thickened or swollen in front of and behind the beaks. The ligament is posterior and lies in a long, curved furrow in the midst of the marginal thickening; where it commences at the beak it is marginal and external, but as it runs backward it recedes from the edge and becomes more or less internal and invisible from the exterior. Moreover, the posterior end of the shell has one or more distinct radial corrugations or plications to give the thin shell strength enough to resist the action of the large posterior adductor muscle which is attached directly upon the principal plication. The pedal muscle is attached to the upper plication when the latter is present. Many writers have adopted the name of *Axinus* Sowerby, 1823, for this genus; the latter name was given to a tertiary species, the structure of which is not fully determined. It may belong to a very distinct genus. Moreover, Turton's name seems to have actual priority of publication.

CRYPTODON GRANDIS Verrill.

- Cryptodon grandis* VERRILL, Trans. Conn. Acad., VI, p. 436, pl. XLIV, fig. 22, 1885; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 575, 1885.—
DALL, Bull. U. S. Nat. Mus., No. 37, p. 50, pl. XLVI, fig. 22, 1889.
Schizotharus grandis (pars) LOCARD, Campagne du "*Caudan*," Annales de l'Université de Lyon, p. 180, 1896.

This large and interesting species, described in detail and well figured in the first article quoted above, is a true *Cryptodon*, although very distinct from any of our other species. Therefore it seems strange that M. Locard has referred it to the very different genus, *Schizotharus* of Conrad, which belongs to the Maetridæ. He identifies without question a single valve, dredged by the *Caudan* off the coast of France, in 1,710 meters, as our species. It is, therefore, doubtful whether his specimen is congeneric with ours, for the latter certainly has no affinity with *Schizotharus*.

One live specimen and a few separate valves were dredged at three stations between N. lat. 38° 29', W. long. 73° 9', and N. lat. 35° 9' 50'', W. long. 74° 57' 40'', in 938 to 1,582 fathoms, 1883-84.

CRYPTODON INSIGNIS, new species.

(Plate XCI, figs. 1, 2.)

- Cryptodon sarsii* VERRILL, Proc. U. S. Nat. Mus., III, p. 399, 1880; Trans. Conn. Acad., V, p. 570, 1882.

Shell unusually large and thick for the genus, opaque white or tinged faintly with reddish internally. Outline somewhat variable, usually broad-ovate or subquadrate, usually moderately swollen, sometimes rather compressed. Umbos moderately large, not very prominent; beaks small and turned forward. Lunule cordate, rather large, pretty well defined. The radial folds and lobes are less marked than is usual in this genus. A well-marked fold or shallow undulation extends from the beak to the posterior margin, opposite the scar of the adductor muscle; anterior to this there is a broad, slightly raised ridge, extending from the umbo to the siphonal lobe of the margin; in front of this there is usually a broad faint depression of the surface which is scarcely apparent in many specimens; a posterior groove runs close to and nearly parallel with the postero-dorsal margin. The antero-dorsal margin, in the lunular region, is straight or slightly incurved; the anterior end is short, a little prominent below the lunule, and obtusely rounded; the ventral margin, is very broadly rounded, usually with a slightly more prominent lobe at or just behind the middle, with a more decided but obtuse projection (siphonal lobe) farther back where it joins the posterior margin, which is usually somewhat incurved, corresponding to the external wave-like depression, becoming convex opposite the posterior external fold; the postero-dorsal margin slopes rapidly from the beak and is sometimes broadly rounded, and at others slightly convex. The surface is covered with conspicuous, more or less irregular,
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rounded, obtuse, often prominent lines of growth with a thin yellowish brown epidermis which, under the lens, is closely covered with minute granules often arranged in more or less distinct concentric lines. The posterior hinge-margin is somewhat thickened, the ligamental groove is long and curved, diverging considerably from the margin of the shell at its posterior end and extending forward under the beak. Muscular scars and pallial line in the largest specimens strongly marked; the anterior scar is considerably elongated and has a number of lobes or scallops on its inner margin.

Length of a medium-sized specimen, 27 mm.; height from siphonal lobe to beak, 27 mm.; breadth, 14 mm. Length of a larger, more ovate specimen, 32 mm.; height from siphonal lobe to beak, 35 mm.; breadth, 21 mm.

This species presents considerable variation in outline and in the degree of convexity of the valves; some are subquadrate in form, others subcordate, and others pretty well rounded, but the majority are oblong-obovate with a posterior truncation, corresponding to the broad radial groove; some of the valves are considerably inflated, but most of them are more compressed than is usual in this genus. There is also considerable variation in the prominence of the siphonal lobe and broad radial ridge, and in the size of the lines of growth, which in some specimens are quite fine and regular, and in others unevenly developed, those on the anterior part appearing almost like concentric ribs.

Many separate valves, at four stations between N. lat. $44^{\circ} 54'$, W. long. $59^{\circ} 46' 45''$, and N. lat. $42^{\circ} 19'$, W. long. $69^{\circ} 47\frac{1}{2}'$, in 65 to 471 fathoms, 1879 and 1885.

The single valve found off Cape Cod, 1879, and identified as *Cryptodon sarsii*, proves to be the young of this species.

CRYPTODON PLICATUS Verrill.

(Plate LXXXIX, fig. 6.)

Cryptodon plicatus VERRILL, Trans. Conn. Acad., VI, pp. 437, 450, 1885.

One young live specimen and one imperfect valve of this characteristic and fragile species were found at two stations, off Marthas Vineyard, in 1,073 to 1,122 fathoms, 1884.

CRYPTODON CROULINENSIS (Jeffreys) Smith.

(Plate XC, figs. 3, 4.)

Clausina croulinensis JEFFREYS, Ann. Mag. Nat. Hist., XX, p. 19, 1847.

Axinus croulinensis JEFFREYS, Brit. Con., II, p. 250, 1864.—G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 62, pl. 19, figs. 8, a-b, 1878.—JEFFREYS, Proc. Zoöl. Soc., London, p. 703, June, 1881.

Cryptodon croulinensis SMITH, E. A., Report Voy. Challenger, Zoöl. Lamelli-branchiata, XIII, p. 193, 1885.

Shell small, obliquely subovate, with the beaks prominent, and the anterior end considerably the longer. The antero-dorsal margin is

nearly straight, sloping rapidly from the beak; the anterior end is distinctly produced, evenly rounded; the ventral margin is slightly but regularly convex to the lower posterior fold; the posterior end is marked by two distinct plications separated by a rather prominent ridge which, at the margin, appears as a rounded projection separating two reentrant curves; the postero-dorsal margin is convex, sloping rapidly to the upper plication. The ligamental area is relatively large, long, elliptical, defined by a distinct groove. Internally the hinge-margin is considerably thickened, especially directly under the beak, where there is a slight swelling; the posterior ligament occupies a very distinct groove, and extends forward under the tip of the beak.

Length, 3.5 mm.; height, 3.75 mm.

The shell here referred to this species appears to agree well with the figures and descriptions given by G. O. Sars. It pretty closely resembles some varieties of *C. gouldii*. The principal differences externally are in the somewhat more produced anterior end and the longer and straighter antero-dorsal margin; the posterior plications are also less strongly developed.

Found in small numbers at about thirty stations north of Cape Cod, between N. lat. $43^{\circ} 44\frac{1}{2}'$, W. long. $69^{\circ} 22'$, and N. lat. $42^{\circ} 30'$, W. long. $70^{\circ} 38'$, in 13 to 73 fathoms, 1873-1879.

CRYPTODON CROULINENSIS (Jeffreys) Smith, variety **ALTUS**, new.

(Plate LXXXVIII, figs. 1, 2.)

Shell higher than long, larger than the common form. Umbos prominent, elevated and turned forward, so as to leave a rather large, conspicuous, flattened, lunular area, which is bordered externally by a slight ridge, followed by a concave depression in the surface, which forms a slight indentation in the anterior margin, and resembles the posterior plication, but is more shallow. The antero-dorsal margin in the lunular region is slightly concave, but slopes very rapidly; the anterior end is a little more produced than the posterior, but both are decidedly short; the ventral margin is pretty evenly rounded; posteriorly there are two distinct plications; the lower or larger one is moderately sunken and extends from the beak to the posterior margin, the upper one is much shorter and narrower and defines the narrow, lanceolate, ligamental area; each produces a decided indentation in the margin, that caused by the lower one being more sharply defined and shorter than the other, these are separated by a well-defined, curved, radiating ridge which extends a little below the margin; the postero-dorsal margin is strongly convex, evenly rounded, with a rapid slope; the hinge-margin is considerably thickened, especially beneath the beak, and in the right valve forms a distinctly raised tubercle.

Length, 5 mm.; height, 6 mm. Eastport, Maine, 1870.

Another specimen, from station 292, is slightly smaller. Length,

4.5 mm.; height, 5.25 mm. In this the anterior or upper plication is much less distinct than in the type, and it is therefore possible that this feature is abnormal.

CRYPTODON EQUALIS, new species.

(Plate XCI, figs. 5, 6.)

Shell of moderate size, grayish white, rather swollen, pyriform, usually a little higher than long, but sometimes the height and length are about equal. Umbos rather prominent; beaks median, conspicuously raised above the margin and curved strongly forward so as to produce a rather deep, broad, cordate, but ill-defined lunular area. Anterior and posterior ends nearly equal. The dorsal margin slopes rapidly on both sides of the beak; anteriorly, in the lunular region, it is nearly straight; the anterior end is pretty evenly rounded, forming a continuous curve with the ventral margin, which forms nearly a semicircular curve; the posterior end has one broad, shallow undulation which causes a slight incurvature in the postero-ventral margin; above this the dorsal margin is very slightly convex and forms an angle at the commencement of the fold. The ligamental area is marked by a smooth, long, lanceolate, slightly sunken portion, clearly separated by an incised line. The general surface is covered with slightly marked, more or less irregular lines of growth. The hinge-margin is moderately thickened and is essentially the same in both valves. There is a well marked swelling both before and behind the beak and a more conspicuous one immediately under it; a less conspicuous thickening, with its external edge excurved, extends along the postero-dorsal margin, in the ligamental region. Muscular and pallial scars indistinct.

Length, 5 mm.; height, $5\frac{1}{2}$ mm.; thickness, 4 mm. Some specimens are somewhat larger than this.

In the large series which we have of this species there is some variation. In some cases the form is less swollen, the length is slightly in excess of the height, so that the general outline is more evenly rounded. The species is, however, notable for the equality of the anterior and posterior ends and the presence of the single slight undulation. *Cryptodon gouldii* somewhat resembles this species, but differs in being longer in proportion to its height, in its more compressed form, and in having two distinct folds or undulations. It is also closely allied to *C. flexuosus* of Europe, but is more pyriform in shape and lacks the anterior angulation noticeable in that species.

Taken at thirty-two stations, between N. lat. $47^{\circ} 40'$, W. long. $47^{\circ} 35' 30''$, and N. lat. $37^{\circ} 08'$, W. long. $74^{\circ} 33'$, in 94 to 1,537 fathoms, 1873-1886.

CRYPTODON PLANUS, new species.

(Plate LXXXVIII, figs. 3, 4.)

Shell small, well-rounded, the length and height about equal, with the beak small, prominent, nearly central, curved strongly forward,

forming a small, sunken, heart-shaped, lunular area. Posteriorly there is only a faint, depressed undulation, which causes but a slight indentation or angulation in the margin; behind this the surface rises slightly and forms an inconspicuous ridge surrounding the ligamental area, which is long, rather narrow, and sunken, so that its margin is scarcely visible in a side view. The dorsal margin is a little convex and slopes but little, and about equally on both sides of the beak; the anterior end is well-rounded and slightly produced; the ventral margin is broadly rounded, a little produced in the middle, and nearly straight or very slightly incurved posteriorly, opposite the undulation; behind this there is a slight obtuse angulation corresponding to the ridge below the ligamental area. Surface dull grayish white. The hinge-margin is considerably thickened, especially below the beaks and lunular area, and a thickened ridge also extends backward beyond the ligamental area. There is no distinct tubercle nor tooth-like projection. The posterior ligament is unusually strong, and occupies a rather conspicuous submarginal groove which runs forward under the beak as a thin incised line.

Length, 4 mm.; height, the same.

Found in 8 to 100 fathoms, north of Cape Cod, in the Gulf of Maine, Casco Bay, Bay of Fundy, and Halifax Harbor, 1872-1885.

CRYPTODON OBSOLETUS, new species.

(Plate LXXXIX, figs. 1, 2.)

Shell small, higher than long, with the ends and ventral margin rounded. Umbos somewhat prominent and swollen; beaks curved strongly forward. Posterior plication obsolete, or nearly so, only visible in certain positions, and imperfectly defined by a faint undulation of the surface and margin. The antero-dorsal margin is slightly convex in the lunular area, and slopes rapidly to the broadly rounded anterior margin with which it forms a very slight and very obtuse angle; the whole ventral margin is well-rounded, a little produced in the middle; the postero-dorsal margin is broadly convex and ends distally in a very obtuse, rounded angle, above which there is a slight inbending of the edge. The hinge-plate is rather thick, especially posteriorly. The ligament is rather strong and considerably curved and occupies a narrow, but very distinct groove, mostly within the margin posteriorly, and extends forward under and in front of the beaks. The anterior hinge-margin is thickened and a little flexuous toward the anterior angle of the shell; the proximal end, just under the beak, is slightly thickened without forming any apparent tooth. Under the microscope, the surface is covered with rather coarse, irregular, concentric undulations, and fine, raised lines of growth, becoming smoother at each end, where there are patches of a closely adherent coating of red mud and iron oxide.

Length, 2.4 mm.; height, 2.6 mm.

Four specimens, at three stations, off Marthas Vineyard, in 100 to 390 fathoms, 1880-1885.

AXINULUS, new subgenus or genus

Type.—*Axinulus brevis*, new species.

We propose this division to include those species which agree with *Cryptodon* in the character of the hinge and ligament, but lack the plications of the shell, and have, therefore, a smaller posterior adductor muscle.

CRYPTODON (AXINULUS) BREVIS, new species

(Plate LXXXIX, figs. 7, 8.)

Shell small, short, the height exceeding the length, somewhat pyriform, with slightly prominent umbos and small subcentral beaks, which are but little prominent and turn forward. The antero- and postero-dorsal margins are about equal in length, the latter slightly more broadly rounded than the former, which is a little incurved near the beak so as to form a very slight lunular area; both ends are broadly rounded and nearly equal; the ventral margin is slightly convex and a little produced just in front of the middle; an exceedingly faint, scarcely discernible undulation runs from the beak to the posterior ventral margin. The surface is covered with very fine, close, parallel lines of growth visible only when much magnified. Grains of fine ferruginous sand or mud usually adhere closely to the surface, both anteriorly and posteriorly. The posterior ligament is well-developed and occupies a well-marked marginal groove; a small, thickened, more internal portion, situated just behind the beak, within the margin, appears to be continuous with the external ligament. The inner edge of the dorsal margin is slightly thickened, for a short distance, just in front of the beak.

Length, $2\frac{3}{8}$ mm.; height, 2.5 mm.

Several live specimens and separate valves were found at six stations, between N. lat. $40^{\circ} 16' 50''$, W. long. $67^{\circ} 5' 15''$, and N. lat. $38^{\circ} 22'$, W. long. $70^{\circ} 17' 30''$, in 984 to 1,825 fathoms, 1883-1886.

At station 2208 was found a single imperfect valve closely resembling this species but of much larger size.

Length, 5.5 mm.; height, 6.5 mm.

It is, however, much less regular in outline, having a nearly straight, rapidly sloping antero-dorsal margin, merging very abruptly into the broadly and very slightly curved and sloping anterior margin, forming a somewhat angular and little produced anterior end; ventral margin strongly convex, curving gradually into the posterior margin which slopes rapidly from the beak; postero-dorsal margin is convex but rises only a little above the outline of the distinct ridge which borders the ligamental area.

CRYPTODON (AXINULUS) INEQUALIS, new species.

(Plate XC, figs. 1, 2.)

Shell small, somewhat oblong, with the anterior end much the longer. Umbos rather prominent, beaks elevated, curved strongly forward, so as to leave a small, deep lunular area. The antero-dorsal margin is at first nearly straight, sloping but little, and is nearly parallel with the ventral margin; the anterior end is produced, broadly and evenly rounded; the ventral margin is much less rounded, with the middle portion almost straight for a short distance, toward the posterior end it is subtruncate and slightly angulated; the postero-dorsal margin is convex and slopes rapidly; a very slight depression runs from the beak to the postero-ventral margin, but is so slight as to be scarcely worthy the name of plication or fold; posterior to this there is a distinct submarginal ridge separated by a rather deep groove, from the ligamental area, which is long and narrow. The surface appears to the naked eye nearly smooth, bluish white; under the microscope it is marked by slight, raised, concentric ridges and faint undulations, which are the most regular and distinct on the umbos. In addition to these the whole surface, when highly magnified, has a fine fibrous appearance; on some parts there are remnants of a thin, pale yellowish epidermis. The hinge-margin is distinctly thickened, with a slight protuberance directly under the beak, where it is thicker than elsewhere. The posterior ligament is rather large and strong, and occupies a conspicuous groove extending from under the beak about one-third the length of the postero-dorsal margin.

Length, 4.5 mm.; height, 4.25 mm.; thickness, about 4 mm.

A few specimens have been found in 14 to 49 fathoms, at about eleven stations north of Cape Cod, in Casco Bay, and in Halifax Harbor, 1873-1879.

CRYPTODON (AXINULUS) SIMPLEX, new species.

(Plate XCII, figs. 3, 4.)

Shell small, thin, fragile, translucent bluish white, somewhat inflated, nearly circular in outline and without any posterior undulations. Beaks small, acute, slightly prominent, turned forward. Antero-dorsal margin excavated in front of the beaks and convex farther forward; anterior margin broadly and evenly rounded and, with the ventral margin, forms nearly a circular curve; the posterior margin similarly rounded, but slightly flattened in the middle; postero-dorsal margin broadly convex without any distinct angulation posteriorly. The surface is nearly smooth and somewhat glossy on the umbos; it is marked by rather indistinct, small, concentric waves or undulations and microscopic lines of growth. Interior somewhat shining. The hinge-margin is thin, delicate, and very simple, with but a very slight thickening in the region of the beak; a narrow groove for the ligament is visible just

before and behind the beaks, but there is no tooth-like prominence at any point.

Length, about 3.1 mm.; height, about 3 mm.

One imperfect specimen, station 1093, N. lat. $39^{\circ} 56'$, W. long. $69^{\circ} 45'$, in 349 fathoms, 1882.

This species is remarkable for the plainness of its surface, and the simplicity of its hinge, as it has neither radial undulations nor tooth-like projections on the hinge-margin. In form it greatly resembles *Axinopsis orbiculata*, but lacks the conspicuous concavity in the antero-dorsal margin. It has, however, a very obvious posterior ligamental furrow in the same relative position as that of other species of *Cryptodon*.

A single valve taken at Eastport, Maine, 1872, agrees closely with the type in form, but is somewhat less thin and hyaline and the beaks are a trifle more prominent. The surface has faint and rather distant concentric undulations, visible only under the microscope, being most distinct on the umbo. The microscopic striations are a little more distinct and in some lights give to the surface a fibrous or finely vermiculate appearance when highly magnified. This character, however, has been noticed in other species. The hinge-margin is a little more thickened and has a minute swelling on the inner margin just beneath the beak, scarcely worthy the name of tooth; the ligamental groove is also somewhat more strongly marked. This may prove to be a distinct species more nearly related to *Axinopsis orbiculata* from which it differs in having the antero-dorsal margin convex instead of strongly concave, and the general outline more evenly rounded, and a less evident tooth-like thickening of the hinge-margin.

Length, about 2.8 mm.; height, about 2.6 mm.

CRYPTODON (AXINULUS) PYGMÆUS, new species.

(Plate LXXXVI, figs. 3, 4.)

Shell minute, somewhat compressed, transversely ovate, inequilateral, with the anterior end the longer, and with a slightly produced posterior angulation. Surface scarcely lustrous, covered with fine lines of growth and microscopic striations, and more or less incrustated with ferruginous mud, especially posteriorly; there is barely a trace of a posterior fold. Umbos a little prominent, beaks small, slightly raised above the margin, and turned a little forward. The antero-dorsal margin is nearly straight, or sometimes slightly convex, with a slightly excavated, small, lunular area; the anterior end is broad, considerably produced, and evenly rounded; the ventral margin is broadly rounded, not at all produced, and joins the posterior margin in a small obtuse angulation, above which the dorsal margin is slightly convex and slopes rapidly from the beaks.

The inner surface is smooth with inconspicuous muscular scars.

The hinge-margin in the right valve is slightly thickened with a distinct, tooth-like prominence below and slightly in front of the center of the beak, and an inner fold-like thickening of the posterior margin to support the ligament; in front of the lunular area the margin is convex and slightly everted.

Length, about 1.6 mm.; height, about 1.4 mm.

A few live specimens were found at three stations between N. lat. $47^{\circ} 40'$, W. long. $47^{\circ} 35' 30''$, and N. lat. $39^{\circ} 54' 30''$, W. long. $70^{\circ} 20'$, in 206 to 499 fathoms, 1883-1886.

This species is allied to *C. ferruginosus* (Forbes), from which it differs in its distinctly produced and angulated posterior end, and longer or more produced, evenly rounded anterior end. It also has considerable resemblance in form to *C. tortuosus* Jeffreys, but that has a very lustrous surface and more vitreous texture, and moreover entirely lacks the posterior angulation.

C. suboratus of Jeffreys, seems to resemble rather closely the small specimens of this species, but that has more prominent beaks, is wedge-shaped, the antero-dorsal margin sloping pretty rapidly from the beak, instead of being nearly straight and horizontal as in our species.

CRYPTODON (AXINULUS) FERRUGINOSUS (Forbes).

(Plate LXXXVII, figs. 7, 8.)

Cryptodon ferruginosus VERRILL, Trans. Conn. Acad., V, p. 570, 1882; VI, p. 279, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 575, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 50, 1889.

Axinus ferruginosus LOCARD, Campagne du *Caudan*, Annales de l'Université de Lyon, p. 191, 1896.

This very common species was found at numerous stations from N. lat. $42^{\circ} 47'$, W. long. $61^{\circ} 04'$, to N. lat. $35^{\circ} 12' 10''$, W. long. $74^{\circ} 57' 15''$, in $125\frac{1}{2}$ to 1,525 fathoms, 1880-1886.

CRYPTODON (AXINULUS) OVATUS, new species.

(Plates XCI, fig. 7; XCIII, fig. 1.)

Shell small, ovate, not swollen, with the posterior end produced and somewhat pointed, rusty brown in color and heavily incrustated with iron oxide. Umbos rather flattened; beaks small and concealed by the coating of ferruginous matter. The anterior end is well-rounded with a nearly semicircular curve; the ventral margin is broadly convex; the posterior margin is tapered and produced at the end, with the dorsal margin a little convex and sloping rapidly. The hinge-margin is a little thickened and much obscured by the incrustation. In the left valve there is a rather prominent, blunt, tooth-like swelling below the lunular area; in the right valve there is a corresponding notch and a rather wide ligamental furrow commencing beneath the beak, and running back subparallel with the dorsal margin, becoming more

internal posteriorly. Just beneath the beak is an elongated tooth-like thickening of the inner margin which consequently curves downward at this point. Muscular scars whitish, inconspicuous. The external surface, so far as visible, seems to be smoothish with irregular lines of growth.

Length, 1.6 mm.; height, 1.4 mm.

Two valves, station 949, N. lat. $40^{\circ} 3'$, W. long. $70^{\circ} 31'$, in 100 fathoms, 1881. This species is encrusted very much as *Cryptodon (Axinulus) ferruginosus*, but is quite different in its much more strongly developed hinge and ovate form.

From station 2113, N. lat. $35^{\circ} 20' 30''$, W. long. $75^{\circ} 19'$, in 15 fathoms, there are three specimens (No. 35531) of considerably larger size which agree closely with this species and are probably identical. They are more extensively encrusted with ferruginous mud and are somewhat higher in proportion to their length; the ventral margin being slightly produced in the middle, but they have the same posterior augulation and the same evenly produced anterior end. The beaks are larger, rounded, and relatively more prominent above the margin. The hinge-margin is very thin and delicate, but does not differ essentially in other respects from the smaller specimens.

Length, 2.6 mm.; height, 2.2 mm.

AXINOPSIS ORBICULATA G. O. Sars, variety INEQUALIS, new.

(Plate XCII, figs. 5, 6.)

Axinopsis orbiculata G. O. Sars, Mollusca Reg. Arcticæ Norvegiæ, p. 63, pl. 19, figs. 11a-d, 1878.—VERRILL, Trans. Conn. Acad., V, p. 569, 1882.—BUSH, Proc. U. S. Nat. Mus., VI, p. 243, pl. IX, fig. 4, 1883.

The numerous specimens of this species show considerable variation in form and character of the hinge. Many specimens show the cardinal tooth and pit as described and figured by G. O. Sars; others have the hinge-margin nearly smooth or with mere rudiments of a tooth and pit. Our specimens moreover show a thin, continuous external ligament, which should be lacking according to Sars' description, but he may have overlooked it. In form many of our specimens are evenly rounded, as figured by Sars, but others have the antero-dorsal margin more concave and the anterior end somewhat produced, while the postero-dorsal margin is somewhat straighter than usual.

Specimens from the Bay of Fundy have a somewhat oblong form, with the ventral margin more nearly straight or but slightly convex, and with the anterior end distinctly produced. This form seems sufficiently distinct to receive a varietal name, and we therefore propose to call it variety *inequalis*.

AXINOPSIS CORDATA, new species.

(Plate XCVII, figs. 5, 6.)

Shell small, white, smoothish, rounded or somewhat cordate, longer anteriorly, with small, little prominent beaks curving forward. Antero-dorsal margin a little convex, sloping gradually and passing somewhat abruptly into the anterior margin, which is broadly and obtusely rounded; ventral margin strongly convex, somewhat produced in the middle; posterior margin pretty evenly rounded, except in the middle, where there is a slightly produced portion corresponding to the plication; postero-dorsal margin strongly convex in the middle. The surface is marked by fine, microscopic, concentric striæ and irregular lines of growth which, on the umbo, appear as slight undulations. The ligamental area is relatively large, prominent in the middle, and defined by a distinct groove, beyond which there is a well-marked but low radiating ridge or plication which forms an inconspicuous projection at the margin; anterior to this there is a very slight wave-like depression of the surface, much as in most species of *Cryptodon*. The hinge-margin is decidedly thickened; in both valves there is a rather large, obtuse tooth just below the beak, from which it is separated by a rather large space for the ligament which runs backward for a short distance in a conspicuous submarginal groove, becoming internal distally; anteriorly the groove is narrow and outside the margin.

Length, about 2 mm.; height, the same.

This species is referred to the genus *Axinopsis* with some doubt, although it has the distinct cardinal tooth and ligament-groove. It has, however, a single posterior plication similar to that seen in some species of *Cryptodon*; but the character of the plications vary in that genus, in some cases being very strong and in others obsolete, or nearly so. In fact, the genus *Axinopsis* can hardly be distinguished from it except by the distinctly developed cardinal tooth, which is only partially differentiated from the proximal end of the anterior hinge-plate.

A few separate valves and two live young were found at six stations between N. lat. 40°, W. long. 71° 14' 30'', and N. lat. 35° 42', W. long. 74° 54' 30'', in 43 to 202 fathoms, 1880-1884.

The young specimens from stations 870 and 943 are referred to this species with considerable doubt, as they have a much more rounded outline, although the hinge-margin is similar.

AXINODON, new genus.

Type.—*Axinodon ellipticus*, new species.

Shell thin, rounded or ovate, without plications. Hinge with one or two small or subrudimentary teeth. Ligament internymphal, posteriorly so far internal that its inner end, distally, is attached below the inner edge of the hinge-plate, and therefore covers its entire breadth.

AXINODON ELLIPTICUS, new species.

(Plates XC, figs. 5, 6; XCII, fig. 1.)

Shell small, nearly smooth, swollen, transversely elliptical and somewhat oblong, with rather prominent umbos and with the beaks considerably behind the middle and curved forward. The antero-dorsal margin is decidedly convex and somewhat excurved, the anterior end is longer and a little broader than the posterior; both are nearly evenly rounded; the ventral margin is broadly rounded and nearly straight for a short distance along the middle; the postero-dorsal margin is convex and merges into the posterior end in a regular curve. The lunular area is rather distinct, but without any very definite boundary. The surface is nearly smooth, covered only with fine, close lines of growth, which, under the microscope, appear as delicate, raised lines, separated by grooves of about the same width; this sculpture is very regular over most of the surface, but on the umbos some of the ridges are so large as to appear like small undulations. The interior surface is smooth and white; the muscular scars are indistinct; the hinge-margin is rather thin; the posterior ligament is prominent, wedge-shaped, widest distally, and occupies a distinct groove covering the whole breadth and extending about one-third the length of the postero-dorsal margin and running forward under the beaks. In the left valve there are two slightly raised, minute, obscure, rounded teeth under the beak, of which the anterior is a little more distinct than the other; farther forward, and separated from the latter by a slight notch, there is an elongated thickening of the margin forming a sort of lateral tooth or lamina and separated from the outer edge by a narrow groove. In the right valve the anterior tooth-like thickening is less distinct and there is only a very slight rounded swelling of the lunular margin under the beak.

Length, 3.5 mm.; height, 3 mm.

Two live specimens (No. 35175), station 2096, N. lat. $39^{\circ} 22' 20''$, W. long. $70^{\circ} 52' 20''$, in 1,451 fathoms, 1883.

LEPTAXINUS, new genus.

Type.—*Leptaxinus minutus*, new species.

Shell small, short-ovate, inequilateral, with the anterior end the longer, and rounded, and the posterior end tapered and angulated, with a slight plication. Hinge-plate well developed, with a delicate, lateral tooth on both sides of the beak in the right valve, and one posterior lateral tooth in the left valve; in both valves with the proximal end of the hinge-plate enlarged and thickened near the beak, that of the left valve most developed and rising into a blunt tooth-like prominence. Ligament commencing under the beak and running back on the ventral side of the posterior hinge-plate, so that for the greater part of its length it is internal.

This genus differs from *Cryptodon* in the more internal position of the ligament and in having distinct lateral teeth. From *Axinodon*, in the stronger hinge-plate, in the presence of the lateral teeth, in having a posterior plication, and in lacking distinct cardinal teeth.

LEPTAXINUS MINUTUS, new species.

(Plate LXXXIX, figs. 3-5.)

Shell minute, broadly ovate, with a slightly produced obtuse point near the middle of the posterior end, and a somewhat produced, broadly rounded anterior end. Beaks behind the middle, rising a little above the dorsal margin and turned forward, leaving a small, rather deep lunular area. Antero-dorsal margin a little convex, sloping but little; anterior margin broadly and evenly rounded, forming nearly a semicircle, and passing continuously into the ventral margin, which is a little more broadly rounded; the posterior margin is somewhat angular, with a distinct prominence a little below the middle, where the radial ridge terminates, below this for a short space the margin is nearly straight or slightly incurved; above, the postero-dorsal margin is straight as far as a slight angle in the ligamental area, above which it is convex to the beak. The hinge-margin is a little thickened, and in the left valve forms a rather prominent and somewhat angular tooth just below and slightly in front of the beak; the ligamental groove is barely visible on the inner face of the posterior hinge-margin, and runs forward as a narrow groove beneath the beak; in the right valve there is a somewhat less prominent tooth just under the beak, behind which the ligamental groove forms a distinct notch in the margin. Under the microscope there is seen in both valves a distinct submarginal ridge with a conspicuous groove behind it, commencing a considerable distance behind the beak and running in and along the inner hinge-margin; there is also in the right valve a short, indistinct groove along the end of the hinge-margin in front of the beak. Externally a rather shallow, depressed undulation runs from the beak to the postero-ventral margin; behind it is a narrow, but slightly prominent, radial ridge running to the posterior angle; back of or above this a rather short ligamental area projects beyond the margin. The surface is covered with a thin, greenish yellow epidermis and is marked by fine, pretty regular, parallel, raised lines of growth, and also faint and rather numerous radiating lines which are not visible except under a high power.

Length, nearly 2 mm.; height, $1\frac{3}{4}$ mm.

One live specimen (No. 45686), station 949, N. lat. $40^{\circ} 3'$, W. long. $70^{\circ} 31'$, in 100 fathoms, 1881.

Family ASTARTIDÆ.

ASTARTE NANA (Jeffreys?) Dall.

Astarte nana DALL, Bull. Mus. Comp. Zool., XII, p. 261, pl. VII, figs. 6a, 6b, 1886; Bull. U. S. Nat. Mus., No. 37, p. 46, pl. VII, figs. 6a, 6b, 1889.

A single valve, which agrees perfectly with Dall's figures, quoted above, was found at station 2307, off Cape Hatteras, North Carolina, in 43 fathoms, 1884. South to Sombrero, in 22 to 196 fathoms.—Dall.

Family CUSPIDARIDÆ.

In the classification of this family we have adopted the groups proposed by Messrs. W. H. Dall and E. A. Smith as defined by Mr. Dall.¹

We, however, consider his two subgeneric groups, *Cardiomya* and *Halonympha*, as distinct genera.

CUSPIDARIA UNDATA Verrill.

(Plates LXXII, fig. 1; LXXVIII, figs. 3, 4.)

Neura undata VERRILL, Trans. Conn. Acad., VI, pp. 223, 277, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.

Not *Myonera undata* DALL, Bull. Mus. Comp. Zool., XII, pp. 302, 304, 1886; Bull. U. S. Nat. Mus., No. 37, p. 68, 1889 (in part).

Three live specimens and two valves were found at stations 2098 and 2566, off Chesapeake Bay, in 2,221 and 2,680 fathoms, 1883 and 1885.

Fragments obtained by the *Blake* near Havana, Dominica, and St. Vincent, in 450 to 611 fathoms, are erroneously referred by Mr. Dall to this species. Our shell is certainly not a *Myonera*.

We have a fragment of a left valve from station 2655, N. lat. 27° 22', W. long. 78° 7' 30'', in 338 fathoms, found among Foraminifera, which belongs to a strongly undulated species, with a short, angular, subacute rostrum defined below by a rather deep groove at which the concentric sculpture changes abruptly. The beak is prominent and turns strongly backward. The cartilage-plate is strong, deeply concave, and directed backward; a moderately elevated internal rib runs backward from the umbonal region to the posterior muscular scar. The shell is thin and has deep internal grooves corresponding to the external ridges. Judging by the lines of growth, the shell was short-ovate, broadly rounded anteriorly, and having posteriorly a short, angular, subacute rostrum; the escutcheon is concave and well-defined by a small, sharp ridge. This fragment seems to belong to an undescribed species of *Myonera*. It can, however, hardly be the same as Mr. Dall's species, as he states that in his "there is no buttress or appearance of an internal rib."

¹ Bull. Mus. Comp. Zool., XII, p. 292, 1886; XVIII, p. 441, 1889.

CUSPIDARIA LAMELLOSA (M. Sars) Dall.

(Plate LXXIV, fig. 10.)

Neara lamellosa VERRILL, Trans. Conn. Acad., V, p. 561, 1882; VI, p. 277, pl. xxx, fig. 3, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.

Cuspidaria lamellosa DALL, Bull. Mus. Comp. Zoöl., XII, p. 294, 1886; Bull. U. S. Nat. Mus., No. 37, p. 66, pl. XLV, fig. 3, 1889.

Comparatively few specimens, at twelve stations, between N. lat. $40^{\circ} 2' 49''$, W. long. $68^{\circ} 49'$, and N. lat. $37^{\circ} 59' 30''$, W. long. $73^{\circ} 48' 40''$, in 319 to 555 fathoms, 1880-1886.

A few specimens occurred which differ from the typical form in having but five or six concentric lamellæ visible on the antero-ventral portion of each valve and only conspicuous unequal lines of growth on the rest of the surface.

CUSPIDARIA TURGIDA, new species.

(Plates LXXII, fig. 7; LXXVII, fig. 4.)

Shell rather large, thin, delicate, translucent, of a pinkish white color within, long-oval, with prominent, posteriorly directed umbos, and narrow, rather long posterior rostrum. The beaks are central, rather acute and turned distinctly forward. The antero-dorsal margin is slightly convex, forming a broad curve; the anterior end is a little prolonged in the middle but otherwise pretty evenly rounded; the ventral margin forms a regular, broad curve becoming strongly incurved at the base of the rostrum; the postero-dorsal margin is straight at first, but slightly concave along the rostrum. The cartilage-plate is small and very oblique, and in the right valve, is separated by a distinct notch from the lateral tooth, which is long and low, with a rounded summit and a long, gradual, posterior slope; there is no trace of buttress or clavicle. In the left valve the hinge-margin is thin, and nearly simple both anteriorly and posteriorly. The exterior surface is covered with a thin, yellowish gray epidermis and is marked with irregular, rather conspicuous lines of growth; on the rostrum there is a distinct diagonal ridge running from the beaks to the lower margin.

Length, 22 mm.; height, 12 mm.; breadth, 11 mm.; distance from center of beak to end of rostrum, 12 mm.; to extreme anterior end, 12 mm.

In form, general appearance, and length of rostrum, this species is intermediate between *C. glacialis* and *C. rostrata*, but the umbos are more oblique and there are obvious differences in the hinge.

One live specimen (No. 78789), station 2714, N. lat. $38^{\circ} 22'$, W. long. $70^{\circ} 17' 30''$, in 1,825 fathoms, 1886.

CUSPIDARIA ROSTRATA (Spengler) Dall.

(Plate LXXII, fig. 6.)

Neura rostrata VERRILL, Trans. Conn. Acad., V, p. 562, pl. LVIII, fig. 39, 1882; VI, p. 277, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XII, p. 35, 1885.

Cuspidaria rostrata DALL, Bull. Mus. Comp. Zoöl., XII, p. 294, 1886; XVIII, p. 444, 1889; Bull. U. S. Nat. Mus., No. 37, p. 66, 1889.—LOCARD, Campagne du *Caudan*, Annales de l'Université de Lyon, p. 177, 1896.

This species was obtained at about fifteen stations between N. lat. $40^{\circ} 6' 50''$, W. long. $70^{\circ} 34' 15''$, and N. lat. $38^{\circ} 31'$, W. long. $73^{\circ} 21'$, in 65 to 156 fathoms. South to Barbados in 65 to 1,639 fathoms.—Dall.

CUSPIDARIA GLACIALIS (G. O. Sars) Dall.

(Plates LXXI, fig. 9; LXXIII, fig. 5; LXXV, fig. 9.)

Neura glacialis G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 88, pl. 6, figs. 8, *a-c*, 1878.—VERRILL, Trans. Conn. Acad., V, p. 562, pl. XLIV, figs. 10, *a-b*, 1882; VI, p. 277, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 35, 1885.

Cuspidaria glacialis DALL, Bull. Mus. Comp. Zoöl., XII, pp. 294, 303, 1886; Bull. U. S. Nat. Mus., No. 37, p. 66, 1889.

Cuspidaria arctica var. *glacialis* DALL, Bull. Mus. Comp. Zoöl., XVIII, p. 444, 1889; Proc. U. S. Nat. Mus., XII, p. 280, 1889.

Cuspidaria glacialis BUSH, Bull. Mus. Comp. Zoöl., XXIII, p. 226, 1893.
Not *Cuspidaria arctica*. (M. Sars).

This very common species was dredged at many stations from N. lat. $44^{\circ} 26'$, W. long. $62^{\circ} 10'$, to N. lat. $37^{\circ} 8'$, W. long. $74^{\circ} 33'$, in 62 to 828 fathoms. South to the Gulf of Mexico, in 64 to 1,467 fathoms.—Dall.

CUSPIDARIA MEDIA, new species.

(Plates LXXI, figs. 5, 6; LXXIII, fig. 6.)

Shell of moderate size, resembling a medium-sized *C. glacialis* (Sars), in form, but decidedly more swollen, with the rostrum narrower and more distinctly defined by a stronger ventral emargination. Umbos large, prominent, and swollen, with strongly incurved and very prominent beaks. The antero-dorsal margin is a little convex and slopes rapidly to the evenly rounded anterior end; the ventral margin is regularly curved and is rather more convex than in *C. glacialis*, and shows a very decided emargination at the base of the rostrum; the postero-dorsal margin is nearly straight but slopes from the beak to the end of the rostrum which is of moderate length and tapers from the base to the narrow, subtruncated end; it has no distinct diagonal ridge, but is separated from the body of the shell by a strongly marked depression. The surface is nearly smooth but is covered with fine lines of growth

which are most distinct on the rostrum. The hinge-margin is thin. The right valve has a thin, low, much elongated posterior lateral tooth which runs nearly parallel with the dorsal margin, above which it projects in a broad curve; the cartilage-plate is small, very oblique, and closely united with the tooth from which it is separated by a faint, curved notch; no buttress. In the left valve there is no lateral tooth, and the cartilage-plate is very small, slightly prominent, with a curved inner edge. The inner surface of the shell is smooth and the muscular scars are faint.

Length of an average specimen, 13 mm.; height, 8 mm.; breadth, 6.5 mm.; beak to end of rostrum, 8.5 mm.; beak to anterior end, 6 mm.

This species is allied to *C. glacialis*, from which it differs in its more swollen form, more oblique anterior end, more prominent ventral margin, more clearly defined rostrum, and straighter postero-dorsal margin. The hinge shows still more decided differences; the lateral tooth of the latter is stouter, more prominent, and less prolonged; the cartilage-plate is smaller and less distinctly defined. From *C. fraterna* it differs in being less produced ventrally and in having a longer rostrum with much straighter dorsal margin and a much longer lateral tooth.

This is a common species off Marthas Vineyard and has been taken at about fifteen stations between N. lat. $40^{\circ} 10' 15''$, W. long. $70^{\circ} 26'$, and N. lat. $39^{\circ} 56'$, W. long. $70^{\circ} 54' 18''$, in 63 to 155 fathoms, 1880-1884. A broken valve, station 362, N. lat. $42^{\circ} 1'$, W. long. $69^{\circ} 34'$, in 106 fathoms, 1879, is also referred to this species.

CUSPIDARIA PARVA, new species.

(Plates LXXIV, fig. 9; LXXVII, fig. 7.)

Shell small, delicate, elongated, inequivalved, having a general resemblance in form to the very young of *C. obesa* and *C. fraterna*. Umbos small, rather prominent; beaks small and incurved. The antero-dorsal margin is moderately convex and slopes regularly to the evenly rounded anterior end; ventral margin very broadly rounded, with a decided incurvature at the base of the rostrum, corresponding to the marked depression of the surface; postero-dorsal margin slopes rapidly at first and is usually concave along the rostrum, which is moderately long (the length varies in different specimens), narrow, with an obtusely rounded or subtruncated end. It is crossed by a distinct diagonal ridge, above which there are several small, raised, radial lines; the surface is elsewhere nearly smooth or presents a microscopic, faintly granulose appearance. The left valve is the larger and considerably overlaps the right along the ventral margin and siphonal region; the right overlaps the left along the postero-dorsal margin; the rostrum is a little bent toward the left in some specimens. The hinge-margin is delicate, with the anterior margin a little everted; cartilage-plate minute, sunken, in the right valve well separated from the prominent,

rather elongated lateral tooth; the left valve also has a small, elongated, tooth-like expansion posterior to the cartilage-plate.

Length, 4.5 mm.; height, 2.25 mm.; breadth, 1.5 mm.

This species may easily be mistaken for the young of *C. obesa* and *C. fraterna*; the structure of the hinge is, however, characteristic.

A comparatively few specimens, at seven station, between N. lat. $41^{\circ} 28' 30''$, W. long. $65^{\circ} 35' 30''$, and $35^{\circ} 49' 30''$, W. long. $74^{\circ} 34' 45''$, in 515 to 1,290 fathoms, 1883-1886.

CUSPIDARIA VENTRICOSA, new species.

(Plates LXXII, fig. 5; LXXVI, fig. 6.)

Shell large, rather solid, swollen, with a ventral enlargement and a moderately elongated, tapered rostrum. Umbos swollen and prominent; beaks incurved. Antero-dorsal margin at first nearly straight, then broadly rounded with the extreme anterior end a little prominent; ventral margin decidedly excurved in the middle, corresponding to the exterior swelling; at the base of the rostrum slightly concave; postero-dorsal margin somewhat concave, the most so at the base of the rostrum, which is obtusely rounded at the end. Exterior covered with very distinct lines of growth and irregular, stronger, concentric grooves. On the rostrum there is an obtuse, diagonal ridge running to the ventral angle of the tip; between this and the dorsal margin there are two others less distinct. The anterior hinge-margin is decidedly thickened in both valves and projects inward with a thick, rounded edge, most conspicuous in the right valve, in which it is abruptly much narrowed near the cartilage-plate; in this valve the lateral tooth is short, stout, obtuse, very prominent, and situated close to the beak, its length along the margin not much exceeding its height; cartilage-plate small, relatively wide, oblique, directed backward and downward, and closely united to the lateral tooth, there being only a slight, rounded notch between.

Length of the larger specimen, 30 mm.; height, 29 mm.; breadth, 18 mm.; beak to end of rostrum, 16 mm.; beak to anterior end, 17 mm. Another specimen is 25 mm. long; 17 mm. high; 12 mm. broad.

Four valves, at three station, between N. lat. $40^{\circ} 29'$, W. long. $66^{\circ} 4'$, and N. lat. $38^{\circ} 27' 30''$, W. long. $70^{\circ} 54' 30''$, in 349 to 1,769 fathoms, 1882-1886.

This species has some resemblance to *C. glacialis*, but is a stouter and more swollen shell, with a relatively larger rostrum, much more elongated and less prominent lateral tooth, and very different cartilage-plate. The latter does not have the swollen ventral region, characteristic of our species, nor the diagonal ribs on the rostrum.

CUSPIDARIA ARCTICA (M. Sars) Dall.

(Plates LXXI, fig. 2; LXXIV, fig. 7.)

Neara arctica Sars, G. O., Mollusca Reg. Arcticæ Norvegiæ, p. 85, pl. 6, figs. 5, a-c, 1878.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 35, 1885.

Cuspidaria arctica DALL, Bull. Mus. Comp. Zoöl., XII, p. 294, 1886.

Not *Neara arctica* VERRILL, Amer. Journ. Science, VI, p. 440, 1873.

A single imperfect valve from station 70, south of Halifax, Nova Scotia, in 190 fathoms, is referred to this species. Though worn and slightly broken, it agrees closely with Sars' figure, but it cannot be fully grown, for it measures but 14 mm. in length and 11 mm. in height.

CUSPIDARIA FORMOSA, new species.

(Plates LXXIV, fig. 6; LXXIX, fig. 9.)

Shell short, high, and swollen. Umbos prominent; beaks incurved. Anterior portion broadly rounded, a little produced at the end, with the dorsal margin convex and a little excurved; the ventral margin is broadly and evenly rounded; the rostrum is short, broad at base, much tapered; the postero-dorsal margin is nearly straight at first, then slightly concave and a little upturned. The exterior is covered with uneven lines of growth between which the surface is microscopically striated and more or less iridescent. The color of the single specimen is pale pink, externally and internally. The right valve has a prominent, triangular lateral tooth with its base prolonged parallel to the margin of the shell; it is separated by a decided notch from the cartilage-plate, which is of moderate size, ovate, somewhat oblique, with its inner edge rounded and prominent.

Length, about 16 mm.; height, 13 mm.; breadth, 10 mm.; beak to end of rostrum, about 9 mm.; beak to anterior end, 8 mm.

A single, much broken, specimen (No. 78313), station 2706, N. lat. 41° 28', W. long. 65° 35', in 1,188 fathoms, 1886.

CUSPIDARIA FRATERNA, new species.

(Plates LXXI, figs. 7, 8; LXXV, fig. 6.)

Shell similar to *Cuspidaria obesa* (Lovén), moderately large, considerably swollen, rather thick and firm for the genus, with a moderately long, tapered rostrum. The umbos are rather prominent and swollen, with the strongly incurved beaks nearly in contact. The anterior end is broadly rounded with a regularly curved, convex dorsal edge which rises nearly to the height of the umbos; the ventral margin is a little protuberant. The postero-dorsal line slopes with a slightly concave outline to the end of the rostrum; on the ventral margin there is a distinct incurvature corresponding to a wave-like depression on the surface,

defining the base of the rostrum. The surface is nearly smooth and somewhat glossy, covered with fine lines of growth which become more prominent and irregular on the rostrum, which has no distinct diagonal line. The hinge-margin is somewhat thickened; the right valve has a rather short, prominent, obtuse, triangular lateral tooth only slightly separated from the cartilage-plate by a concave margin; the cartilage-plate is small, very oblique, with the inner edge curved and not at all angulated. Muscular scars and pallial line indistinct; no buttress.

Length, 13 mm.; height, 9 mm.; breadth, 6 mm.; from beak to end of rostrum, 8 mm.; from beak to anterior end, 7 mm.

Found at about thirty stations between N. lat. $40^{\circ} 2' 49''$, W. long. $68^{\circ} 49'$, and N. lat. $37^{\circ} 23'$, W. long. $73^{\circ} 53'$, in 302 to 984 fathoms.

This species resembles *C. obesa* (Lovén) in form; it is, however, a larger species with a firmer and more swollen shell; the ventral margin is more prominent, so that it has a relatively higher form and is broader at the base of the rostrum. The hinge shows more decided differences, for in *C. obesa* the lateral tooth is smaller, shorter, and closely approximated to the cartilage-plate which is distinctly angulated, the inner end being acute and separated from the tooth by a small angular notch.

CUSPIDARIA OBESA (Lovén) Dall.

(Plate LXXV, fig. 7.)

Neura obesa LOVÉN, Ind. Moll. Scand. Occid., p. 48, 1846.—VERRILL, Trans. Conn. Acad., V, p. 563, pl. XLIV, fig. 10c, 1882; VI, p. 277, 1884 (in part); Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885 (in part).—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 43, 1885.

Cuspidaria obesa DALL, Bull. Mus. Comp. Zoöl., XII, p. 295 (not pl. III, fig. 1), 1886; Bull. U. S. Nat. Mus., No. 37, p. 66 (not pl. III, fig. 1), 1889.

Not *Neura pellucida* STIMPSON.

This species has been found at about twenty-four stations between N. lat. $43^{\circ} 23'$, W. long. $68^{\circ} 30'$, and N. lat. $35^{\circ} 12' 10''$, W. long. $74^{\circ} 57' 15''$, in 96 to 811 fathoms, 1873-1887.

It is recorded by Mr. Dall from off Barbados in 100 fathoms and off the coast of California in 16 fathoms.

After a careful study and comparison of the numerous species belonging to the family Cuspidaridæ we have been able to satisfactorily prove that the form described by Stimpson as *Neura pellucida* is quite distinct from that described by Lovén as *N. obesa*, with which it has been so long confounded.

CUSPIDARIA PELLUCIDA (Stimpson).

(Plates LXXV, fig. 8; LXXVI, fig. 8.)

Neora pellucida STIMPSON, Invert. Grand Manan, p. 21, pl. I, fig. 13, 1853.—
GOULD, Invert. Massachusetts (2d ed.), p. 61, fig. 378, 1870.—VERRILL,
Check-list, p. 24, 1879.

Neora sp. VERRILL, Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for
1883, p. 574, 1885.

Not *Neora obesa* LOVÉN.

Shell small, much swollen, with a strongly tapered, somewhat produced rostrum. Umbos relatively large and prominent, beaks minute, strongly incurved. The anterior portion is broadly and evenly rounded, the margin forming nearly a semicircle, with the dorsal margin strongly convex and excurved, rising nearly as high as the umbos; the ventral margin is broadly rounded but distinctly incurved at the base of the rostrum which is rather narrow distally, obtusely rounded at the tip and slightly upturned; the postero dorsal margin slopes considerably, is nearly straight at first but becomes slightly concave on the rostrum. External surface nearly smooth but usually showing more or less prominent lines of growth, most distinct on the distal part of the rostrum which is destitute of a distinct diagonal line. The right valve has a short, very prominent, strongly curved lateral tooth rising close to the beak, the most prominent part being near the proximal end which rises rather abruptly from the very minute cartilage-plate from which it is not separated by a notch; just in front of the beak, the hinge-margin is distinctly thickened, sinuous, and a little prominent, forming a sort of tooth, separated from the lateral tooth only by the minute sunken cartilage-plate; the left valve also has a slight, sinuous thickening of the margin in front of the cartilage-plate.

Length of one of the largest specimens, 4.5 mm.; height, 3 mm.; breadth, 3 mm.; beak to end of rostrum, 3 mm.; beak to anterior end, 2.5 mm.

This species has been taken at Eastport Harbor; Bay of Fundy, near Grand Manan Island; and at about twenty-one stations between N. lat. $47^{\circ} 40'$, W. long. $47^{\circ} 35' 30''$, and N. lat. $35^{\circ} 14' 20''$, W. long. $74^{\circ} 59' 10''$, in 52 to 516 fathoms, 1868–1886.

The specimens here described are from the Bay of Fundy, near Grand Manan Island and Eastport Harbor, very near the locality where Doctor Stimpson's types were obtained. In former articles we have united this species with *C. obesa* (Lovén). A careful reexamination of a large series of specimens of both forms has convinced us that they are distinct but closely related species. In *C. obesa* the anterior portion is more produced, giving the shell a more ovate outline; the rostrum is broader and rather more upturned; the cartilage-plate is relatively much larger, more prominent, and angular at the edge, and in the right valve is separated from the lateral tooth by an

angular notch; while the tooth itself is relatively smaller, shorter, less prominent, and more distinctly triangular in form.

CUSPIDARIA SUBTORTA (Sars).

(Plates LXXIII, fig. 1; LXXIV, figs. 4, 5.)

Neera subtorta Sars, G. O., Mollusca Reg. Arcticæ Norvegiæ, p. 87, pl. 6, figs. 6, a-c, 1878.—JEFFREYS, Ann. Mag. Nat. Hist., p. 234, September, 1877; Proc. Zoöl. Soc., London, p. 937, November, 1881.—SMITH, E. A., Report Voy. *Chalenger*, Zoöl. Lamellibranchiata, XIII, p. 35, 1885.

Shell inequivalve, rather short, relatively high, much swollen in the middle, with tumid umbos and a short, tapered, somewhat upturned rostrum. The anterior portion is broadly rounded, the margin forming nearly a semicircle; the antero-dorsal margin is strongly convex and slightly excurved; the ventral margin is evenly rounded, except at the base of the rostrum where it is distinctly incurved, especially in the right valve; the postero-dorsal margin is very strongly concave in the left valve and less so in the right. The rostrum is separated from the body of the shell by a sinuous depression and has a poorly defined diagonal ridge; it is a little bent to the left and, when viewed from above, appears slightly twisted. The surface of the shell is nearly smooth, but shows distinct lines of growth anteriorly, and especially on the superior part of the rostrum; the epidermis is very thin, yellowish white, more or less wrinkled on the rostrum; the hinge-margin is rather strong; the lateral tooth in the right valve is large, rather elongated, rather prominent, obtusely triangular, and not separated from the very small, narrow, oblique, sunken cartilage-plate by a notch; in the left valve there is a small, short, prominent tooth arising from the posterior margin of the cartilage-plate and separated from the posterior hinge-margin by a distinct angular notch.

Length, 8 mm.; height, 6 mm.; breadth, about 5 mm.

One live specimen (No. 52545), station 2499, N. lat. $44^{\circ} 46' 30''$, W. long. $59^{\circ} 55' 45''$, in 130 fathoms, 1885.

This species appears to be identical with the European *subtorta*. It differs from all of our other species in having a distinct tooth-like tubercle behind the cartilage-plate in the left valve. The inequality of the valves and the twisted rostrum give the shell a peculiar aspect.

CARDIOMYA ABYSSICOLA, new species.

(Plates LXXIII, fig. 4; LXXIV, fig. 1; LXXVII, fig. 9.)

Shell rather large, swollen, with tumid umbos; outline elongate-ovate, with a narrow, rather elongated, tapered, slightly excurved posterior rostrum, the tips divergent and gaping; the anterior end is broadly round, with the dorsal and ventral margins convex, the latter narrowing gradually posteriorly with a slight sinus at the base of the rostrum; the postero-dorsal margin is concave, so that the end of the rostrum is

somewhat upturned. The entire body of the shell is covered with numerous narrow, elevated, radiating ribs, separated by much wider concave interspaces, some of the widest of which have a small secondary rib in the center toward the margin; the ribs increase in elevation and strength posteriorly, toward the base of the rostrum, but never become broad; for a short distance on the base of the rostrum the ribs are nearly obsolete but become prominent again on its dorsal and terminal portions; this part is also crossed by irregular raised lines of growth which cross the ribs obliquely; the inner surface is covered with rounded grooves corresponding to the external ribs, separated by convex ribs of about the same width; these become obsolete anteriorly and posteriorly. The hinge-margin in the left valve is only a little thickened and slightly excurved, the cartilage-plate is central, stout, regularly ovate in form, with a thickened inner margin; in the right valve there is a prominent, rather stout, elongated posterior tooth, the anterior end of which joins closely the cartilage-plate, leaving scarcely any notch between; the highest part of the tooth is near the middle, the slope, however, is a little steeper anteriorly; a deep groove separates the tooth from the thin, slightly excurved dorsal margin; anteriorly the margin is but slightly thickened, and shows a very narrow, beveled edge externally for the attachment of the thin ligament; a similar but more distinct ligamental groove extends from the beak to the base of the rostrum; there is a short, rather stout, rib-like clavicle or buttress running from beneath the middle of the tooth obliquely backward and downward in the direction of the base of the rostrum; a less prominent buttress is also present in the left valve.

Length of one of the largest specimens, 25 mm.; height, 15 mm.; thickness, 14 mm.; from beak to end of rostrum, 13 mm.; to antero-ventral margin, 12 mm. One badly broken valve is considerably larger than this. There are also two young live specimens which measure about 6 mm. in length and 3.5 mm. in height. Their form is somewhat narrower and longer than in the adult, and the rostrum appears rather longer and narrower; the postero-dorsal margin is nearly straight; the ventral margin is decidedly concave at the base of the rostrum; the shells are very thin, somewhat transparent and glossy, and have about twenty-six sharply defined, considerably elevated, nearly equal, narrow ribs on the body of the shell, separated by much wider spaces; the edge of the left valve overlaps that of the right, especially along the base of the rostrum.

In general appearance this species greatly resembles *C. multicosata* Verrill and Smith. It differs, however, in having a regularly more ovate form with the anterior region somewhat narrower and more prolonged and the postero-ventral margin less incurved at the base of the rostrum, so that the latter is broader and less differentiated. The external costæ differ in being narrow and sharp, separated by broad concave interspaces, and of nearly uniform size, there being no marked contrast between those on the anterior and posterior portions of the shell,

although the elevation and distance between them gradually increase posteriorly, while in the former they are broadly rounded and separated for the most part by narrow interstices. The hinge also differs considerably; the cartilage-plate is less prominent and broader than that of *multicostata*, and the tooth in the right valve is longer and not so prominent and scarcely forms a notch at its junction with the cartilage-plate; anteriorly the margin is very thin and simple with a very narrow, linear, ligamental groove along its outer edge, while in the former the groove is broader and its inner edge is raised almost in the form of a lateral tooth.

It also resembles *C. costellata* var. *corpulenta* Dall in the character of the costæ, but the latter is much shorter and higher in form and has a very short, ill-defined rostrum.

Two young live specimens, two separate valves, and some fragments were taken at three stations, between N. lat. 40° 29', W. long. 66° 14', and N. lat. 36° 47', W. long. 73° 9' 30'', in 1,685 to 1,813 fathoms, 1885-86.

CARDIOMYA MULTICOSTATA Verrill and Smith.

(Plate LXXIII, fig. 3.)

Neera multicostata VERRILL, Trans. Conn. Acad., V, p. 559, pl. LVIII, fig. 40, 1882; VI, p. 277, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, pl. XXX, fig. 129, 1885.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 36, 1885.

Not *Cardiomya striata* DALL, Bull. Mus. Comp. Zoöl., XII, p. 298, pl. III, fig. 10, 1886; Bull. U. S. Nat. Mus., No. 37, p. 66, pl. III, fig. 10, 1889; Proc. U. S. Nat. Mus., XII, p. 281, 1889.

Cardiomya striata DALL, Bull. U. S. Nat. Mus., No. 37, pl. LXV, fig. 129, 1889.

Not *Cardiomya costellata* (DESHAYES) var. *curta* DALL, Bull. Mus. Comp. Zoöl., XII, p. 297, 1886.

Neera multicostata var. *curta* VERRILL, Trans. Conn. Acad., V, p. 560, 1882.

This comparatively rare species was found at but eight stations off Marthas Vineyard, in 85 to 158 fathoms, 1880-1882.

Although this species resembles *Cardiomya striata* (Jeffreys) in the character of its sculpture, the marked difference in outline, especially in its clearly defined rostrum, render it advisable to keep the two forms separate until a careful comparison of the hinges can satisfactorily decide the question of their identity.

The two valves designated as variety *curta* have the radiating ribs rounded and not angular, but fewer in number than the typical form, and must be distinct from *curta* of Jeffreys, which Mr. Dall makes a variety of *costellata* of Deshayes.

CARDIOMYA PERROSTRATA Dall.

(Plates LXXIII, fig. 2; LXXIV, fig. 3.)

Neæra perrostrata VERRILL, Trans. Conn. Acad., V, p. 561, 1882; VI, p. 277, 1884.*Cardiomya perrostrata* DALL, Bull. Mus. Comp. Zoöl., XII, p. 296, pl. II, figs. 3a, 3b, 1886; Bull. U. S. Nat. Mus., No. 37, p. 66, pl. II, figs. 3a, 3b, 1889.

Only a few specimens were obtained from seven stations between N. lat. $40^{\circ} 15' 30''$, W. long. $70^{\circ} 27'$, and N. lat. $39^{\circ} 46' 30''$, W. long. $70^{\circ} 54'$, in 58 to 325 fathoms, 1880-1884.

South to Granada, in 339 to 416 fathoms.—Dall.

CARDIOMYA GEMMA, new species.

(Plates LXXI, figs. 3, 4; LXXIV, fig. 11.)

Neæra paucistriata BUSH, Trans. Conn. Acad., VI, p. 473, 1885.*Not Myonera paucistriata* DALL, Bull. Mus. Comp. Zoöl., XII, p. 302, 1886; Bull. U. S. Nat. Mus., No. 37, p. 68, 1889; Proc. U. S. Nat. Mus., XII, p. 233, pl. XIII, fig. 12, 1889.*Cardiomya* sp. BUSH, Bull. Mus. Comp. Zoöl., XXIII, p. 227, 1893.

Shell small, inequivalved, thin, fragile, translucent, bluish white, somewhat ovate, with a well-defined rostrum. Umbos smooth, a little prominent; the beaks small, inconspicuous. The antero-dorsal margin is convex and rises distinctly above the beaks so that the greatest height of the shell is in front of them; thence it slopes rapidly to the somewhat prominent anterior end; the ventral margin is broadly rounded with a slight angle at the termination of each radial rib, decidedly incurved at the base of the rostrum which is a little elongated, nearly straight, somewhat tapered, and rather upturned distally; the postero-dorsal margin is depressed and somewhat concave. Each valve has three conspicuous, prominent, thin, elevated, distant, radial ribs on the posterior half and a fourth less distinct one at about the middle; this is rudimentary in the left valve; none of them reach the umbos. The surface is also covered with very delicate lines of growth; the rostrum does not have a diagonal ridge. The hinge-margin is thin and delicate; the right valve has a small but prominent, moderately long lateral tooth separated from the very minute cartilage-plate by a distinct notch. The lateral tooth is supported by a small buttress.

Length, 5 mm.; height, 3 mm.

A few specimens off Cape Hatteras, North Carolina, in 16 and 17 fathoms, 1884.

CARDIOMYA GLYPTA Bush.

(Plates LXXI, fig. 1; LXXVI, figs. 3, 7.)

Nucra costata BUSH, Trans. Conn. Acad., VI, p. 472, pl. XLV, fig. 21, 1885; Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 587, 1885; not Sowerby, 1834.

Cardiomya ornatissima DALL, Bull. Mus. Comp. Zool., XII, p. 296, 1886; Bull. U. S. Nat. Mus., No. 37, p. 66, pl. XLI, fig. 21, 1889.

A few specimens were found at two stations off Cape Hatteras, North Carolina, in 48 fathoms. South to Guadaloupe, in 2 to 124 fathoms.—Dall.

In addition to the published description it should be stated that the antero-dorsal margin of the right valve rises into a distinct, prominent, obtuse lobe in front of the tooth; this lobe overlaps the margin of the left valve when the shell is closed. There is a small buttress beneath the posterior lateral tooth. One broken valve, considerably larger than the type, has in the intervals between the three primary ribs two or three small secondary ones; on the anterior end six ribs are visible, of which one or two are larger than the rest, so that altogether about thirteen or fourteen ribs can be counted; some of these are, however, very small and extend only part way to the umbo; even the largest do not extend over the extreme part of the umbo.

Mr. Dall considers this species to be identical with D'Orbigny's *ornatissima*, but we see no sufficient reason for uniting the two forms.

The name *costata* was used by Sowerby in 1834.

HALONYMPHA STRIATELLA, new species.

(Plates LXXII, figs. 2, 3; LXXVII, fig. 10.)

Shell small, thin, broadly and obliquely ovate, with a narrow, short rostrum. Umbo swollen. Beak behind the middle. The antero-dorsal margin is broadly and nearly evenly convex; the anterior end is evenly rounded; the ventral margin is broadly convex with a slight incurvature at the base of the rostrum, which is short, narrow, and obtuse at the end; the postero-dorsal margin is strongly concave and slopes rapidly. In the region of the umbo the surface is lustrous and nearly smooth, but marked with faint, parallel lines; elsewhere it is closely covered with very regular, fine, raised concentric lines separated by incised lines of about the same width or narrower; on the rostrum there is a faint diagonal ridge posterior to which the concentric lines are irregular. The interior surface is smooth and lustrous but the external lines show through by transparency. In the right valve there is a small, sharp, triangular tooth projecting inward with a very small cartilage-pit in front of and confluent with it; slightly farther forward there is another small, slender tooth rising nearly parallel with the

margin; external to this there are remnants of a small anterior ligament occupying a short furrow. Commencing behind the beak and extending to the base of the rostrum, there is a comparatively large and prominent lamelliform process rising from beneath the margin and projecting downward, with the face portion broadly rounded, and its upper surface concave. Above the base of this, and extending from near the beak to about the middle of the rostrum, is a narrow, slightly thickened ridge separated from the dorsal margin by a narrow furrow.

Length, 6 mm.; height, 4.5 mm.; breadth, about 3 mm.

One valve, station 2655, among Foraminifera, N. lat. $27^{\circ} 22'$, W. long. $78^{\circ} 7' 30''$, in 338 fathoms, 1886.

This species has considerable resemblance to *H. claviculata* Dall, but the latter is more regularly ovate in form, and has a much shorter and broader rostrum, and somewhat coarser sculpture. The posterior shelf-like clavicle also differs in form, being quite narrow for a considerable distance next the cartilage-pit, and more expanded distally. The shell described and figured by Smith¹ under the same name appears to be a distinct species, and may be identical with our shell, for it has nearly the same form and agrees closely in the narrow tapered rostrum. The figure of the interior, however, in that case, is incorrect, owing to the omission of the clavicle, and apparently the substitution of the hinge of the left valve for the right.

MYONERA GIGANTEA Verrill.

(Plate LXXVI, figs. 4, 5.)

Neæra gigantea VERRILL, Trans. Conn. Acad., VI, pp. 223, 277, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, 1885.

Three imperfect, dead specimens have been found at three stations between N. lat. $38^{\circ} 22'$, W. long. $70^{\circ} 17' 30''$, and N. lat. $37^{\circ} 56' 20''$, W. long. $70^{\circ} 57' 30''$, in 1,825 to 1,917 fathoms, 1883 and 1886.

MYONERA RUGINOSA (Jeffreys) Verrill and Bush.

(Plates LXXII, fig. 4; LXXIV, fig. 2.)

Neæra ruginosa JEFFREYS, Proc. Zoöl. Soc. London, p. 942, pl. LXXI, fig. 7, November, 1881.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 35, 1885.

Shell small, short, broad-ovate, not much swollen, with a short, wide, gaping, obliquely truncate rostrum. Umbos small, prominent, not much swollen; beaks small, prominent, incurved, smooth and shining. The anterior portion is evenly rounded, nearly semicircular; the anterodorsal margin is convex and prominent; the ventral margin is broadly and evenly rounded, except at the base of the rostrum where it is sinuous and incurved; the postero-dorsal margin is nearly straight to the

¹ Report Voy. *Challenger* Zoöl. Lamellibranchiata, XIII, p. 52, pl. ix, figs. 8-8b, 1885.

end of the short rostrum which has a distinct, median, diagonal ridge or angulation and another less distinct one at its base. The surface of the shell is thickly covered with very numerous, and crowded, concentric, more or less irregular, raised lines of growth which give it a finely lamellose appearance when viewed under a lens. These lines become more crowded, more prominent, and form two sinuous waves in crossing the rostrum. Color, in alcohol, white tinged with reddish brown. The hinge-margin is delicate; the right valve has no lateral tooth but shows a slight thickening of the posterior margin; the cartilage-plate is small, ovate, directed backward.

Length, 6 mm.; height, 4.5 mm.; breadth, 3 mm.

One live specimen (No. 52544), station 2570, N. lat. $39^{\circ} 54'$, W. long. $67^{\circ} 5' 30''$, in 1,813 fathoms, 1885.

"Porcupine Expedition, 1870," off Cape Mondego, in 740 to 1,095 fathoms.—Jeffreys.

MYONERA LIMATULA Dall.

(Plate LXXIV, fig. 8.)

Neera limatula DALL, Bull. Mus. Comp. Zoöl., IX, p. 112, 1881.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XII, p. 35, 1885.

Myonera limatula DALL, Bull. Mus. Comp. Zoöl., XII, p. 304, pl. III, fig. 5, 1886; Bull. U. S. Nat. Mus., No. 37, p. 68, pl. III, fig. 5, 1889.

A single live specimen (No. 38171) was taken at station 2048, N. lat. $40^{\circ} 2'$, W. long. $68^{\circ} 50' 30''$, in 547 fathoms, 1883.

MYONERA (?) PRETIOSA, new species.

(Plate LXXVII, fig. 5.)

Shell small, very thin and fragile, nearly transparent, compressed, elongate-oval with a well-defined, somewhat elongated rostrum. Umbo prominent, scarcely oblique and nearly smooth. The antero-dorsal margin is convex, anterior end evenly rounded; ventral margin broadly convex, becoming incurved at the base of the rostrum; postero-dorsal margin nearly straight. The antero dorsal region is distinctly excavated in front of the beaks. The body of the shell is ornamented with ten or more thin, distinct, slightly raised, concentric riblets separated by much wider interspaces. On the rostrum there are two well-marked minutely spinulous keels between which are delicate lines of growth; the first runs from the beak quite close to and parallel with the dorsal margin; while the second extends from the umbo diagonally across the rostrum to its lower edge.

Length, 6 mm.; height, 3 mm.; breadth, about 2 mm.

This shell has no very close resemblance to any hitherto described.

One valve, station 2655, N. lat. $27^{\circ} 22'$, W. long. $78^{\circ} 7' 30''$, in 333 fathoms, among Foraminifera, 1886.

As but a left valve was found, the true position of this species can not be decided.

Family POROMYIDÆ.

POROMYA SUBLEVIS Verrill, variety MICRODONTA Dall.

(Plates LXXVI, figs. 1, 2; LXXXVII, fig. 1.)

Poromya sublevis VERRILL, Trans. Conn. Acad., VI, pp. 221, 277, pl. XXXII, fig. 21, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 574, pl. XXX, fig. 128, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, pp. 281, 282, 1886; XVIII, p. 448, 1889 (variety?); Bull. U. S. Nat. Mus., No. 37, p. 68, pl. LXV, fig. 128, 1889.

Poromya microdonta DALL, Proc. U. S. Nat. Mus., XII, p. 290, pl. VIII, fig. 6, 1889 (variety?).

Shell rather large, thick, well-rounded, cordate, inequivalved, very tumid, with very large, prominent umbos which are strongly curved forward spirally; beaks large; lunule small, cordate, often not very distinct. The shell varies considerably in outline and size and elevation of the umbos; in most specimens the height equals or slightly exceeds the length; the outline of the cavity of the shell is usually somewhat elliptical, the length decidedly exceeding the height, but sometimes it is nearly circular. The anterior and posterior margins are usually pretty evenly rounded; the ventral margin usually projects a little in the middle; the beak is situated in front of the median line. Externally the shell is nearly smooth and is covered with a thin, closely adherent, brownish-yellow epidermis; under a lens the surface shows minute raised points or granules which are arranged in radial rows that become more distinct and crowded posteriorly but for the most part disappear on the most prominent part of the umbos. These granule-like points are variable in number and distinctness, in some specimens being nearly obsolete and in others distinct and regularly arranged; the epidermis often also shows fine lines of growth; the beaks are smooth and shining. The left valve has a posterior, wave-like, radial depression, and behind this a low, rounded ridge projecting at the margin as a slight siphonal lobe; in the right valve, the corresponding lobe and depression are only faintly marked in most cases. The right valve is larger than the left and overlaps it considerably along the ventral margin and both in front of and behind the beaks. The interior is pearly and often shows radial striations. The hinge-margin is considerably thickened and strongly curved; the right valve has a large, thick, somewhat rounded tooth just beneath the beak and adnate to the inner surface of the shell, for some distance within the cavity of the beak and to the thickened edge behind the beak, but separated from the anterior margin by a deep, curved furrow in the lunular area; the lunular margin is convex and somewhat everted, separated from the rest of the anterior margin by a slight notch. The ligament is rather long and well-rounded and its groove extends forward in a curved furrow under the beak; it extends backward in a curved line parallel with the margin of the shell for some distance

behind the tooth. External to the posterior part of the ligament there is a submarginal thickening or fold, especially in the right valve. In the left valve the central tooth is represented by an irregular, bilobed, or somewhat V-shaped thickening of the margin, of which the anterior part, situated just in front of the beak, is the more prominent; but this varies in form in different specimens. The postero-dorsal margin along the ligamental region is less thickened but has a distinct rounded ridge inside the ligament.

Length of one of the largest specimens, 16 mm.; total height, 16 mm.; height of cavity, 12 mm.; breadth, 16 mm. In a more rounded specimen the length is 15 mm.; total height, 16 mm.; height of cavity, 13.5 mm.; breadth, 14 mm.

A few dead specimens of the typical form (*sublevis*) have been taken at five stations between N. lat. $39^{\circ} 15'$, W. long. $68^{\circ} 8'$, and N. lat. $37^{\circ} 56' 20''$, W. long. $70^{\circ} 57' 30''$, in 1,594 to 1,917 fathoms, 1883-1886.

Several live and dead specimens of the varietal form (*microdonta*) have been taken at eight stations between N. lat. $39^{\circ} 26'$, W. long. $68^{\circ} 3' 30''$, and N. lat. $36^{\circ} 47'$, W. long. $73^{\circ} 9' 30''$, in 1,631 to 1,859 fathoms, 1885-1886.

Mr. Dall extends the range south to Patagonia, in 122 to 1,635 fathoms.

Our specimens show considerable variation in form as well as in the prominence of the cardinal tooth in the right valve, and thus unite the extreme forms *P. sublevis* Verrill, and *P. microdonta* Dall.

CETOCONCHA ATYPHA, new species.

Shell short-ovate, nearly equilateral, and nearly equally rounded at both ends, judging from the lines of growth. Umbos rather prominent, but less so than in several allied species. Beaks rather prominent and curved strongly forward, but not spiral. Surface somewhat shining and slightly iridescent where rubbed, covered with a very thin, yellowish epidermis with very numerous, minute, granule-like elevations which are arranged in regular radiating lines, and are much the most numerous on the posterior end where the radial rows are closely crowded and the granules in each are also near together; on the center the rows and granules are more distant, so that the number is only about half as great in the same space; on the anterior end they are so scattered that the radial rows are indistinct and the granules are a little larger; on the lunular area they are nearly obsolete. The anterior end and lunular area are marked by rather conspicuous lines of growth which, near the dorsal margin, take the form of distinct, raised, concentric ridges. The antero-dorsal margin is nearly horizontal and rises up, in a side view, in an acute edge, a little higher than the level of the beak, so as to produce a broad, compressed, lunular margin. When viewed from above, this part of the margin forms a very marked obtuse angle with the posterior hinge-margin. The postero-dorsal margin is also nearly

horizontal, slightly convex or nearly straight; the ligament is very prominent behind the beak, extending backward in a conspicuous groove nearly to the posterior end, and terminates anteriorly in a deep narrow groove directly under the beak. In the left valve the inner edge of the posterior hinge-margin is somewhat sinuous; just behind the beaks, opposite the most prominent part of the umbos, it is thickened and somewhat revolute, decreasing both in thickness and elevation to a shallow indentation of the margin; back of this, it increases regularly in thickness and prominence and is again revolute along the posterior part of the ligamental furrow. There is no central tooth nor any distinct resilium. In the right valve the posterior hinge-margin is even more thickened and revolute just back of the beaks, and the indented, thinner portion, at the end of the prominent part of the ligament, is more marked. The ligamental groove is consequently less conspicuous, being partially concealed by the revolute margin. The antero-dorsal margin is compressed and projects strongly upward, rising distinctly above the umbos in a side view and is more convex than in the left valve. There is also a slight elevation within the dorsal margin directly below the beaks, which might be considered the rudiments of a tooth.

The largest specimen, when perfect, would be about 15 mm. long.

Two very much broken valves, station 2229, N. lat. $37^{\circ} 38' 40''$, W. long. $73^{\circ} 16' 30''$, in 1,423 fathoms, 1884.

This species somewhat resembles *Cetochonca nitida* (Verrill)¹ Dall.² It is however more oblong, with the umbos much smaller and less prominent and the beaks less spiral and nearer together. The granulation of the surface is somewhat stronger and more generally distributed. The ligamental groove is longer, deeper, and the ligament itself is more prominent behind the beaks. The angulation of the hinge-margin of the left valve in a horizontal plane is a peculiar feature not found in the other related species and indicates that the valves are decidedly unlike in form, but the right valve is too much broken to show the anterior margin.

CETOMYA species.

A broken left valve (No. 52013) from station 2481, N. lat. $44^{\circ} 7' 30''$, W. long. $57^{\circ} 16' 45''$, in 116 fathoms, resembles *Poromya* (*Cetomya*) *elongata* Dall, from the West Indies and Barbados, in 100 to 119 fathoms. It is, however, too incomplete for determination without direct comparison with authentic specimens.

It is larger and more strongly truncate posteriorly than *Poromya granulata* (Nyst) Forbes and Hanley, and the granules are coarser and not so numerous. It differs, moreover, very strongly in the hinge characters, for the hinge-plate is much thinner and the large tooth in the left valve is wanting in our species.

¹ *Thracia nitida* Verrill, Trans. Conn. Acad., VI, p. 221, pl. XXXII, fig. 22, 1884.

² *Cetochonca nitida* Dall, Bull. Mus. Comp. Zool., XII, p. 281, 1886.

Family VERTICORDIDÆ.

VERTICORDIA GRANULIFERA (Verrill) Dall.

(Plates LXXXVII, fig. 2; XCV, figs. 2, 3, 4.)

Pecchiolia granulifera VERRILL, Trans. Conn. Acad., VI, pp. 434, 448, 450, 1885.*Verticordia granifera* DALL, Bull. Mus. Comp. Zoöl., XII, p. 286, 1886.*Verticordia granulifera* DALL, Bull. U. S. Nat. Mus., No. 37, p. 66, 1889.

In addition to the published description, it should be stated that in the type-specimen (No. 44838), the lunular area is small, deeply sunken, with the corresponding internal margin very much thickened, forming a strong, curved, tooth-like projection having a rounded summit, reaching strongly above the margin of the shell when seen in a profile view; behind this, directly under the beak and beneath the overhanging margin, there is a triangular space or notch for the reception of the prominent tooth of the opposite valve; this is followed posteriorly by a short, triangular, shelf-like projection, a little beneath the margin, which has a depression on its upper surface for the reception of its ligament but shows, in this specimen, no notch or scar corresponding to the ossicle. Directly under the strongly incurved beak there is a slight, thin groove in which the front part of the ligament was attached. The postero-dorsal edge is a little thickened and projects inward beyond the general line of the margin; its outer surface has a smooth, slightly excavated groove, extending parallel with the edge, for some distance; this portion was overlapped by the projecting edge of the opposite valve.

A very large specimen (No. 78679) from station 2713, which measures 21 mm. in length, 22½ mm. in height, and 10 mm. in thickness, has, in the right valve, directly beneath the beak, a very strong, high, curved, pointed, angular tooth attached by a very broad, thick base, a considerable distance within the margin. Behind the ossicle, well within and nearly parallel with the margin for its entire length, is a conspicuous shelf-like ridge against which the projecting edge of the opposite valve rests. The ossicle is strong, somewhat rectilinear in outline, with the posterior end deeply forked, the inner surface strongly convex, the outer strongly concave, with thick, somewhat beveled edges, to which the ligament is attached. Interior surface somewhat pearly. Scars and pallial line not very clearly defined.

But four specimens, beside the type, have been found at four stations between N. lat. 40° 9' 30'', W. long. 67° 9', and N. lat. 36° 47', W. long. 73° 9' 30'', in 1,356 to 1,859 fathoms, 1884-1886.

Family LYONSIELLIDÆ.

LYONSIELLA SUBQUADRATA (Jeffreys.)

(Plate LXXXVII, fig. 3.)

Pecchiolia subquadrata JEFFREYS, Proc. Zool. Soc. London, p. 932, pl. LXX, fig. 3, November, 1881.—Not DALL, Bull. Mus. Comp. Zool., XII, p. 272, 1886.

Our specimen seems to agree in every respect, except size, with the original description and figure as given by Jeffreys, ours being considerably larger.

The umbo is prominent and the beak is curved strongly forward, producing a deep lunular area which is defined neither by a groove nor a ridge. The surface is everywhere covered with small but prominent granules which are numerous, pretty evenly spaced, and arranged somewhat distinctly in radiating rows which, under the microscope, are defined by slight radial ridges uniting those of the same row. The granulations are easily visible with slight enlargement. Under the compound microscope they have the form of elevated, acute cones and blunt tubercles, their height usually greater than their diameter, except on the umbo, where they are low and rounded. Internally the surface is everywhere marked with small, deep pits looking like punctures made by a fine needle, and corresponding to the external granules. The hinge-margin is thickened and entirely edentulous, as described by Jeffreys. Posterior to the beak there is a distinct groove in the thickness of the margin for the reception of a ligament. Beneath the beak there is a slight, oblique, marginal notch or slit for the reception of the resilium, running back within and underneath the dorsal margin, so that it is scarcely visible in a direct front view.

This shell appears to be identical with the species originally described and figured by Jeffreys under the name of *Pecchiolia subquadrata*. Mr. Dall has evidently found an entirely different species in the Jeffrey's collection under this name, which he has referred to the genus *Callocardia* and subgenus *Vesicomya*, belonging to an entirely different family from our shell. In order to avoid confusion the shell examined and described by Mr. Dall should receive a distinct specific name; we therefore propose *Callocardia (Vesicomya) dalli*. Mr. Dall states that "the sparsely set, microscopic tubercles can only be observed with a magnifier; to the eye the surface looks shining and smooth," which shows the surface to be quite different from that of our shell. In his shell there are also two cardinal teeth in each valve.

One valve (No. 78800), station 2714, N. lat. $38^{\circ} 22'$, W. long. $70^{\circ} 17' 30''$, in 1,825 fathoms, 1886.

North of the Hebrides, in 542 fathoms; and off Cape Mondego in Vigo Bay, in 740 to 1,095 fathoms. "*Porcupine Expedition, 1869-70.*"—Jeffreys.

LYONSIELLA CORDATA, new species.

(Plate XCV, figs. 7, 8.)

Shell rather large and firm for the genus, somewhat translucent bluish white, swollen, cordate, with a posterior obtuse prominence. Umbos prominent, turned forward spirally; beaks small, strongly incurved. Lunule small, cordate, defined only by one of the ordinary fine radial ridges; the part that lies immediately under the beak is deeply sunken with the edge pinched up into a prominent keel. The antero-dorsal margin is strongly convex and prominent in the lunular region, but not so high as the umbos; the anterior margin is but slightly convex and nearly perpendicular to the axis of the shell; the ventral margin is strongly convex and somewhat produced in the middle, farther back it is but slightly convex; the posterior end is obtusely rounded, decidedly prominent but not angular; the postero-dorsal margin is a little convex and slopes gradually. The surface is covered with about sixty delicate, radiating, raised lines or riblets which are crossed by fine lines of growth, the thin, brownish or grayish green epidermis often rising into small points at their intersection, especially anteriorly and posteriorly; these riblets become coarser and more distant anteriorly, and are lacking on the lunule. The ligament is thin and strong and extends backward along nearly the whole of the dorsal margin and curves spirally under and around the beak in the region of the resilium, so that the two come almost in contact. The hinge margin, in front of the beak and lunular area, is strongly convex and protuberant, rising nearly to the height of the umbo; posteriorly it is convex and thin in both valves; in the left one it is strengthened by a slight marginal rib within the ligamental furrow; both of these are less evident in the right valve. There are no teeth in either valve. The ossicle is relatively large, oblong, somewhat saddle-shaped, narrowest and truncated anteriorly, broadest and forked posteriorly, the divisions acute. The resilium beneath the ossicle is well developed, dark brown, and extends forward and upward to the margin, beneath the beak.

Length of the largest specimen, 11 mm.; height, 12 mm. Another is 11 mm. long; 11.5 mm. high; 9 mm. broad.

Two living specimens and one valve, at three stations between N. lat. $39^{\circ} 15'$, W. long. $68^{\circ} 8'$, and N. lat. $37^{\circ} 38' 40''$, W. long. $73^{\circ} 16' 30''$, in 1,423 to 1,825 fathoms, 1884-1886.

Family LYONSIDÆ.

LYONSIA GRANULIFERA, new species.

(Plate XCV, fig. 1.)

Shell oblong, truncated posteriorly, narrowed and rounded anteriorly. Umbo rather prominent with the beak in front of the middle and curved forward; lunular area considerably sunken. Anterior end evenly

rounded with the dorsal margin rapidly sloped; ventral margin broadly and evenly rounded; posterior end somewhat obliquely truncated without any definite boundary, but with a distinct depression extending from under the beak to about the middle of the posterior margin; postero-dorsal margin nearly straight, longer, and sloping less rapidly than the anterior. The entire surface is covered with minute, irregular, raised, granules and pretty distinct, but irregular, lines of growth and slightly raised, distant, thin, radiating lines running from the umbo to the margin, except on the posterior end where the lines of growth become more prominent; these radial lines are however, in many places, rather faint and seem to consist mainly of the thin, brownish epidermis, which is lacking in certain parts. Minute grains of sand and shells of Foraminifera are firmly adherent to the surface, mainly along the radial lines, and especially posteriorly. The interior is white, lustrous and but slightly nacreous. Muscular and pallial scars indistinct. The hinge-margin is thin; in the left valve the anterior border is somewhat thickened in the lunular area and terminates abruptly in a rounded, tooth-like shoulder just under the beak; the posterior margin shows a slightly raised elongated, roughened area for the attachment of the resilium, commencing under the beak and running back for some distance within the margin, on its nearly vertical inner surface, so that it is scarcely visible in a front view. Ossicle not observed. Ligament very thin, occupying a groove along the posterior margin.

Length, 19 mm.; height, 13 mm.; breadth, 9 mm.; from the beak to the antero-dorsal angle, 7 mm.; to the postero-dorsal angle, 12 mm.

One valve (No. 52561), station 2492, N. lat. $45^{\circ} 22'$, W. long. $58^{\circ} 43' 45''$, in 75 fathoms, 1885.

This species is allied to *L. arenosa* (Moller) with which it agrees very closely in the character of the external surface and structure of the hinge. It differs in its longer, more ovate form, in its more produced anterior end, and in its less swollen umbo.

Family PANDORIDÆ.

CLIDIOPHORA INORNATA, new species.

(Plate XCV, figs. 5, 6.)

Shell small, much compressed, very inequilateral, posterior end narrowed, somewhat acuminate, the right valve flat or slightly convex and the left valve a little swollen. Umbos not prominent; beaks small and appressed. The antero-dorsal margin is slightly convex and slopes rapidly to the bluntly rounded anterior end; the ventral margin is broadly rounded and slightly prominent, considerably behind the middle, beyond which it is incurved to meet the posterior rostral angulation; the posterior end is produced into a short, narrow, sub-truncated, slightly upturned rostrum, its lower angle formed by a somewhat prominent, radial rib or ridge, extending from the beak (on the

left valve); the postero-dorsal margin is usually slightly concave, but is sometimes nearly straight, and in some cases decidedly concave, and slopes gradually to the superior angulation of the rostrum; the ligamental area is narrow, deep, and long, extending for nearly the entire length of the dorsal margin, and is clearly defined by a marginal ridge which is sharper on the left valve. In most specimens this valve is marked by a slight, ill-defined groove running from the beak to the antero-ventral margin, where it often forms a slight emargination, but is often scarcely discernible, except by the change in the direction of the lines of growth and character of the epidermis. The surface of the left valve is covered with irregular concentric ridges and rather uneven lines of growth; the right valve usually shows rather regular, concentric undulations on which are numerous fine, pretty regular, lines of growth; this valve is also usually marked by faint, and rather indistinct, radiating, impressed lines which are more or less broken and often branched or forked; these are scarcely visible without a lens. Epidermis thin, brownish yellow, usually mostly peeled off in dry specimens, but on the anterior end, in front of the radial groove, it is a little more persistent. In the left valve the anterior tooth is strong and prominent, with the proximal end the thicker, more elevated, rounded or clavate; distally it is curved and diverges considerably from the antero-dorsal margin; between this tooth and the resilial pit, there is a small central tooth only a little elevated. The resilial pit is directed obliquely backward, and its cavity is obliquely upturned, forming a distinct excavation on the inner surface of the posterior tooth with which it is confluent; this posterior tooth is simply a distinctly thickened and slightly elevated portion of the postero-dorsal margin, which forms the boundary of the ligamental area, it is often, but not always, opposite the position of the resilial pit. In the right valve the anterior tooth is a slightly raised, somewhat curved ridge on the inner surface of the shell, running to the middle of the anterior muscular scar; the central tooth is shorter and much more elevated, most prominent at its inner end; between these two teeth there is an additional, slightly raised, tooth-like ridge; the posterior tooth is about as long as the anterior, and much more elevated and stouter, its distal end being the thicker and higher, with a distinct angular summit; the oblique resilial pit is excavated out of its anterior surface. The ossicle is somewhat elongated, curved or crescent shaped. The interior of the shell is only slightly lustrous and shows but little iridescence.

Length of one of the largest specimens, 19 mm.; height, 11 mm.; thickness, about 3 mm.

Found in considerable numbers at twenty-three stations, north of Cape Cod, off Stellwagens Bank, and off Chatham, in 10 to 43 fathoms, 1872-1881.

This species, which is common in the vicinity of Cape Cod, has probably been confounded, hitherto, with *C. trilineata* Say, and *C. gouldiana* Dall. From the latter, which occurs abundantly in the same

region, it differs in its much smaller size, much less iridescent interior, straighter postero-dorsal margin, less upturned rostrum, and narrow, or more acuminate, posterior half of the shell. The hinge also differs in several respects.

KENNERLIA BREVIS, new species.

(Plate LXXXVIII, figs. 7, a, b.)

Kennerlia glacialis VERRILL, Notice of Recent Add. to Mar. Invert., Pt. 2, Proc. U. S. Nat. Mus., III, p. 397, 1881; Trans. Conn. Acad., V, p. 567, 1882; VI, p. 277, 1884.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 68, 1889 (in part).

Shell short, sublunate, very inequilateral, obtuse at both ends, slightly narrowed anteriorly. The antero-dorsal margin is short and slopes rather rapidly to the anterior end, where it forms an obtuse angle with the ventral margin which is broadly and nearly evenly rounded, and passes into the rounded posterior margin without angulation, but sometimes with a slightly sinuous curve below; there is also, sometimes, a very slight sinuosity anteriorly; the postero-dorsal margin is nearly straight. The left valve is rather convex, moderately thick, nearly smooth, with a distinct, narrow radial ridge running from the beak to the posterior end. The right valve is smaller, concave or nearly flat, lunate, widest behind the middle, regularly curved ventrally or faintly sinuate anteriorly; its surface is marked by lines of growth and crossed by radial grooves, of which about ten are very distinct, while many others, much finer, can be seen with a lens. In the right valve the hinge consists of two small, divergent teeth, both of which are directed posteriorly. The rather thin, elongated posterior one, in a profile view, is obtusely triangular, its highest point distal to the middle; the slender resilium is attached to this, nearly the whole length of its anterior side, and carries a long, narrow ossicle. The cardinal tooth directly under the beak, is much shorter and somewhat thicker, with its highest point near the proximal end which is close to the dorsal margin. There is also a slightly elevated, rather indistinct, anterior submarginal ridge, parallel with the margin, which supports a slender ligamental groove. In the left valve the hinge consists of a submarginal, thickened, blunt anterior tooth, running forward subparallel with the margin, and a posterior submarginal thickening or ridge having the resilium attached to its anterior side; the V-shaped space is relatively very wide and is not divided by any distinct intermediate ridges, such as occur in typical *Pandora*. The resilium appears to be simple, not divided in a V-shaped form as in the latter genus.

Length of one of the largest specimens, 11.5 mm.; height, 7 mm.; thickness, 3 mm.

Found in small numbers at about ten stations between N. lat. $40^{\circ} 15' 30''$, W. long. $70^{\circ} 27'$, and N. lat. $35^{\circ} 10' 40''$, W. long. $75^{\circ} 6' 10''$, in 58 to 100 fathoms, 1880-1886.

This species, which is southern in its range, is closely related to the

northern *K. glacialis* (Leach) with which it was formerly identified. It is a smaller, shorter, and more inflated species, with a shorter and more sloping antero-dorsal margin and a more evenly curved ventral margin, without the distinct antero-ventral indentation seen in that species. The convex valve has a distinct, posterior radial ridge which is faint or lacking in *K. glacialis*. There are also differences in the hinge, in the right valve of the latter the teeth are more divergent, etc.

Doctor Carpenter, who established the group *Kennerlia*, defined it as differing from typical *Pandora* in having an ossicle on the cartilage or resilium, and radial grooves on the right valve. Perhaps the simple linear form of the resilium in *Kennerlia* and its forked or V-shaped form in true *Pandora* (type *P. rostrata* Lamarck) may be of more importance. The intermediate ridge in the left valve of *Pandora* fits between the two divisions of the V-shaped resilium. There is also in *Kennerlia* a small, buttress-like projection within the margin, under the beak, which supports an inward projecting portion of the ligament, darker in color than the resilium.

Family PERIPLOMIDÆ.

PERIPLOMA AFFINIS, new species.

(Plate LXXXVII, fig. 4.)

Shell thin, fragile, broad-ovate, with the beaks behind the middle and with a short, narrowed posterior end. The antero-dorsal margin is broadly convex; anterior end nearly evenly rounded, but slightly produced in the middle; ventral margin evenly convex to the base of the rostral region where it becomes slightly incurved; posterior end much narrowed, compressed and produced into a short, blunt rostrum with the edges gaping slightly at the end; postero-dorsal margin nearly straight, sloping rapidly to the angle of the rostrum; a faint diagonal ridge extends to the lower rostral angle, posterior to which the shell is smoother than elsewhere and marked with several faint, radial riblets. The general surface is covered with irregular, uneven and often rather faint, concentric undulations, separated by rather wide concave intervals which, like the elevations, are covered by thin, elevated lines of growth. The undulations are most regular on the umbos and become less distinct and more irregular toward the margin and anteriorly, and show by transparency on the interior of the shell. The chondrophore is small, but very prominent, spoon-shaped, narrow at the base and expanded distally, with a nearly round resilial pit. The ossicle is well developed, bent into a crescent shape, and so formed as to fit into the small rounded notch in the shell margin in front of the chondrophores. A somewhat elevated submarginal ridge extends forward from the notch and serves to support the thin ligament; a similar but less prominent ridge extends backward from the chondrophores and defines a distinct ligamental groove.

Length of the largest specimens, 13 mm.; height, 10 mm.; breadth, 8 mm.

Three specimens were found at three stations, off Marthas Vineyard, in 100 to 115 fathoms, 1880-81.

This species resembles *P. undulata* in sculpture, but the latter is narrower and longer in form, and has a more decidedly longer rostrum; its chondrophore is shorter and broader, and not so distinctly spoon-shaped distally, while the marginal notch in front of it is relatively much smaller.

PERIPLOMA UNDULATA Verrill.

(Plates LXXIX, fig. 1; LXXXVII, fig. 5.)

Periploma undulata VERRILL, Trans. Conn. Acad., VI, pp. 433, 448, 1885.

A few specimens were found at six stations between N. lat. $39^{\circ} 9'$, W. long. $73^{\circ} 3' 15''$, and N. lat. $36^{\circ} 42'$, W. long. $74^{\circ} 30'$, in 541 to 816 fathoms, 1884-1887.

Family LIMIDÆ.

LIMATULA REGULARIS, new species.

Shell small, thin, nearly equilateral, much higher than long, with the hinge-line straight and rather long. Umbos and median part of the shell swollen. Beaks rather prominent, directly incurved. Ligamental area relatively large, elongated, diamond-shaped, with the pointed end extending nearly to the angles of the hinge-margin, with a central, more sunken, short, rhomboidal ligament-pit which, on a separate valve, forms nearly an equilateral triangle. The anterior and posterior ends are nearly equally curved, a little convex, but slightly narrowed where they join the hinge-margin and form a distinct obtuse angle; on one side, supposed to be anterior, below the angle the margin is slightly incurved for a short distance, making this angle less obtuse than the other. The ventral margin is nearly evenly rounded, forming nearly the segment of a circle. The surface is covered with small, elevated, radial ridges separated by concave grooves of greater breadth; in the middle of the shell between ten and twelve of the ridges are distinctly higher and thicker; on each side their size diminishes outwardly, so that near the angles of the hinge they become nearly or quite obsolete, the last ones being mere raised, microscopic threads; in some cases smaller ones alternate with the larger ones, so that the total number can not be definitely determined, but fifty or more can often be counted. There is often no very evident median external sulcus, such as occurs in several related species, but the two or three central radii are often, but not always, distinctly larger than the rest. The radii are crossed by very fine lines of growth not sufficiently strong to render them at all nodulose. The inner margin is

distinctly crenulated along the prominent ventral edge, the crenulations corresponding to the external grooves and ridges, but at the ends it is smooth. There is often a distinct, median internal groove, extending from near the beak to the middle of the ventral margin, bordered on each side by a distinct raised ridge, sometimes having an additional groove on their outer sides. The hinge-margin is rather thin, nearly straight, and a little excavated or incurved along the ligamental pit; on each side and considerably within the margin there is a small triangular buttress or shelf-like process extending to the anterior and posterior margins as in the allied species, but rather larger than usual.

Length of one of the largest species, 6 mm.; height, 9.6 mm.; thickness, about 5 mm.; length of hinge-margin, 3.6 mm.

A number of separate valves, station 2265, N. lat. $37^{\circ} 7' 40''$, W. long. $74^{\circ} 35' 40''$, in 70 fathoms, 1884.

This species is allied to *Limatula subovata* (Jeffreys) Smith,¹ which is distinguished by its shorter hinge-margin, more contracted form, with stronger and higher radial ribs and well-marked median sulcus. It also lacks the incurvature of the margins below the angles of the hinge.

LIMATULA NODULOSA, new species.

Shell small, nearly equilateral, vertically ovate, narrowed above, with a comparatively short, straight, hinge-margin. Umbos prominent, a little compressed. Beaks small, a little prominent, directly incurved. Surface covered with radial ribs which are very fine and even on the anterior and posterior ends, but in the middle region, become much stronger and are rendered nodulose by strongly marked, raised, concentric lines and grooves. The two median ones are much stronger than the others and are separated by a distinct median sulcus. The inner surface is marked by radial ridges and grooves of which the median ones are much the stronger; inner margin crenulated ventrally by the ends of the ribs and grooves. Ligamental area diamond shape with a small, short, rhomboidal ligament-pit in the middle. The hinge-margin forms an obtuse angle at each end, the two nearly or quite equal; internal buttress well developed with the inner margin regularly curved and continuous across the middle, so as to thicken the hinge in this part.

Length, 4.5 mm.; height, 7 mm.; thickness, about 4 mm.; length of the hinge-margin, 2 mm.

A single valve, among Foraminifera, at station 2385, N. lat. $28^{\circ} 51'$, W. long. $88^{\circ} 18'$, in 730 fathoms, 1885.

This species agrees with *L. subovata* (Jeffreys) Smith almost completely in size and form, but differs very decidedly in the strong, nodulose, radial ribs which cover the middle portion of the shell.

¹ *Limaea subovata* Verrill, Notice of Recent Add. to Mar. Invert., Pt. 2, Proc. U.S. Nat. Mus., III, p. 402, 1881.

LIMATULA HYALINA, new species.

Shell small, thin, translucent, vertically ovate, somewhat oblique, and produced postero-ventrally. Hinge-line straight, rather short, forming a well-marked angle at each end owing to the outline of each margin becoming somewhat concave below. Beaks small, acute, incurved. Umbos prominent, smooth, beyond which the shell is covered with numerous, clearly defined, rather sharp radial ridges, separated by wider concave intervals; from twenty to twenty-five of the radii can be easily counted; toward the posterior margin they become faint and indistinct, while the extreme margin, on both sides, is smooth. The anterior margin is broadly rounded and slopes backward below the middle; the posterior margin is nearly straight or even a little incurved in its upper half, but becomes slightly convex below; the ventral margin is evenly rounded and the edge is slightly scalloped by the radial ribs and furrows. There is no distinct median sulcus or larger ribs. The ligamental area is rather short and broad with a relatively large and thick central ligament which occupies a distinctly excavated pit in the hinge-margin.

Length of one of the largest specimens, 4.5 mm.; height, 7.5 mm.; thickness, 3 mm.

A number of live specimens, among Foraminifera, stations 2367 to 2374, N. lat. 29° +, W. long. 85° +, in 25 to 27 fathoms, 1885.

This species somewhat resembles *Limatula confusa* Smith, which was also taken in the north Atlantic and West Indian areas, in 450 to 1,450 fathoms. Our species is, however, more compressed and more oblique, and the radial ribs do not extend to the extreme margins as in the latter. The hinge-margin is also relatively shorter and the ligamental area larger, so that the beaks are more separated.

Family PECTINIDÆ.

In this family the classification adopted is that proposed by the senior author in a recent paper on the group.¹ We give here a brief abstract of the existing genera and subgenera therein described. For fuller discussions of the characters and interrelations of these groups and illustrations of typical species of most of them, reference should be had to that article.

In the following synopsis the generic groups are arranged in chronological order, without regard to their zoological affinities.

¹ "A study of the family Pectinidæ, with a revision of the Genera and Subgenera." By A. E. Verrill, Trans. Conn. Acad. of Sciences, X, pp. 43-95 (six plates), July, 1897.

PECTEN Müller, 1776.

Pecten (1st section) KLEIN, 1753 + *Vola*.

Pecten MÜLLER, Prod. Zool. Dan., 1776 (*pars*).—DACOSTA, 1778.—BOLTEN, 1798 (restricted).—CUVIER, 1798.—LAMARCK, Syst., 1801.—VERRILL, Trans. Conn. Acad., , pp. 56, 89, 91, 1897.

Janira SCHUMACHER, 1817.—DALL, 1886 (*pars*).—FISCHER, 1887.

Vola H. and A. ADAMS (after KLEIN), 1858.—STOLICZKA, Mem. Geolog. Survey of India, Cretaceous Pelecypod Fauna, III, p. 426, 1871.—ZITTEL, 1881.

Vola + *Janira* CHENU, 1862.

Type.—*Pecten maximus* (Linnæus).

Since Boltén, in 1798, definitely restricted the name *Pecten* to this group, his restriction has precedence over that of Schumacher.

The shells are generally large and heavy, and the valves are very unequal, even when very young. The right valve is strongly convex with a large and much incurved umbo and beak, while the left valve is flat or even concave. It is usually smaller than the right, and shuts closely inside of its scalloped margin, and its umbo is nearly or quite obsolete. The auricles are of moderate size and not oblique, and in the right valve they are strongly convex or excurved in the middle. This valve has a sinuous, excurved byssal notch, with obsolete pectinidial teeth. The surface of both valves has strong radial ribs interlocking at the margin. Internally there are angular, thickened, and fluted radial ribs opposite the external grooves; these ribs become more prominent and bicarinate or fluted near the margins.

AMUSIUM Boltén, 1798.

Amusium BOLTEN, 1798.—MÜHLFELDT, 1811.—SCHUMACHER, 1817.—WOODWARD, 1866.—DALL, 1886.—VERRILL, Trans. Conn. Acad., X, pp. 57, 90, 92, 1897.

Amusium H. and A. ADAMS, 1858 (*pars*).—STOLICZKA, Mem. Geolog. Survey of India, Cretaceous Pelecypod Fauna, III, p. 426, 1871.—FISCHER, 1887.—ZITTEL, 1881.

Pleuronectia SWAIN, 1840.—CHENU, 1862.

Type.—*Amusium pleuronectes* (Linnæus).

In this very distinct genus the shell is round, thin, nearly smooth, and strongly compressed. The surface is often polished, sometimes lightly radially striated, never strongly ribbed. The margins are simple and thin. The valves may be a little unequal in convexity and usually differ in color and somewhat in sculpture. The valves come together ventrally, but usually gape at both ends. The auricles are small, symmetrical, nearly equilateral, often with lateral crura; the byssal notch is small or absent, pectinidial teeth nearly or quite abortive. The adult probably has no byssus. Hinge-plate simple. Interior of valves strengthened by a number of raised divergent ribs, or liræ, independent of any external sculpture.

CHLAMYS Bolten, 1798.

Chlamys BOLTEN, Mus. Bolt., 1st ed., p. 165, 1798, restricted.—FISCHER, 1827 (*pars*).

Pecten SCHUMACHER, 1817 (restricted).—VERRILL, Trans. Conn. Acad., X, pp. 58, 89, 91, 1897.

Pecten (pars) and *Chlamys (pars)* H. and A. ADAMS, 1858.—CHENU, 1862.—ZITTEL, 1881.

Pecten STOLICZKA, 1871 (restricted).

Type.—*Chlamys islandica* (Müller).

The original type of this genus is identical with *P. islandicus* (Müller). Therefore this should be adopted, without question, as the true type, as has been done by Fischer and others.

The typical species of *Chlamys* are high, rounded, somewhat oblique, nearly equivalve shells, with large inequilateral and oblique auricles, a large byssal notch, and several pectinidial teeth. The surface is strongly radially sculptured, with both primary and numerous interpolated ribs, increasing in number with age. The ribs are generally crossed by concentric sculpture, often forming rough, scale-like projections. The margins are scalloped and the shell closes rather tightly except at the byssal area. The inner surface has ribs and double flutings, corresponding to the external grooves and radii. The hinge-plate has generally two slightly divergent ribs on each end.

PALLIUM Schumacher, 1817.

Pallium SCHUMACHER, 1817.—H. and A. ADAMS, 1858.—CHENU, 1862.—STOLICZKA, 1871.—ZITTEL, 1881.—FISCHER, 1827.—VERRILL, Trans. Conn. Acad., X, pp. 59, 89, 91, pl. XXI, fig. 4, 1897.

Dentipecten RUPPEL, 1835.

Type.—*Pallium plica* (Linnæus).

The special feature of this very distinct group is the development of several (usually three) well-marked, nearly transverse, blunt teeth, alternating with distinct pits on each end of the hinge-plate. The shell is elevated, rather thick, with external, large, obtuse or rounded radial ribs or corrugations, and with internal, angular, double or bicarinate ribs opposite the external grooves, near the margin. The auricles are small, but high. The hinge-teeth are marked with distinct cross lines.

HINNITES DeFrance, 1821.

Hinnites VERRILL, Trans. Conn. Acad., X, pp. 59, 89, 91, 1897.

Type.—*Hinnites cortessi* DeFrance.

Shell free and much like *Chlamys*, when young, but later in life it becomes attached by the right valve and irregular.

HEMIPECTEN Adams and Reeve, 1849.

Hemipecten VERRILL, Trans. Conn. Acad., X, pp. 60, 89, 91, 1897.

Type.—*Hemipecten forbesianus* Adams and Reeve.

This group includes species with thin, irregular shells attached by the right valve, like *Hinnites*, but the attachment is effected mainly by a permanent modified byssus. The posterior auricles are nearly obsolete. The byssal notch becomes irregular and nearly inclosed, as in *Anomia*.

PSEUDAMUSIUM H. and A. Adams, 1858.

Pseudamusium (pars) H. and A. ADAMS, 1858 (after KLEIN).—CHENU, 1862.—STOLICZKA, 1871.—ZITTEL, 1881.—FISCHER, 1887.—DALL, 1886 (*pars*).—VERRILL, Trans. Conn. Acad., X, pp. 60, 90, 92, pl. XVII, figs. 8, 8a, 1897 (restricted).

Type.—*Pseudamusium exoticum* (Chemnitz, Lamarck).

The typical species of this group have nearly smooth, round, symmetrical, closed shells with well-defined, small, straight, obtuse-angled auricles. The valves are nearly equal and have nearly simple, even margins. The external sculpture consists of small radial striæ or riblets, without strong angular ribs and grooves, and it may differ on the two valves. Some of the species show the fine divergent "camptonectes sculpture" on one or both valves, especially when young. The margin is not scalloped, or but faintly so, and there are no definite internal ribs. The hinge-plate has usually but one longitudinal fold on each end which is feeble and nearly parallel with the marginal ligamental groove and is usually cross-lined. The byssal notch is small and the pectinidial teeth vary from one up to five in number, or sometimes may be lacking.

CAMPTONECTES Meek, 1864.

Camptonectes MEEK, 1864.—STOLICZKA, 1871.—ZITTEL, 1881 (type, *arenatus* Goldfuss).—VERRILL, Trans. Conn. Acad., X, pp. 62, 90, 91, 1897.

Type.—*Camptonectes lenis* (Sowerby).

Shell subovate, plain, not corrugated, and without strong radial ribs; margin nearly plain. Valves subequal. Auricles unequal; byssal notch well developed. Surface of the shell covered with fine, obliquely divergent, curved, crenulated or vermiculated riblets with intervening, narrow, punctate grooves.

The curious vermiculated sculpture is not peculiar to this division, but is more or less obvious on the shells of some species of *Pseudamusium*, and on species of several other groups, both with and without radial ribs. It is a structural feature that runs obliquely across the ribs and grooves. Most of the species are Mesozoic fossils.

The recent *Pecten striatus* and *P. tigrinus* Lamarck, of Europe, apparently belong to this group, and *P. teste* might also well be referred to it. The latter is one of the types of *Palliolum* which might well be regarded as a section of this genus.

LYROPECTEN Conrad, 1867.

Lyropecten of several later authors.

Lyropecten CONRAD, 1867.—VERRILL, Trans. Conn. Acad., X, pp. 63, 89, 91, 1897.

Type.—*Lyropecten nodosus* (Linnaeus).

Shell large and strong, corrugated, with large, fluted, and usually nodose, primary radial ribs, which do not increase in number, and with coarsely scalloped margins. Valves somewhat unequal. Auricles of medium size, unequal. Hinge-plate with several, usually three, oblique, divergent ribs on each end. This is one of the best defined groups, and may be regarded as of generic value. It is allied to *Pallium*.

PROPEAMUSIUM Gregorio, 1883.

Propcamusium (subgenus) DALL, Bull. Mus. Comp. Zoöl., XII, p. 210, 1886.—FISCHER, 1887.—(genus) VERRILL, Trans. Conn. Acad., X, pp. 64, 90, 92, pl. XX, figs. 5-9, 1897.

Type.—*Propcamusium inequisculpta* (Tiberi) = *Propcamusium fenestratum* (Forbes).

This group is allied to *Amusium*. It includes small, mostly deep-sea species, with thin, rounded shells, having the valves unequal in size and sculpture; the lower and flatter one is concentrically grooved, and usually turns up at the thin margin to meet the upper valve, as in *Cyclopecten*. The upper valve may be cancellated or radially sculptured. When full grown there are several well-formed, raised, internal ribs; these may be absent in the young.

This division differs from *Amusium* in the sculpture of the valves and in having the auricles and byssal notch well developed.

The species closely resemble those of *Cyclopecten*; the only obvious difference in the shells is in the presence of internal ribs.

PALLIOLUM Monterosato, 1884.

Palliolum (subgenus or section) VERRILL, Trans. Conn. Acad., X, pp. 65, 90, 91, pl. XVIII, figs. 6-14, 1897.

Types cited.—*Palliolum testæ* (Bivona) and *Palliolum vitreum* (Chemnitz).

This group is separated from *Pseudamusium* H. and A. Adams, and can scarcely be distinguished from *Camptonectes* by any known characters.

The two species named by its author as types agree in having thin, rounded, nearly equivalved shells, with the posterior auricle poorly developed, and with fine camptonectes sculpture on both valves, with small radial riblets, and usually with rows of small scales. The margins are plain and come evenly together, without flattening.

ÆQUIPECTEN Fischer, 1887.

Æquipecten (subgenus of *Chlamys*) VERRILL, Trans. Conn. Acad., X, pp. 59, 67, 89, 91, pl. XVI, figs. 6-11; pl. XX, figs. 1-3, 6, 6a, 1897.

Type.—*Æquipecten opercularis* (Linnaeus).

Shell broadly rounded, with the valves nearly equal and symmetrical. Auricles well-formed, angular; byssal notch well-developed. The sculpture consists of a moderate number of large and nearly equal primary radial ribs, which increase in size, but are not much increased in number with age, by the interpolation of new ones. Internal ribs or flutings correspond to external grooves, but each one is bicarinate or double, especially near the margins. Hinge-plate with one or two slightly divergent ribs at each end, often crossed by strong transverse incisions. Pectinial teeth abortive in the type, but present in most species. The foot of the type species is subcylindrical, well-developed, with a byssal fissure and a terminal, deeply bilobed "scooped-shaped" disk, which can be expanded. In *Æ. irradians*¹ the foot has a similar structure, but the terminal disk appears to be smaller.

PECTINELLA Verrill, 1897.

Pectinella VERRILL, Trans. Conn. Acad., X, pp. 68, 90, 92, 1897.

Type.—*Pectinella sigsbei* (Dall).

Shell small, thin, swollen, nearly smooth, with convex and slightly unequal valves. Auricles very unequal, oblique, the anterior larger, with a deep byssal notch in the right valve, but without pectinial teeth; posterior auricle small. The surface is smooth except for fine lines of growth. Camptonectes sculpture is not present. The texture is not hyaline.

The only known species is *Pectinella sigsbei* (Dall)² which was taken by the *Blake* Expedition in the West Indies, in 158 fathoms.

LISSOPECTEN Verrill, 1897.

Lissopecten (subgenus of *Chlamys*) VERRILL, Trans. Conn. Acad., X, pp. 68, 90, 91, 1897.

Type.—*Lissopecten hyalinus* (Poli).

Shell slightly inequivalve, broadly rounded, not oblique, thin, translucent, nearly smooth. The external sculpture consists of faint, nearly obsolete radial ridges and obscure riblets, but one or both auricles may have a more or less cancellated sculpture. The interior sculpture consists of very distinct, simple, raised ribs. Auricles angular, well-developed. Byssal notch deep. Pectinial teeth prominent. Margin not scalloped, nearly plain and simple.

¹ Trans. Conn. Acad., X, pl. XX, fig. 6.

² Bull. Mus. Comp. Zool., XII, p. 223, pl. IV, fig. 2, 1886.

Although this group agrees with *Amusium* in having internal ribs without corresponding external grooves, it seems to be allied rather to *Chlamys*. It may be regarded as a division of the latter in which the external radial ribs have degenerated.

LEPTOPECTEN Verrill, 1897.

Leptopecten (subgenus of *Chlamys*) VERRILL, Trans. Conn. Acad., X, pp. 69, 89, 91, 1897.

Type.—*Leptopecten monotimeris* (Conrad).

Shell thin, translucent, oblique, broadly rounded, with strong, rounded radial ridges or folds, like corrugations, which appear in reverse on the interior surface. The internal ribs are not angulated by a deposit of shell, nor distinctly thickened. Margin with broad scallops. The exterior surface is covered with fine divergent camptonectes sculpture, both on the ribs and intervals. The ribs do not increase in number with age but become broader and more flattened. Auricles large and broad, thin, corrugated. Byssal notch large and deep. Pectinidial teeth prominent. Hinge-plate thin and but little differentiated. Cardinal ridge thin and small, close to the ligament, crossed by fine incisions.

PLACOPECTEN Verrill, 1897.

Placopecten (subgenus of *Chlamys*) VERRILL, Trans. Conn. Acad., X, pp. 69, 89, 91, pl. XVIII, figs. 1-7; pl. XX, figs. 7, 8, 8a; pl. XXI, figs. 1-2a, 1897.

Type.—*Placopecten clintonius* (Say).

Shell large, compressed, broadly rounded, rather thin, with simple sharp edges, meeting evenly ventrally, but gaping considerably at both ends, especially when adult. Valves only slightly unequal in form, the right one being a little flatter, but they differ in color and somewhat in sculpture, the right one being smoother and paler. Both have fine radial lines or riblets, and they have vermiculated divergent riblets when young. Auricles small, symmetrical, nearly equal. Byssal notch small, simple. Pectinidial teeth generally obsolete, except when young. No internal ribs. Inner surface often with more or less pearly luster and a crystalline structure. Hinge-plate with two feeble, slightly divergent ribs on each end, crossed by fine transverse incisions. The foot¹ is well developed, oblique, slightly narrowed distally and enlarged at the end, where it is divided into two lobes by a rather deep, oblique, longitudinal fissure, so that the lobes can be spread apart or closed at will, thus resembling somewhat the foot of *Ledida*. Toward the base, on the anterior side, there is also a short, deep byssal slit, terminating at a prominent tubercle about the middle of the front side.

¹Trans. Conn. Acad., X, pl. XX, fig. 8.

CYCLOPECTEN Verrill, 1897.

Cyclopecten VERRILL, Trans. Conn. Acad., X, pp. 70, 90, 92, pl. XVI, fig. 1; pl. XIX, figs. 1-4, 1897.

Types.—*Cyclopecten pustulosus* Verrill and *Cyclopecten imbrifer* (Lovén).

Shells thin, rounded, scarcely oblique, with symmetrical auricles and simple margins. The two valves are unlike in sculpture. The right valve is a little flattened and upturned at the flexible margin, so as to fit tightly against the upper valve. The thin lower valve has, in the typical species, regular, thin, elevated, concentric lamellæ, which aid in the adaptation of the edge to that of the upper valve; the margin is usually flattened or bevelled. The upper (left) valve is radially sculptured, rarely smooth; it usually has radial rows of arched scales, pustules, or points, and also concentric raised lines; it is sometimes cancellated. No radial ribs, nor interlocking points at the margin. Auricles well-developed, subequal, angulated and well defined at both ends; byssal notch well-defined; few or no pectinidial teeth. Cardinal folds single, rather feebly developed, often cross-lined. Eyes few. Byssus small, and of few threads.

This genus includes a large number of small species, mostly from deep-water.

HYALOPECTEN Verrill, 1897.

Hyalopecten VERRILL, Trans. Conn. Acad., X, pp. 71, 90, 92, pl. XVIII, fig. 5, 1897.

Type.—*Hyalopecten undatus* Verrill.

Shell compressed, thin, hyaline. Valves nearly equal, with concentric undulations or corrugations, affecting the entire thickness; margins simple; sculpture none, or consisting of fine radial lines on one or both valves, without camptonectes sculpture. Hinge-plate thin and nearly plain; auricles well-developed, unequal; byssal notch distinct.

For the possible relations of this group to the Mesozoic genus, *Synsyclonema*, see the original article.

The species recorded are as follows: *H. dilectus* Verrill and Bush, from 1,813 fathoms, off Marthas Vineyard; *H. fragilis* (Jeffreys), from northern Europe and the Arctic Ocean, and off the United States coast, in 578 to 1,525 fathoms; *H. undatus* Verrill, off the United States coast, in 1,423 fathoms; and *H. pudicus* (Smith), off Marion Island, in 1,375 fathoms.

PARAMUSIUM Verrill, 1897.

Paramusium VERRILL, Trans. Conn. Acad., X, pp. 72, 90, 92, 1897.

Type.—*Paramusium dalli* (Smith).¹

Shell thin, rounded, much compressed; valves nearly equal; sculpture nearly obsolete, different on the two valves; the lower valve with concentric undulations. Auricles very small, equal. Byssal notch and

¹*P. dalli* ranges from the Gulf of Mexico to Barbados, in 218 to 1,591 fathoms.

pectinidial teeth obsolete. The shell has a prismatic structure. Internal liræ and auricular cruræ well-developed.

The structure of the animal was described by Mr. Dall as very different from that of typical *Amusium*. According to his description it has a single pair of gills, with long, simple, separate filaments. The foot is slender, with a byssal groove; the end is much enlarged, with an oblique, expanded, concave terminal disk, striated within. No labial palpi. Ocelli without pigment.

A specimen, well preserved in alcohol, examined by us, had two rows of long, slender, reflected gill-filaments, as usual in this family. They were attached to a broad basal membrane, with a free, lanceolate, posterior portion. Two pairs of broad, foliaceous, incurved palpi, tinged with dark brown. Those of the anterior pair are united into a hood over the mouth; the others are smaller, curved inward, somewhat lanceolate at the tips. No ocelli could be found. The pallial tentacles are all in one row, numerous, of various sizes; from four to six large ones, with as many alternating small ones, correspond to each larger undulation or scallop of the mantle-margin. No guard-tentacles. Muscular pallial border is broad, thickened, radially striated, forming a ridge, as preserved, but not tentaculated. Free portion of rectum long and slender.

A synopsis of the Pectinidæ was recently published by Dr. Frederico Sacco.¹

He recognized three genera: *Chlamys*, *Amusium*, and *Pecten*, with the same types given by Verrill. Under *Chlamys* he gives nine subgenera. Of these, four—*Chlamys* (restricted), *Hinnites*, *Æquipecten*, and *Palliolium*—correspond with the groups of the same name given by Verrill; *Felipes* Locard (type, *pesfelis* L.), *Peplum* Bucquoy, Dantzenberg, and Dollfus, 1889 (type, *inflexum* Poli), *Macrochalmis* Sacco, 1897 (type, *latis-sima* Brocchi), *Flexopecten* Sacco, 1897 (type, *flexuosus* Poli), *Lissochlamis* Sacco, 1897 (type, *excisa* Bronn), are additional to those given by Verrill.

Under *Amusium* he has, besides the typical group, four subgenera. Of these, two are new—*Parramusium* Sacco, 1897 (type, *duodecimlamel-latum* Bronn), *Variamusium* Sacco, 1897 (type, *cancellatum* Schmidt). The two others are *Propeamusium* and *Pseudamusium*.

The three new subgenera of *Pecten* are *Amusiopecten* Sacco, 1897 (type, *burdigalensis* Lamarck); *Oöpecten* Sacco, 1897 (type, *rotundatus* Lamarck); and *Flabelliopecten* Sacco, 1897 (type, *flabelliformis* Brocchi).

¹ Bolletino dei Mus. Zool. ed Anat. Comp., Univ. di Torino, XII, p. 101. It was apparently issued at about the same time as that by Professor Verrill, here abstracted.

CHLAMYS BENEDICTI Verrill and Bush.

(Plate LXXXIV, figs. 1, 2.)

Chlamys benedicti VERRILL and BUSH, in VERRILL, Trans. Conn. Acad., X, pp. 74, 91, 1897.

Shell small, higher than long; anterior auricle much larger than the posterior, with a deep byssal notch in the lower or right valve. The dorsal margin is straight and but slightly oblique; the posterior auricle in the right valve is decidedly angular, with its outer end slightly incurved and serrated by the termination of the radial ribs; the anterior auricle is considerably prolonged, angulated at the upper corner, obtusely rounded at the end and deeply notched where it joins the main shell; it has four strongly marked radiating ribs, besides the dorso-marginal fold; below these there is a slightly concave space corresponding to the byssal notch; on the body of the shell there are from four to seven sharp serrations along the lower margin of the notch. In the upper valve the anterior auricle is broad and decidedly angular, the dorsal and outer margins forming less than a right angle; its surface is covered with five or six strong radiating ribs decussated by more numerous, finer, concentric raised lines. The anterior and posterior margins of the body of the shell slope about equally and form an acute angle; the ventral margin forms a regular semicircular curve. The entire surface in both valves is crossed by strongly raised, rather close, radiating ribs separated by rather wide, deep grooves and are decussated by regular, raised, concentric lines, which are scarcely apparent on the ribs, except on very young shells, but there are rather strong, elevated, spine-like points arranged along the ribs in pretty regular, concentric lines, especially near the margins; these become higher and more pointed anteriorly and are frequently nearly obsolete in the middle portion of the lower valve; the ribs project at the margin as blunt points or serrations; on the inner surface there are radial grooves corresponding to the external ribs. The hinge-margin is thin, with a slender ligamental, submarginal groove and a small, triangular resilial pit in the center. The color is variable; the single valve from station 2571 is uniform lemon yellow; those from the other locality are chestnut or reddish brown and variegated with paler and sometimes white blotches.

Length of the largest specimen, 5.5 mm.; height, 6 mm.; length of dorsal margin, 4 mm.

A few live young specimens, among Foraminifera, stations 2369 to 2374, in 25 to 27 fathoms, and a single valve, station 2571, in 1,356 fathoms, 1885.

This species is a typical *Chlamys*, allied to *C. varia* of Europe, but when compared with young of that species of the same size the radial ribs are found to be fewer and coarser, and there are other differences which render it probably that they are distinct. It differs from the young of *C. islandica* in the number of ribs and shape of the auricles.

It is probable, however, that it grows to a much larger size than any of the specimens obtained.

It is named in honor of Mr. James E. Benedict, for several years zoölogist in charge on the steamer *Albatross*, through whose care and great interest so many small species were brought to light.

CHLAMYS COSTELLATA Verrill and Bush.

(Plate LXXXVI, fig. 6.)

Chlamys costellata VERRILL and BUSH, in VERRILL, Trans. Conn. Acad., X, pp. 75, 91, 1897.

Shell small, thin, translucent, bluish white, covered on both valves with continuous, elevated and somewhat thickened, well-separated, radiating riblets, of which there are more than thirty in the left valve of the largest example. Length of the shell considerably less than its height. Dorsal hinge-margin elongated, especially on the anterior end. In the right valve the anterior auricle is considerably elongated, obtusely rounded or subtruncated at the end, with a wide, angular byssal notch beneath it, having two or three pectinidial teeth; it has a broad, smooth, angular area next the body of the shell, above which there are three well-marked, angular, radial ridges, separated by wider concave interspaces; the posterior auricle is small, triangular, the outer corner forming a little more than a right angle, and the posterior margin nearly straight, without any distinct notch. The dorsal margins of the body of the shell are nearly straight and diverge at less than a right angle; the ventral margin is pretty evenly rounded, a little produced in the middle. The beak is small, acute, appressed, and does not project beyond the margin. The radial ribs are very distinct, clean cut, thickened, rounded at the summit, separated by nearly smooth intervals, two or three times as broad as the ribs themselves; the ribs increase regularly in width from near the umbo to the margin; a few intermediate ridges commence near the margin. The left valve is badly broken; it is, however, somewhat more convex than the other, and the radial ribs are crossed by numerous concentric striations giving them a finely crenulated or beaded appearance; the anterior auricle is broad, triangular, the outer end slightly rounded, with a slight incurved notch below; it is crossed by about six small, radial ribs, similar to those on the body of the shell; raised lines of growth also occur at irregular intervals. Inner surface smooth and lustrous, showing the grooves corresponding to the external ribs and also a very distinct microscopic structure, but it is destitute of radial liræ. Internally, the hinge-margin is thin and narrow, with a sharply impressed, submarginal groove on each side; the resilial pit is excavated in the margin of the hinge itself; the anterior auricle has internal grooves corresponding to the external ribs.

Length of the largest specimen, 6 mm.; height, 6.5 mm.

Three live specimens, at two stations, off the Grand Banks, in 67 to 72 fathoms, 1885-86.

HYALOPECTEN DILECTUS Verrill and Bush.

(Plate XCVII, fig. 9.)

Hyalopecten dilectus VERRILL and BUSH, in VERRILL, Trans. Conn. Acad., X, pp. 80, 92, 1897.

Shell small, thin, fragile, strongly undulated, slightly oblique, with the ventral margin broadly rounded, dorsal margin straight. In the right valve the anterior auricle is rather narrow, elongated, with a deep angular notch beneath; the posterior auricle is shorter, with a prominent dorsal angle which is less than a right angle, owing to the emargination of the posterior end. In the left valve the anterior auricle is broad, with its posterior end nearly rectilinear, and forms a right angle with the dorsal margin; the posterior auricle has a slightly prominent dorsal angle and posterior emargination as in the right valve. The beaks are a little prominent and project somewhat above the dorsal margin, more in the upper or left valve. The surface in both valves is covered with broad and rather regular undulations, which are most prominent in the left valve, and are crossed by regular, well-spaced, thin, raised,¹ radial lines, which become fine and more crowded at the ends of the valve; they are nearly obsolete in the right valve, being represented by microscopic striæ. In both valves the anterior auricle is marked by several fine, rough, radial ridges which are stronger and more numerous in the left valve. The interior is strongly undulated, and the left valve is marked by distinct, radial grooves. Resilium small, central. Color yellow, or dirty white.

Length, 8 mm.; height, the same.

One live, imperfect specimen (No. 52539), station 2570, off Marthas Vineyard, in 1,813 fathoms, 1885.

This species is closely allied to *Hyalopecten fragilis* (Jeffreys) and resembles very nearly his figure,¹ which probably represents a species distinct from the original type described by him, and may be identical with our shell. The latter differs decidedly from the original description of *H. fragilis*. Moreover, we have obtained from several stations a shell of similar size which appears to be the true *fragilis*,² as it agrees closely with the description. *Hyalopecten pudicus* (Smith) from east of Marion Island, in 1,375 fathoms, is a closely related species, as is also *Hyalopecten undatus* Verrill.

These four species agree in having the valves thin and translucent and sculptured with distinct concentric undulations, while the radial sculpture does not form strong ribs. They seem to be related to the genus or subgenus *Synecyclonema* Meek, which was based on a cretaceous species and has not hitherto been reported as still living. But the exact characters of the typical fossil species are not yet known.

¹ Proc. Zoöl. Soc., London, pl. XLV, fig. 1, June, 1879.

²The true *Hyalopecten fragilis* (Jeffreys) was taken at five stations between N. lat. 40° 6', W. long. 68° 1' 30'', and N. lat. 35° 49' 30'', W. long. 74° 34' 45'', in 578 to 1,525 fathoms, 1883-1886.

CAMPTONECTES GRÆNLANDICA (Sowerby) Verrill.

(Plate LXXXV, fig. 7.)

Pecten grænlandicus SOWERBY, Thesaurus Conchyliorum, Pt. II, p. 57, pl. XIII, fig. 40, 1842.—HANLEY, Recent Shells, p. 274, 1842 to 1856.—JEFFREYS, Ann. and Mag. Nat. History, p. 231, 1877.

Pecten grænlandicus G. O. SARS, Moll. Reg. Arct. Norveg., p. 23, pl. 2, figs. 4, a-c, 1878.

Pecten grænlandicus JEFFREYS, Proc. Zool. Soc. London, p. 560, 1879.—VERRILL, Check-list, p. 26, 1879.

Pecten grænlandicus VERRILL, Trans. Conn. Acad., V, p. 581, 1882.

Pecten grænlandicus LOCARD, Campagne du Caudan, Annales de l'Université de Lyon, p. 217, 1896.

Camptonectes grænlandica VERRILL, Trans. Conn. Acad., X, pp. 82, 91, 1897.

The shell is rounded, inequivalved, very thin, hyaline, nearly smooth, often with a violet iridescence when fresh. The left valve is covered, even from the nucleus, with fine microscopic camptonectes sculpture, in the form of thin, raised, divergent riblets, more or less irregular and wavy, most visible by translucency. The left valve sometimes has, also, fine radial striae and delicate lines of growth. The margins are thin and smooth, that of the right valve turns up a little against the other, which is larger, and the valves close very tightly, so that anteriorly there is scarcely any visible gape, even at the byssal notch or at the end of the auricle. The byssal notch is well-marked and the pectinidial teeth are small and few. The byssus is probably very slender. The auricles are not oblique and are nearly equal. The hinge-plate is very thin; the single longitudinal ridge is scarcely visible.

A row of six or seven ocelli can be seen through the shell in alcoholic specimens.

A few live specimens were dredged by the United States Fish Commission at four stations, off Newfoundland Banks, in 130 to 224 fathoms, between N. lat. 47° 40', W. long. 47° 35' 30'', and N. lat. 44° 46' 30'', W. long. 59° 55' 45'', 1884-1886. It is also known from the Arctic Ocean and off northern Europe.

CYCLOPECTEN NANUS Verrill and Bush.

(Plate LXXXV, figs. 2-4.)

Cyclopecten nanus VERRILL and BUSH, in VERRILL, Trans. Conn. Acad., X, pp. 85, 92, pl. XVI, figs. 12-12c, 1897.

Shell small, the breadth and height about equal, the valves nearly equal in size and convexity. Dorsal hinge-margin rather long and straight; auricles relatively large and broad, both ends in the left valve subtruncated or a little convex and forming nearly a right angle with the dorsal margin, and having a small incurved notch, well differentiated from the body of the shell. In the right valve the anterior auricle is narrow, somewhat more elongated, obtusely rounded at the

end, with a sharp, angular, byssal notch beneath it, separated from the body of the shell by a narrow groove. The dorsal margins of the body of the shell are nearly straight and form more than a right angle; the ventral margin is broadly rounded, nearly semicircular, forming a very obtusely rounded angle, where it joins the dorsal margins. Umbos a little prominent, with a small, smooth, rather acute, incurved beak, which projects a little above the hinge-margin. The surface of the left valve is everywhere thickly covered with fine, almost microscopic, radiating striæ, which become a little more distinct on the anterior auricle; slightly raised thin lines of growth are often very distinct on some parts of the shell, especially on the anterior auricle, where they become closer, more regular, and often produce, in crossing the radial striations, a quite regular, microscopic decussation; the sculpture on the posterior auricle is sometimes similar but finer, although in many specimens the surface is nearly smooth or marked only by very fine radial striæ. The right valve is less convex than the left (its ventral edge does not quite reach that of the opposite valve), the umbo is less prominent, the beak less acute, and scarcely projects beyond, and often falls short of, the hinge-margin; the inequality is less marked than in most of the allied species. The body of the shell in this valve is smooth, except for very fine, irregular lines of growth; on the anterior auricle there are from three to six, or more, distinct radial ridges, roughened by conspicuous lines of growth; the margin below the byssal notch is entire, without pectinidial teeth; the posterior auricle is nearly smooth. The internal hinge-plate is thin in the middle, but relatively broad on each auricle, and is crossed by numerous fine, well-marked, transverse striations; these are much more conspicuous than in any of the related species, whether young or old. The resilial pit is small, rounded, situated just under the beak. The inner surface is smooth and glossy, although in fresh specimens the external radiating lines show through by transparency. There are no internal liræ.

The ground color of the right valve is yellowish or grayish white, with more or less numerous light yellowish brown and reddish brown spots or blotches, and sometimes with irregular patches of opaque white; the right valve is white, sometimes with a few yellowish brown spots. Some specimens are nearly destitute of spots.

Length of one of the largest specimens, 7 mm.; height, 6 mm.; dorsal hinge-margin, 4 mm.

It has been taken in considerable numbers, live and dead, at three stations between N. lat. $37^{\circ} 7' 40''$, W. long. $74^{\circ} 35' 40''$, and N. lat. $35^{\circ} 42'$, W. long. $74^{\circ} 54' 30''$, in 43 to 132 fathoms, 1884.

Although very small, this species seems to be adult. It is so distinct from all other species of our coast that a detailed comparison is unnecessary. It resembles the young of *P. clintonus* more than any other native species, but a comparison of specimens of the same size shows marked differences.

CYCLOPECTEN LEPTALEUS Verrill.

(Plate LXXXV, fig. 1.)

Pecten leptaleus VERRILL, Trans. Conn. Acad., V, pp. 232, 281, 1882; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 577, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, p. 221, 1886.

Pseudamysium leptaleus DALL, Bull. U. S. Nat. Mus., No. 37, p. 34, 1889.

Cyclopecten leptaleus VERRILL, Trans. Conn. Acad., X, pp. 85, 92, 1897.

Mr. Dall has expressed a doubt as to this species being distinct from *Pecten imbrifer* Lovén, therefore a very much enlarged figure of the shell is here introduced for comparison.

In addition to the published description, it should be stated that the concentric lines are somewhat thickened and elevated, even where thinnest, and that the beaded character is quite unlike anything found on *C. imbrifer*, or allied species. The beads are closely arranged, elliptical in form, and most elevated at the center, the elevation being often greater than the diameter; the summit is smooth and glassy, so that when viewed from above, under a lens, they often appear to have a central cavity. The radial lines are comparatively very thin and delicate, and not visible, except when considerably magnified. The beaks are more acute than in *C. imbrifer*, and the nucleus smaller and smoother.

Two live specimens, station 2109, off Cape Hatteras, North Carolina, in 142 fathoms, 1883.

CYCLOPECTEN PUSTULOSUS Verrill.

(Plate LXXXV, figs. 5, 6, 10, 11.)

Pecten pustulosus VERRILL, Amer. Journ. Science, V, p. 14, 1873; Trans. Conn. Acad., III, p. 50, 1874.

Pecten hoskynsi var. *pustulosus* VERRILL, Trans. Conn. Acad., V, p. 581, pl. XLII, figs. 22, 22a, 1882 (not pl. XLIV, fig. 11). Not *Pecten hoskynsi* G. O. Sars.

Pecten pustulosus VERRILL, Trans. Conn. Acad., VI, p. 261 (p. 281 in part), 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 557 (in part), pl. XXXI, figs. 142a, b, 1885.

Pecten imbrifer DALL, Bull. Mus. Comp. Zoöl., XII, p. 220 (in part), (not pl. IV, figs. 4a, 4b), 1886; Bull. U. S. Nat. Mus., No. 37, p. 34 (in part), pl. LXIV, figs. 142a, b, 1889 (not pl. IV, figs. 4a, 4b). Not *Pecten imbrifer* Lovén.

Cyclopecten pustulosus VERRILL Trans. Conn. Acad., X, pp. 70, 83, 92, pl. XIX, figs. 3, 4, 1897.

This species has been referred to *Propeamusium hoskynsi* by Jeffreys, and to *Pecten (Cyclopecten) imbrifer* by Dall. It never has the internal ribs, like the former, which it resembles in sculpture. From the latter, as originally described by Lovén, and redescribed and figured by G. O. Sars, it differs especially in the character of the ornamentation of the left valve. The Scandinavian form, according to these authors, has the vesicles much less crowded in each radial row and subconical and mucronate in form; while in ours they are usually

closely crowded, often even in contact in the radial rows, and in form either rounded or elliptical with the longest diameter in the direction of the concentric lines, with the summit evenly rounded, showing no tendency to the subconical or mucronate form. When perfect they resemble small blisters with the surface roughened or minutely granulose under the microscope; when broken or worn off, as frequently happens, the basal part remains in the form of a semicircular or semielliptical, imbricated, arched scale, usually considerably elevated above the surface and connected by very delicate concentric raised lines. The surface of the anterior auricle of the left valve is roughened by close, elevated, concentric lines, and from four to six well-marked radiating ridges or ribs, upon which the concentric lines form regular elevated arched projections, often so crowded as to be imbricated; in some young examples, like the one figured, the concentric lines on the auricle are less crowded and only two or three of the radial ribs are developed; in such examples the vesicles on the body of the shell are relatively fewer, larger, more rounded, and much less crowded in the radial series. In some specimens the posterior margin, below the auricle, is nearly smooth or marked only by the fine lines of growth, while in others, especially larger specimens, this region is covered by rather sharp granules, some of which, toward the ventral margin, change to pointed scales arranged in crowded radial rows. The raised concentric lines on the right valve are generally more or less appressed and sometimes imbricated; toward the ventral margin some of them show very fine microscopic crenulations, which are much less distinct than on *C. imbrifer*, as figured by Sars.

This species is distinct from that figured by Mr. Dall¹ under the name of *C. imbrifer*. His specimen apparently belongs to the following species.

Several live and dead specimens, at eleven stations between N. lat. $44^{\circ} 34'$, W. long. $56^{\circ} 41' 45''$, and N. lat. $39^{\circ} 48' 30''$, W. long. $70^{\circ} 54'$, in $99\frac{1}{2}$ to 547 fathoms, 1872-1885.

CYCLOPECTEN SUBIMBRIFER Verrill and Bush.

(Plate LXXXV, figs. 8, 9.)

Pecten hoskynsi VERRILL, Trans. Conn. Acad., V, p. 581, pl. XLIV, fig. 11, 1882. Not Forbes.

Pecten (Pseudamysium) imbrifer DALL, Bull. Mus. Comp. Zoöl., XII, p. 220 (in part), pl. IV, figs. 4a, 4b, 1886; Bull. U. S. Nat. Mus., No. 37, p. 34 (in part), pl. IV, figs. 4a, 4b, 1889.

Cyclopecten subimbrifer VERRILL and BUSH, in VERRILL, Trans. Conn. Acad., X, pp. 84, 92, 1897.

Shell small, inequivalved, white or grayish white, translucent, length and height nearly equal. Dorsal margin straight. Anterior auricle in the left valve rather large and broad, the outer end obtusely rounded,

¹ Blake Mollusca, pl. IV, figs. 4a, 4b.

covered with small, close, radial ribs and crowded concentric ridges; posterior auricle much smaller, with from one to three faint, radial ridges and many concentric, raised lines, and with its outer end forming less than a right angle, with a slight incurved notch below. In the right valve the anterior auricle has a similar radial sculpture and the byssal notch is rather deep and narrow. The dorsal lines of the body of the shell form rather less than a right angle; the ventral margin forms nearly a semicircle with an obtuse angle where it meets the dorsal outline. Umbos a little prominent; beaks small, acute, smooth, and projecting beyond the margin of the hinge. The surface of the left valve is covered with slightly raised concentric lines, which are interrupted or broken up by small arched scales which are sometimes semicircular, but more frequently somewhat angulated or V-shaped, and usually are separated by intervals about equal to their breadth; these scales vary in number, but are usually arranged in about forty radial rows, and increase regularly in size from the umbos, where they are replaced by thin, slightly raised, radial lines crossing the stronger, more elevated, concentric lines, but not rising into points. In some specimens the radial arrangement is scarcely discernible; the scales appear as irregularities in the concentric lines. The postero-dorsal area below the auricle is nearly smooth, except for the fine lines of growth, but sometimes shows minute granules. The right valve, which is smaller than the left, is covered by fine, thin, close, concentric, raised lines, which sometimes show microscopic striations. The anterior auricle is decussated by from six to eight, or more, small radial ridges, which are crossed by the raised, concentric lines; the latter rise into sharp scales at the dorsal margin; the small posterior auricle has finer concentric lines and only two or three faint, radial ridges.

Comparatively few specimens, at three stations, between N. lat. $42^{\circ} 45' 30''$, W. long. $62^{\circ} 43'$, and N. lat. $39^{\circ} 53' 30''$, W. long. $71^{\circ} 13' 30''$, in 121 to 312 fathoms, 1877-1885.

C. kermadecensis (Smith), from north of Kermadec Islands, in 600 fathoms, is a related species.

PROPEAMUSIUM THALASSINUM (Dall) Verrill.

(Plate LXXXVII, fig. 6.)

Amussium fenestratum VERRILL, Trans. Conn. Acad., V, p. 582, 1882.

Amussium sp. VERRILL, Trans. Conn. Acad., VI, pp. 261, 281, 1884.

Pecten (*Pseudamussium*) *thalassinus* DALL, Bull. Mus. Comp. Zoöl., XII, p. 221, 1886; Bull. U. S. Nat. Mus., No. 37, p. 34, 1889.

Propeamussium thalassinum VERRILL, Trans. Conn. Acad., X, pp. 87, 92, pl. XIX, figs. 5-7, 1897.

Found at thirteen stations, between N. lat. $40^{\circ} 5' 39''$, W. long. $70^{\circ} 23' 52''$, and N. lat. $35^{\circ} 42'$, W. long. $74^{\circ} 54' 30''$, in 43 to 317 fathoms, 1880-1885. South to Barbados, in 22 to 317 fathoms.—Dall.

Family ARCIDÆ.

BATHYARCA Kobelt.

Type.—*Bathyarca pectunculoides* (Scacchi).

Shell oblong, subovate, or rounded, rather thin, usually finely cancellated, with hairy or scaly epidermis, more or less equilateral, frequently slightly inequivalved, with a slight byssal sinus. Byssus very small. Ligamental area lanceolate, longer and narrower behind the beaks, with a sagittate posterior ligament. Hinge-margin nearly straight, usually narrow and edentulous in the middle, with a series of small, oblique, striated and crenulated teeth on each end, the distal ones becoming larger and more oblique; those of the posterior series usually longer and more oblique, or divergent, than those in the anterior.

The animal of *B. pectunculoides* var. *grandis*, preserved in alcohol, has the margin of the mantle plain without ocelli, with a well-developed muscular septum, posteriorly; the foot large and thick, geniculate, pointed posteriorly, with a strong byssal groove and a slender, solid, byssal stem; two pairs of rather small, long, lanceolate palpi; the rectum with a free terminal portion; two pairs of rather large gills, with the posterior end of the stem free for some distance, curved, and tapered to a point, and with the reflected portion of the filament of the same length as the direct; the filaments are very slender, delicate, and soft and but slightly attached to each other.

This division, which is probably of generic value, includes a number of small and mostly deep-water species which have been variously placed by recent authors. Mr. E. A. Smith puts several of them in *Scapharca* with a mark of doubt. Mr. Dall puts two allied species in the Jurassic genus *Macrodon*,¹ with which they do not seem to agree very closely, and mentions the affinity of others to *Barbatia*.

The last group differs in the stout, rough shell, strongly gaping ventrally for the large byssus, and in the character of the teeth and ligament. *Scapharca* has a thick, strongly ribbed, inequivalved shell, a firm byssus, and continuous, strong, lanceolate ligament. *Macrodon* has, on the posterior hinge-plate long, divergent lamellæ, nearly parallel with the dorsal margin.

We would refer the following species to *Bathyarca*.—*B. pectuncu-*

¹The two West Indian species described by Mr. Dall as *Macrodon asperula* and *M. sagrinata*, should, perhaps, form a separate genus, characterized by the few very oblique, sublamellar, posterior teeth and several smaller, nearly transverse anterior ones. It may be designated as *Bentharca*, with *Bentharca asperula* as the type.

These are closely related to one of the Eocene fossil species (*Arca adversidentata*), which Deshayes placed in his group of "Cucullaires," but later writers (Conrad, 1869, Fischer, and others) have taken his first species (*heterodonta*) of that group as the type of the genus "Cucullaria," which differs in having the anterior as well as the posterior teeth long and lamelliform; hence we would associate Tertiary species like *Bentharca adversidentata* with the living deep-water forms.

loides (Scacchi) and its varieties, *grandis* Verrill, *Freilei* Jefeireys, *septentrionalis* Sars, *crenulata* Verrill, *orbiculata* Dall, from off St. Vincent, northward. *B. glacialis* (Gray), Arctic America and Europe. *B. anomala* Verrill and Bush, Gulf of Maine. *B. abyssorum* Verrill and Bush, off Delaware Bay. *B. profundicola* Verrill, from off West Indies, northward. *B. glomerula* (Dall), *B. polycyca* (Dall), *B. eulebrensis* (Smith), off West Indies. *B. inæquisculpta* (Smith), *B. pteroessa* (Smith), Atlantic and Pacific. *B. imitata* (Smith), Pacific.

Bentharca asperula (Dall), and *B. sagrinata* (Dall), are from the West Indies, in deep water.

BATHYARCA ABYSSORUM, new species.

(Plate LXXVI, fig. 9.)

Shell small, short, well-rounded at both ends, swollen, inequilateral, slightly oblique, with a rather long, straight hinge-margin. Umbos large, swollen, prominent. Beaks prominent and curved strongly forward, situated considerably in front of the middle. Surface everywhere covered with nearly equal, delicate, raised, radiating lines and small, rather even, raised lines of growth; these together produce a finely cancellated surface which, when fresh, is covered with a thin brownish-yellow epidermis forming small scale-like points at the intersection of the lines; the surface is also marked with slight, irregular, concentric waves or undulations.

The anterior margin is shorter than the posterior and forms an obtuse, rounded angle at its junction with the hinge-margin; the ventral margin is obliquely curved, most prominent behind the middle, where the curve forms nearly the segment of a circle; posterior margin is very broadly rounded and forms a distinct obtuse angle where it joins the dorsal margin. The ligamental area is lanceolate, moderately large, decidedly wider just in front of the beaks, becoming narrow and pointed posteriorly. The dark ligamental patch is arrow-shaped, situated behind the beaks. The hinge-margin is rather wide and strong, with a small, central edentulous space, mostly behind the beaks. The teeth, which are striated on the sides and crenulated on the edge, are equally and decidedly oblique in the two series; the proximal ones are small and the others increase in size and obliquity to near the end of the series, where one or two of the outermost are decidedly smaller and very oblique. In the largest specimen there are about six teeth in the anterior and eight in the posterior series. The inner surface shows faint radial grooves and ridges, much coarser than the external striæ; there is also a fine, impressed line, with a finely crenulated edge close to the margin.

Length of the largest specimen, 6 mm.; height, 6.5 mm.; thickness, 5.5 mm.; length of the hinge margin, 3.5 mm.

Three specimens were found at stations 2713 and 2714, off Delaware Bay, in 1,825 to 1,859 fathoms, 1886.

This species is allied to *B. glomerula* Dall. The latter differs in having a less rounded form with a longer hinge-margin, more definite terminal angles, and much more numerous and smaller teeth which are nearly continuous. In our specimens of *B. glomerula* of corresponding size, there are about ten teeth in each series and they are about one-half as large. According to Mr. Dall's figures, the umbos of his species are larger than in the more northern form, but our specimens of his species have the umbos smaller than is indicated by his figures. The position of the beaks and form of the ligamental area is nearly the same in both species; but the latter appears to be a little wider in ours and the beaks are a trifle more oblique. The external sculpture is similar but the radial lines are decidedly stronger and less numerous in *glomerula*, and the sculpture is quite different in the two valves, while in ours there is no perceptible difference. *B. inaequisculpta* (Smith) is also a closely allied species which Mr. Dall considers identical with *B. glomerula*. Mr. Smith's figures are quite different from those of Mr. Dall, and also from our West Indian specimens of the latter, and still more different from *B. abyssorum*.

BATHYARCA PROFUNDICOLA (Verrill).

(Plate LXXVIII, fig. 2.)

Arca profundicola VERRILL, Trans. Conn. Acad., VI, p. 439, pl. XLIV, figs. 23, 23a, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, p. 245, 1886.

Macrodon profundicola DALL, Bull. U. S. Nat. Mus., No. 37, p. 42, pl. XLVI, figs. 23, 23a, 1889.

A very few specimens, at three stations, between N. lat. $40^{\circ} 29'$, W. long. $66^{\circ} 4'$, and N. lat. 37° , W. long. $71^{\circ} 54'$, in 1,769 to 2,620 fathoms, 1884 and 1885. Also among Foraminifera, station 2385, N. lat. $28^{\circ} 51'$, W. long. $88^{\circ} 18'$, in 730 fathoms.

BATHYARCA ANOMALA, new species.

(Plate LXXVII, fig. 8.)

Shell small, oblong, inequilateral, much swollen with large prominent umbos, and pointed beaks, curved strongly forward and considerably separated, owing to the unusually wide, lanceolate, ligamental area, which is covered behind the beaks with the remains of a dark thickened ligament. Dorsal margin straight for nearly its entire length; anterior and posterior ends broadly and about equally rounded, the posterior a little the more swollen below and longer; ventral margin broadly rounded, a little prominent in the middle, with a slight byssal indentation in front. Surface everywhere covered with fine, regular, raised, radiating lines which are decussated by finer lines of growth; the rather thin brown epidermis is scaly or chaffy on the radii, especially toward the margins, where it forms minute points. Hinge-margin considerably thickened, increasing in strength toward the ends; in the

middle, where it is narrowest, it is nearly smooth and rounded, with only slight indications of one or two transverse teeth on each side; next these there are two or three somewhat oblique, slightly divergent, irregular, longitudinal, slightly striated and crenulated folds, separated distally by rather deep grooves nearly parallel with the inner margin. The inner edge of the ventral margin is thin and plain.

Length, 8.5 mm.; height, 7 mm.; thickness, 6 mm.

One living specimen (No. 74081) was dredged by the *Bache* at station 52, off Cashes Ledge, in 27 fathoms, 1874.

As only a single specimen has been found, it is possible that it is but an abnormal variety, although it appears to have been healthy and well-grown in every respect. It is related to *B. pectunculoides* (Plate LXXVII, fig. 6), but differs remarkably in the character of the hinge, which has the transverse teeth scarcely discernible, and oblique, irregular folds on the distal parts of the margin, and also in the greater width of the ligamental area.

Family LIMOPSIDÆ.

LIMOPSIS SULCATA, new species.

(Plates XCII, fig. 2; XCV, fig. 9; XCVI, fig. 1.)

Shell very oblique (young specimens are less oblique and in some cases are more nearly circular), broad-ovate, the posterior ventral margin much produced and obtusely rounded; auricles only slightly developed. The dorsal margin is short and straight, with a narrow, smooth area beneath the beaks; the anterior margin is subtruncate, or very obtusely rounded; the ventral margin is oblique, broadly rounded, forming an obtusely rounded angle with the posterior margin, which is strongly sloping and only a little convex. The umbos are small and somewhat prominent; the beaks small, pointed, and curved inward. The entire surface is covered with strongly marked, concentric grooves and prominent rounded, narrow ribs; the latter are crossed by numerous fine, radiating, incised striations, which divide them into beadlike, or squarish, portions, which are most obvious on the middle and posterior parts and become very faint anteriorly. The hinge-margin is much thickened and bears a curved series of rather large, flattened teeth, of which about eight are situated in front of the beaks and about ten behind them; those nearest the center are small; the resilial pit extends upward to the beak in the form of a small triangular depression. The inner surface of the shell is marked by fine, radiating striæ; the margin is thickened and cut away near the edge; no crenulations have been observed in our specimens.

Greatest length, 12 mm.; greatest height, 13 mm.; breadth, 6 mm.

A number of separate valves, at about ten stations, between N. lat. $40^{\circ} 8'$, W. long. $68^{\circ} 45'$, and N. lat. $37^{\circ} 7' 4''$, W. long. $74^{\circ} 35' 40''$, in 64 to 349 fathoms, 1880-1884.

LIMOPSIS MINUTA (Philippi).

(Plates LXXV, fig. 1; LXXVIII, fig. 7.)

Limopsis minuta VERRILL Trans. Conn. Acad., V, p. 576, 1882; VI, p. 280, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 577, 1885.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 258, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, p. 236, 1886; Bull. U. S. Nat. Mus., No. 37, p. 42, 1889.—BUSH, Bull. Mus. Comp. Zoöl., XXIII, p. 235, pl. 1, fig. 8, 1893.—LOCARD, Campagne du *Caudan*, Annales de l'Université de Lyon, p. 198, 1896.

A very common and abundant species, at eighty-two stations, between N. lat. $44^{\circ} 7' 30''$, W. long. $57^{\circ} 16' 45''$, and N. lat. $35^{\circ} 49' 30''$, W. long. $74^{\circ} 34' 45''$, in 116 to 2,221 fathoms, 1880–1887. South to Barbados, in 30 to 2,221 fathoms.—Dall.

LIMOPSIS AFFINIS Verrill.

(Plate LXXV, fig. 2.)

Limopsis affinis VERRILL, Trans. Conn. Acad., VI, p. 442, 1885.

Two live specimens, at station 2092, N. lat. $39^{\circ} 58' 35''$, W. long. $71^{\circ} 30''$, in 197 fathoms, 1883.

LIMOPSIS PLANA Verrill.

(Plate LXXV, fig. 5.)

Limopsis sp. (?) VERRILL, Trans. Conn. Acad., V, p. 280, 1884.

Limopsis plana VERRILL, Trans. Conn. Acad., VI, p. 441, 1882; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 577, 1885.

Limopsis aurita, var. *plana* DALL, Bull. U. S. Nat. Mus., No. 37, p. 42, 1889.

Limopsis plana BUSH, Bull. Mus. Comp. Zoöl., XXIII, pp. 240, 244, pl. II, figs. 19, 20, 1893.

Three live specimens and one valve, at two stations, between N. lat. $38^{\circ} 22'$, W. long. $70^{\circ} 17' 30''$, and N. lat. $37^{\circ} 40' 30''$, W. long. $70^{\circ} 37' 30''$, in 1,825 to 2,221 fathoms, 1883–1886. South to Dominica, West Indies, in 1,131 to 2,221 fathoms.—Dall.

The largest specimen, from station 2710, is 18.5 mm. long; 18.5 mm. high; hinge-margin, 11 mm. long; ligamental area, 3 mm. long.

LIMOPSIS AURITA (Brocchi) Jeffreys.

(Plate LXXV, fig. 3.)

? *Arca aurita* BROCCHI, Conch. foss. Subap., II, p. 485, pl. XI, fig. 9 (t. Jeffreys).

Limopsis aurita JEFFREYS, British Conch., II, p. 161, pl. IV, fig. 3, 1864; V, pl. XXX, fig. 1, 1869.—SMITH, E. A., Report Voy. *Challenger*, Zoöl., Lamellibranchiata, XIII, p. 257, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, p. 237, 1886; Bull. U. S. Nat. Mus., No. 37, p. 42, 1889.—LOCARD, Campagne du *Caudan*, Annales de l'Université de Lyon, p. 197, 1896.

Not *Limopsis aurita*, variety, VERRILL, Trans. Conn. Acad., VI, p. 440, 1885.

One valve, among Foraminifera, station 2385, N. lat. $28^{\circ} 51'$, W. long. $88^{\circ} 18'$, in 730 fathoms. South to Grenada, in 21 to 1,582 fathoms.—Dall.

The northern specimens (*L. profundicola*) formerly referred doubtfully to this species prove to be distinct. The single specimen now included agrees well with a specimen of the fossil form from Europe.

LIMOPSIS PROFUNDICOLA, new species.

(Plates LXXV, fig. 4; LXXXIII, fig. 4.)

Limopsis aurita, variety (?) VERRILL, Trans. Conn. Acad., VI, p. 440, 1885.

Comparatively few specimens, at ten stations, between N. lat. $41^{\circ} 7'$, W. long. $65^{\circ} 26' 30''$, and N. lat. $36^{\circ} 47'$, W. long. $73^{\circ} 9' 30''$, in 1,525 to 1,859 fathoms, 1884-1886.

Family MYTILIDÆ.

CRENELLA FRAGILIS Verrill.

(Plate LXXXIII, figs. 1, 2.)

Crenella fragilis VERRILL, Trans. Conn. Acad., VI, p. 444, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 40, 1889.

One valve and a fragment, station 2265, N. lat. $37^{\circ} 7' 40''$, W. long. $74^{\circ} 35' 40''$, in 70 fathoms, 1884.

GLOMIDÆ, new family.

Glomina VERRILL and BUSH, Amer. Journ. Sci., III, pp. 53, 59, January, 1897.

Shell short, roundish at both ends. Hinge-plate with a row of transverse teeth each side of the middle. Ligament thick, elongated, attached for most of its length to the inner surface of the posterior hinge-plate and running forward in a narrow groove beneath the beaks, so that its anterior portion is external and its thickened posterior portion is partly internal. No pallial sinus. Animal not known.

This group includes, so far as known, only the genus *Glomus* Jeffreys, which has been referred by several writers to the Arcidæ, and by others to the Ledidæ, from both of which it differs widely. Its relations to the Nuculidæ are somewhat uncertain, owing to our ignorance of the soft parts. In the form and position of the ligament it differs entirely from all other genera of Nuculidæ and Ledidæ.

A more mature consideration of this group, since the publication of our former article, leads us to consider it as a family distinct from Nuculidæ.

GLOMUS Jeffreys.

Glomus JEFFREYS, Annals Mag. Nat. Hist., p. 433, November, 1876.—VERRILL and BUSH, Amer. Journ. Sci., III, pp. 53, 59, January, 1897.

Type.—*Glomus nitens* Jeffreys.

Shell thin, smooth, subequilateral, rounded at both ends, with the beaks turned forward. No lunule or escutcheon. Hinge with two series of obliquely transverse teeth; a small lateral tooth may be present.

The following are described species:

G. nitens Jeffreys, North Atlantic (Europe) and from off Marthas Vineyard south to off Rio de la Plata (America); *G. jeffreysi* Smith; *G. simplex* Smith, and *G. inaequilateralis* Smith, West Indies; *G. japonicus* Smith, off Japan.

GLOMUS NITENS Jeffreys.

(Plate XCVII, figs. 1, 2.)

Glomus nitens JEFFREYS, Annals Mag. Nat. Hist., p. 433, November, 1876; Proc. Zoöl. Soc., London, p. 573, pl. XLV, fig. 5, June, 1879.—VERRILL, Trans. Conn. Acad., VI, p. 231, 1884; Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.—SMITH, E. A., Report Voy. Challenger, Zoöl., Lamelli-branchiata, XIII, p. 248, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 46, 1889.—VERRILL and BUSH, Amer. Journ. Sci., III, p. 53, figs. 1, 2, January, 1897.

The specimens which we refer to this species agree closely in size and form with Jeffreys's figures, but there is in both valves a small submarginal lateral tooth just beyond the posterior series of teeth, and in the right valve a similar but less prominent one just beyond the anterior series. These are not mentioned in Jeffreys's description. In the posterior series there are fewer teeth than in his figure and they have an acute, oblique, V shaped outline and are but little raised; in the anterior series there are four larger, oblique teeth which are not so distinctly V-shaped, owing to their oblique position and because the surface of the hinge-plate is turned downward. The posterior ligament is strong, long, wedge-shaped, widest distally where it occupies most of the width of the hinge-plate; the narrow prolongation runs forward under the beaks in a narrow groove. There is a thickened, edentulous space under the beaks, separating the two series of teeth, which has, when highly magnified, a very small, angular notch in the middle of its lower edge, which in our specimen is filled with what appears like the remains of a resilium; there is also a very minute, V-shaped notch in the external margin. The beaks turn forward. The pallial impression is rather indistinct, but appears entire. Interior somewhat lustrous, but not at all nacreous.

Two imperfect specimens, at two stations, off Marthas Vineyard and off Delaware Bay, in 1,544 and 1,608 fathoms, 1883 and 1886. South to Rio de la Plata, in 294 to 1,900 fathoms.—Dall and Smith.

REVIEW OF THE GENERA OF LEDIDÆ AND NUCULIDÆ OF THE ATLANTIC COAST OF THE UNITED STATES.¹

These families are often united by modern malacologists under a single family (Nuculidæ), while others regard them as distinct. They are certainly closely related anatomically, as well as by the structure of the shell. Thus all the members of both families have a single pair of

¹ An abstract of the portion of this article relating to these families was published in the American Journal of Science, III, p. 51, January, 1897.

simple "foliobranchiate" (or protobranchiate) gills; two pairs of large labial palpi, the outer ones furnished with long extensile labial tentacles; a large muscular foot with an expanded, concave, terminal disk, adapted for rapid motions in jumping and swimming, as well as for creeping; and all have two series of transverse or oblique teeth on the hinge-margin. The peculiar structures of foot and gills appear together elsewhere only in the family Solemyidæ, which is evidently a related group, though it lacks hinge-teeth and has a very different shell. As these three families have gills of a peculiar and simple structure, each one consisting of two rows of flat lamellæ, attached to a single stem, they have recently been regarded as forming a special order (Protobranchiata).

This group is of special interest because of its great antiquity. Large numbers of fossil forms very closely allied to existing genera and species occur even in Silurian and Devonian formations.

Thus the common living genera *Nucula* and *Leda* are represented by numerous Devonian species, many of which can not be separated from the recent forms, even as subgenera, by any tangible characters. Other species of the same age, referred to *Paleoneilo*, agree in nearly all essential characters with the living genus *Tindaria*. These fossil shells are generally larger and stronger than the corresponding living species. Many Palæozoic genera which are now extinct were as highly organized and as much specialized as their living allies.

The thin-shelled, strongly siphonate genera, such as *Yoldia*, *Yoldiella*, etc., do not appear so early in geological time and may be regarded as more modern specializations of the *Leda*-like forms. They are also the forms that swim and jump with the greatest activity. Therefore the thin and light character of their shells may be regarded as having been secondarily acquired, partly in consequence of their active movements, in which a heavy shell would be disadvantageous, and partly because the development of long siphons enables them to live concealed much of the time beneath the surface of the soft mud in which they generally live. In *Solemya* the shell is still lighter and thinner, in accordance with more developed swimming habits, combined with burrowing when at rest. Such forms as *Nucula* and *Tindaria*, which have no siphon tubes, must live at or near the surface of the mud, over which they creep with their large expanded pedal disk. These have, for their protection, comparatively solid shells similar to those of Palæozoic species, in form, texture, and sculpture.

The family Nuculidæ differs from Ledidæ mainly in having no siphon tubes, the mantle edges being completely disunited. The Ledidæ are remarkable for the great variations in the structure of the hinge-teeth, ligament, cartilage, and mantle, as well as in the form of the shell. The pallial sinus may be wanting or well developed. Some genera have long united siphons (*Yoldia*); some have shorter ones, more or less separated (*Leda*); while in *Tindaria* there is no true siphon, but only an

effluent orifice differentiated. The ligament may be wholly external, as in *Malletia*, *Tindaria*, etc., or it may be rudimentary and replaced by an internal cartilage or "resilium," or both may coexist in varying degrees of development and degeneration. The hinge-teeth may be very numerous and regularly V-shaped in each series, or they may be comparatively few and irregular, sometimes becoming oblique and lamelliform (*Silicula*). The beaks generally turn backward (*Yoldia*, *Leda*, *Nucula*), but in *Malletia*, *Tindaria*, and some other genera they turn forward. On this account, when there is neither pallial sinus nor external ligament, it is often difficult, if not impossible, to tell which is the anterior end of the shell without the soft parts. Hence many fossil and some recent species have probably been reversed in the descriptions. Thus many of the Palæozoic species referred to *Nucula* are described as having the beaks turned forward, the longer end of the shell being considered posterior, but in modern *Nucula* the beaks turn backward and the shorter end is posterior. Many of the deep-sea species with small, thin shells show no distinct muscular nor pallial scars, which increases this difficulty. When a differentiated external ligament is present, we have assumed that it is posterior to the beaks (opisthodontic), though a narrow extension usually runs under and forward of the beaks in a groove. When the shell of a dimyarian bivalve gapes posteriorly, the existence of a siphon may generally be assumed; for otherwise the internal soft parts would be exposed to enemies. The existence of a posterior rostrum or a protrusion of the posterior margin defined by an inferior emargination indicates the existence of a siphon, or at least an anal tube, but these organs may exist without such modifications of the shell. If these rules be applied to Palæozoic forms we must conclude that the rostrate and subrostrate forms of *Palæoneilo*, etc., had some sort of a siphon, and therefore were not true Nuculidæ.

Numerous Palæozoic species referred to the genus *Palæoneilo* probably belong to or near the *Tindariinæ*. Some of the species¹ from the American Devonian rocks can hardly be distinguished from *Tindaria* by any important structural characters, unless it be the form of the teeth. It is probable that *Nuculites* and several related genera belong near this division, for they have an external ligament and no resilium. In these genera the plain, transverse teeth are very numerous and more simple than in the modern genera, seldom showing any trace of the acute, V-shaped form characteristic of most modern genera, though in some species the teeth are slightly angulated in the middle.

Mr. Dall has proposed the family *Ctenodontidæ*² to include numerous Palæozoic species belonging to *Ctenodonta*, and allied genera, some of which Zittel and others refer to *Arcidæ* on account of their thickened pectunculoid shells. They seem to be allied rather to *Tindariinæ*.

¹ For example see *P. constricta* Hall, *P. plana* Hall in *Palæontology of New York*, V, Pt. I, pp. 333, 334, pl. XLVIII, figs. 1-28, 1885.

² *Trans. Wagner Free Inst.*, III, p. 515, 1895

The Ledidæ, as here understood, were divided into five subfamilies by Fischer, namely:

(1) Cucullellinæ = Ctenodontidæ Dall + *Palæoneilo* and *Cardiolaria*; (2) Sareptinæ (for *Sarepta* only); (3) Ledinæ; (4) Malletinæ (including *Tindaria*); (5) Lyrodesmatinæ (for ancient fossil forms like *Lyrodesma*, but including the living genus *Phaseolus* or *Silicula*). An additional group was formed for some other doubtful fossil genera. The second of these groups is not well founded, for *Sarepta* agrees closely with *Yoldia*, except in the alleged absence of a pallial sinus, but its gaping shell indicates a siphon tube. The fourth should not include *Tindaria*, which lacks the pallial sinus and siphon tubes characteristic of the rest of the group and should be taken as the type of a new subfamily. The fifth should not include *Phaseolus*, which differs widely from the fossil forms and belongs in the Ledinæ. The other genera of this group are referred to Trigoniadæ by other authors, and that would seem to be a more correct arrangement.

Family NUCULIDÆ.

NUCULINA d'Orbigny, 1845.

Pleurodon S. WOOD, 1840.

Nuculina D'ORBIGNY, 1845.

Nucinella S. WOOD, 1848.

Nuculina VERRILL and BUSH, Amer. Journ. Sci., III, pp. 53, 59, January, 1897.

We have included *Nuculina* in the Nuculidæ with some doubt, because authors differ as to its structure. Some state that its ligament is wholly external and others to the contrary. Fischer places it in the Arcidæ, near *Limopsis*, but it has no ligamentary area.

Mr. Dall kindly forwarded to us excellent unpublished figures of two American species of this genus. In these the thickened ligament is external to the hinge-plate, on the end of the shell which is destitute of a lateral tooth, and is the shorter (posterior?). The beaks turn toward this end. Mr. Dall states that the shells are not distinctly nacreous within.

The following are some of the known species:

N. miliaris Deshayes; *N. ovalis* S. Wood; *N. calabra* Seguenza, fossil; *N. munita* Carpenter, from the Catalin Islands; *N. sulcata* A. Adams, from Korean Straits; *N. adamsi* Dall, from Florida and the West Indies.

NUCULA Lamarck, 1799.

Nucula LAMARCK, Prodrôme d'une Nouv. cl. des Coquilles, p. 87, No. 104, 1799.

Nuculana LINK, Beschr. Rost. Samml., p. 155, 1807 (not of Adams, 1858, nor of Harris, 1897).

Nucula DALL, Bull. Mus. Comp. Zoöl., XII, p. 245, 1886.

Type.—*Nucula nucleus* Lamarck.

Nuculana (Link) was an exact synonym or variant of *Nucula*, of earlier date, as the description plainly shows. There was, therefore,

no valid excuse for applying it to a different group (*Leda*), that had already received a valid name, as was done by H. and A. Adams.

That a species belonging to *Leda* was mentioned by Link does not alter the case, for all the species of *Leda* and *Yoldia* then known were referred to *Nucula* by Lamarek and all other conchologists.

NUCULA PROXIMA Say, variety OVATA, new.

(Plates LXXXI, fig. 6; LXXXVIII, fig. 5.)

We designate by this name a single specimen which differs so widely in form from the ordinary type of *Nucula proxima* that it could well be taken for a distinct species if it had occurred in large numbers or in a remote locality. It is broad-ovate or elliptical in form and much less angular and oblique than the typical *proxima*. It is decidedly compressed with the umbos much less prominent than usual. The surface is glossy, grayish white, marked with distinct lines of growth and microscopic radiating striae. The anterior end is evenly rounded and more produced than in *proxima*; the ventral margin is broadly and evenly rounded; the posterior end is obtuse, slightly produced and scarcely angulated; the postero-dorsal margin is convex and slopes much less rapidly than in *proxima*, so that the posterior end is more evenly rounded and broader. Internally the margin is plain. The hinge-teeth are much as in *proxima*, but the two series are less curved and meet in a broad angle.

Length, 3.5 mm.; height, 3 mm.

One live specimen (No. 73467), station 863, in Vineyard Sound, off Cuttyhunk, in 18 fathoms, 1880.

NUCULA SUBOVATA, new species.

(Plates LXXXI, fig. 8; LXXXIII, fig. 5.)

Shell small, broad-ovate, with somewhat prominent umbos, and rather acute, somewhat prominent beaks behind the middle. Surface smooth and lustrous, covered with rather regular, concentric lines of growth, which are scarcely visible to the naked eye. Epidermis thin, pale yellowish green. The antero-dorsal margin is nearly straight at first; then, forming a convex curve, slopes gradually to the bluntly rounded anterior end which is somewhat produced but not angulated; the postero-dorsal margin is convex, sloping rapidly, and forms a slight rounded angulation in the middle of the posterior end, where it joins the broadly rounded, ventral margin. Hinge-margin rather broad and strong in proportion to the size of the shell, with a moderately large rounded, slightly oblique chondrophore projecting considerably within the margin. The portion of the hinge-plate behind the beaks is considerably shorter than that in front and bears about six, strong, V-shaped teeth of which the two distal ones and the two proximal ones are much smaller than the others; in front of the beaks it is broad and

strongly curved, and bears about nine broad, elevated, strong, transverse teeth of which five or six in the middle are much larger than the others; above these the outer hinge-margin is somewhat expanded and everted. There is a thin, continuous ligament both before and behind the beaks. Epidermis thin, pale greenish yellow. The inner ventral margin is thin and plain.

Length, 4.9 mm.; height, 3.9 mm.

Some of the smaller specimens have a narrower and less thickened hinge-plate with the teeth more delicate than in the type.

Four specimens, at four stations, between N. lat. 40° , W. long. $71^{\circ} 14' 30''$, and N. lat. $37^{\circ} 8'$, W. long. $74^{\circ} 33'$, in 157 to 444 fathoms, 1881-1885.

This species has some resemblance to *N. tenuis*, but it is much less oblique and more elongated in form, and is less inequilateral, the posterior end not being subtruncated, while the anterior end is narrower, relatively shorter, and much less oblique. The hinge-margin is also different; the teeth are fewer and much stronger, and the hinge-margin much broader, while the chondrophore is smaller, more rounded, much less oblique, and projects freely from the inner hinge-margin instead of being united closely to it.

It also bears some resemblance in form to *Nucula pernambucensis* Smith,¹ but there are marked differences in the hinge and number of teeth.

NUCULA GRANULOSA Verrill.

(Plates LXXXI, fig. 2; LXXXVIII, fig. 8.)

Nucula granulosa VERRILL, Trans. Conn. Acad., VI, p. 280, 1884; Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 42, 1889.

Taken at about sixteen stations, between N. lat. $41^{\circ} 53'$, W. long. $65^{\circ} 35'$, and N. lat. $38^{\circ} 36' 3''$, W. long. $73^{\circ} 6'$, in 384 to 1,061 fathoms, 1880-1886.

NUCULA VERRILLII Dall.

(Plate XCV, fig. 10.)

Nucula trigona VERRILL, Trans. Conn. Acad., VI, p. 438, 1885 (not Bronn, 1849, not Seguenza, 1877).

Nucula verrillii DALL, Bull. Mus. Comp. Zoöl., XII, p. 248, 1886; Bull. U. S. Nat. Mus., No. 37, p. 42, 1889; Proc. U. S. Nat. Mus., XII, p. 257, pl. xiv, fig. 4, 1889.—BUSH, Bull. Mus. Comp. Zoöl., XXIII, pp. 240, 243, pl. i, fig. 6, 1893.

Comparatively few specimens, at six stations, between N. lat. $39^{\circ} 43' 45''$, W. long. $70^{\circ} 7'$, and N. lat. $36^{\circ} 47'$, W. long. $73^{\circ} 9' 30''$, in 1,140 to 1,825 fathoms, 1884-1886. South to Yucatan, in 430 to 1,685 fathoms.—Dall.

¹Report Voy. Challenger, Zoöl. Lamellibranchiata, XIII, p. 227, pl. xviii, figs. 10-10a, 1885.

NUCULA CANCELLATA Jeffreys.

(Plates LXXXI, fig. 3; LXXXVI, fig. 5.)

Nucula cancellata VERRILL, Trans. Conn. Acad., VI, pp. 231, 280, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 42, 1889; Proc. U. S. Nat. Mus., XII, p. 258, 1889.

A very abundant species, at forty-four stations, between N. lat. 42° 47', W. long. 61° 4', and N. lat. 37° 27', W. long. 73° 33', in 384 to 2,033 fathoms, 1883–1887. South to off Tobago, West Indies, in 880 fathoms.—Dall.

Family LEDIDÆ.¹

Subfamily LEDINÆ.

LEDA Schumacher, 1817.

Leda VERRILL and BUSH, Amer. Journ. Sci., III, pp. 54, 62, January, 1897.
Nuculana HARRIS, Cat. British Museum, p. 348, 1897 (not Link, 1807).

Type.—*Leda rostrata* (Montagu, 1808).

This genus has been variously extended and restricted by authors, and several subgeneric and sectional groups have been proposed. In the more extended sense it is scarcely capable of a definition that will distinguish it from *Yoldia*, etc.

We proposed, therefore, to restrict it to the typical species, such as *L. cuspidata* Gould, *L. caudata* (Donovan), *L. pernula* (Müller), *L. tenuisulcata* (Couthouy), and many others closely related. These have a long, tapered, bicarinate rostrum, and well-developed siphon tubes, partially united. The palpal tentacles are long, flat, tapered, and arise external to the bases of the outer palpi, which are broad with slender, acute, posterior tips.

Mr. Harris quotes *rostrata* Linnæus as the type of his *Nuculana*, but no such species occurs until Gmelin's edition, 1790; *rostrata* Chemnitz, 1784, used by Schumacher as the type of *Leda*, is now considered the same as *fluviatilis* Sowerby and also Schreter, 1779; *rostrata* Lamarck, 1819, is the same as *pernula* Müller, 1774 or 6?, so that in using *rostrata* Montagu, 1808, we avoid confusion of names without leading to any misunderstanding of the form of the shell, for all of the above species have the same rostrated form.

LEDA BUSHIANA Verrill.

(Plates LXXIX, fig. 8; LXXXII, fig. 9.)

Leda bushiana VERRILL, Trans. Conn. Acad., VI, pp. 229, 280, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 44, 1889.

A few specimens, off Cape Hatteras, North Carolina, in 516 fathoms, 1883. South to Florida Straits, in 120 to 516 fathoms.—Dall.

¹ *Nuculanidae* Harris, Australian Ter. Moll., Cat. British Museum, p. 348, 1897.

LEDA PERNULA (Müller).

(Plate LXXXII, fig. 2.)

Leda pernula G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 35, pl. 5, figs. 1 a-d, 1878.—JEFFREYS, Proc. Zool. Soc., London, p. 574, June, 1879.—VERRILL, Proc. U. S. Nat. Mus., III, p. 401, 1881; Trans. Conn. Acad., V, p. 572, 1882; not VI, p. 280, pl. XXX, figs. 14, 14a, 1884.—Not DALL, Bull. U. S. Nat. Mus., No. 37, pl. XLV, figs. 14, 14a, 1889.

Found at a number of stations between N. lat. $46^{\circ} 23'$, W. long. $52^{\circ} 45'$, and N. lat. $37^{\circ} 8'$, W. long. $74^{\circ} 33'$, in 25 to 471 fathoms, 1872-1885.

LEDA CAUDATA (Donovan).

(Plate LXXXII, fig. 1.)

Arca caudata DONOVAN, British Shells, pl. LXXVIII; Chenu ed., p. 50, pl. XVII, figs. 8-12.

Leda caudata LOVÉN, Ind. Moll. Scand., p. 34.—GOULD, Rep. on Invert. of Mass., Binney's ed., p. 165, fig. 471, 1870.—TRYON, Amer. Mar. Conch., p. 182, pl. XXXVIII, figs. 494, 495, 1873.

Leda pernula VERRILL, Trans. Conn. Acad., V, p. 572, 1882, in part; VI, p. 280, pl. XXX, figs. 14, 14a, 1884.—DALL, Bull. U. S. Nat. Mus., No. 37, pl. XLV, figs. 14, 14a, 1889.—(?) BUSH, Bull. Mus. Comp. Zool., XXIII, p. 234, 1893.

Leda caudata VERRILL and BUSH, Amer. Journ. Sci., III, p. 54, fig. 19, January, 1897.

This deeper-water form, previously identified as *Leda pernula*, was found at a very few stations between N. lat. $42^{\circ} 57'$, W. long. $69^{\circ} 50'$, and N. lat. $37^{\circ} 16' 30''$, W. long. $74^{\circ} 20' 36''$, in 102 to 641 fathoms, 1874-1885.

LEDELLA Verrill and Bush, 1897.

Junonia SEGUENZA, Nuclidi terziarie merid. d' Ital., R. Acad. Lincei, p. 1175, 1877 (not of HÜBNER).

Ledella VERRILL and BUSH, Amer. Journ. Sci., III, pp. 54, 62, January, 1897.

Type.—*Ledella messanensis* (Seguenza).

This group includes a large number of small species, both living and fossil, in which the shell is rather short, usually ovate or swollen, with a small, acute or subacute unicarinate rostrum, situated medially or sub-medially, and defined below by an emargination or undulation in the postero-ventral margin. The postero-dorsal margin is convex. The escutcheon or ligamental area is very distinctly defined by the carina, but is not sunken. The chondrophore is usually small but distinct. The siphon tubes are separate, at least in some species. It includes numerous minute tertiary species referred by Seguenza to the section of *Leda* named by him *Junonia*, and also a considerable number of recent deep-water species generally described by authors under *Leda*. As the name *Junonia* was preoccupied, the group, which seemed to be of generic value, required a new name.

The following species appear to belong here:

L. seminula (Seguenza), *L. nicotæ* (Seguenza), *L. peraffinis* (Se-

guenza), *L. rectidorsata* (Seguenza), *L. confusa* (Seguenza), fossil; *L. solidula* (Smith) and *L. semen* (Smith), from off Brazil; *L. confinis* (Smith), off the Azores; *L. inopinata* (Smith), *L. prolata* (Smith), and *L. ultima* (Smith), from the Pacific; *L. messanensis* (Seguenza), from off the Barbados, northward; *L. messanensis* (Seguenza) var. *sublevis* Verrill and Bush, off Delaware Bay, northward; and *L. parva* Verrill and Bush, off Marthas Vineyard.

LEDELLA MESSANENSIS (Seguenza).

(Plate LXXXI, fig. 9.)

Leda acuminata JEFFREYS, Ann. Mag. Nat. Hist., p. 69, July, 1870 (not VON BUCH).—SEGUENZA, *Nuculidi terziarie merid. d' Ital.*, R. Acad. Lincei, 1877, p. 1175, pl. III, figs. 15, 15a, 15e.

Leda messanensis JEFFREYS, Proc. Zoöl. Soc. London, p. 576, June, 1879.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 237, 1885.—DALL, Bull. Mus. Comp. Zoöl., XII, p. 249, 1886; Bull. U. S. Nat. Mus., No. 37, p. 44, 1889.

The shell which is here regarded as the true *messanensis* is small, swollen, ovate, nearly equilateral, with a distinct, short, oblique rostrum bent downward at the tip and separated from the body of the shell by a distinct depression and marginal indentation. The shell is thick and solid for so small a species; its surface is covered with fine, regular, raised, thin, concentric lines separated by wider concave grooves. The hinge-margin is thick, strong, with about seven or eight, mostly strong, nearly erect, and not crowded, teeth in each series. The chondrophore is relatively large, triangular, and projects on the inner margin. The epidermis is pale yellow. According to Jeffreys the siphon tubes are long and separate.

Length, about 2.6 mm.; height, about 2 mm.

A few specimens, at three stations between N. lat. 38° 29', W. long. 73° 9', and N. lat. 37°, W. long. 71° 54', in 965 to 2,620 fathoms, 1884-85. South to the Barbados, in 32 to 2,033 fathoms.—Dall.

LEDELLA MESSANENSIS (Seguenza) variety SUBLEVIS, new.

(Plate LXXXI, fig. 7.)

Yoldia messanensis, variety VERRILL, Trans. Conn. Acad., VI, pp. 227, 280, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.

Ledella messanensis, variety VERRILL and BUSH, Amer. Journ. Sci., III, p. 60, fig. 13, January, 1897.

This variety differs from the form above described, principally in having the concentric sculpture wholly or partially obsolete and in its somewhat more elongated form. It has nine or ten teeth in each series, due perhaps to the larger size of the specimen.

Comparatively few specimens, at thirteen stations, between N. lat. 42° 47', W. long. 61° 4', and N. lat. 38° 20', W. long. 70° 8' 30'', in 1,188 to 2,033 fathoms, 1883-1886.

LEDELLA PARVA Verrill and Bush.

(Plate LXXXI, fig. 1.)

Ledella parva VERRILL and BUSH, Amer. Journ. Sci., III, p. 54, fig. 18, January, 1897.

Shell minute, narrow-ovate, the anterior end the longer and obtusely rounded, and the posterior end with a short, subtruncate, median rostrum. Umbos somewhat swollen; beaks a little prominent and turned slightly backward. The surface is nearly smooth, showing only microscopic lines of growth. The antero-dorsal margin is elongated, slightly convex, and slopes very gradually to the rounded anterior end; the ventral margin is broadly and evenly convex, but somewhat pinched up posteriorly to form a slight emargination below the rostrum, which is short, narrow, subtruncate at the tip, and is defined by a slight, inconspicuous ridge; the postero-dorsal margin is nearly straight and slopes rapidly to the upper angle of the rostrum. The hinge-plate is strong, considerably thickened, with a very obtuse angle at the beak; the anterior portion is the longer with the inner margin convex, and the posterior portion is the wider, more oblique, with the inner margin strongly concave; the plain outer margin is sharp and projects considerably above the teeth which are strong, stand nearly erect, and are less V-shaped than usual. There are about fifteen in the anterior series, of which three or four proximal ones are quite small, and nine stouter ones in the posterior series, including one very small one next the beak. The chondrophore is rather small and deep with a distinctly projecting inner edge.

Length, 3 mm.; height, 2 mm.

One valve (No. 78365), station 2689, off Marthas Vineyard, in 525 fathoms, 1886.

This species seems to be closely allied to *L. semen* (Smith) from off the coast of Brazil (Voyage of the *Challenger*), but that species, although of the same size, has fewer teeth, nine of which are said be anterior and twelve posterior.

PORTLANDIA Mörch, 1837.

Portlandia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 54, 62, January, 1897.

Type.—*Portlandia arctica* (Gray) 1819 = *Leda portlandica* (Hitchcock).

We consider this a distinct genus, but would restrict it to the original type, unless a few species, which we have not seen, should prove to belong to it. In any case it does not appear that any of the northern species of Europe and America that have been referred to it are really closely allied to the type. In many respects this genus is intermediate between *Leda* and *Yoldia*. In its closed shell, definite rostrum, etc., it agrees more nearly with the former, but in general outline, with the latter.

YOLDIA Möller, 1842.

Yoldia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 55, 62, figs. 12, 16, January, 1897.

Type.—*Yoldia hyperborea* Torrell = *Yoldia arctica* Möller (not Gray).

We have restricted this genus to the typical forms, such as *Y. limatula* (Say), *Y. sapotilla* (Gould), *Y. myalis* (Couthouy), and many closely allied foreign species.

These have a nearly smooth, compressed, lanceolate, gaping shell, more or less prolonged and tapered posteriorly, with a poorly defined, wide rostrum, generally without carinations. The external ligament is marginal, feebly developed, continuous under the beaks, and not much differentiated from the general epidermis. The chondrophore is large, concave, and projects within the margin. The pallial sinus is large and deep. The siphon tubes and posterior pallial tentacle are long. The palpal tentacles are long and tapered; in life they may extend nearly to the end of the expanded siphon.

ADRANELLA, new subgenus of *Yoldia*.

Type.—*Adranella casta*, new species.

This subgenus is allied to *Yoldia*, but is distinguished by its oblong-ovate, compressed form, with a broadly rounded, posterior end, having a very small, nearly obsolete, rostrum. Surface sculptured with distinct, raised, concentric lines. Hinge-plate and teeth strong. Resilium occupying a distinct pit in the apex of a large shelf-like, triangular chondrophore.

YOLDIA (ADRANELLA) CASTA, new species.

(Plate LXXX, fig. 4.)

Shell small, oblong-ovate, somewhat compressed, inequilateral, with the posterior end a little the longer and considerably the broader. Umbos small; beaks curved inward and slightly backward. Antero-dorsal margin slightly concave near the beak, a little convex opposite the distal teeth; anterior end a little narrowed, obtusely rounded; ventral margin broadly and evenly rounded with a very faint undulation posteriorly; postero-dorsal margin a little convex, sloping less than the anterior, and turning up at the end so as to form a slight, hardly distinct rostrum. The hinge-plate is rather large and thick, especially distally on each side, becoming narrow and turning upward at the beak, where it is interrupted by a small, rather deep resilial pit, which is bordered interiorly by a thickened extension of the hinge-margin forming a sort of shelf, the whole constituting a broadly triangular chondrophore with the pit near its apex. The anterior series of teeth contains twelve, of which three or four proximal ones are very small, and form a series which curves upward, exterior to the chondrophore, and terminates at the superior margin of the shell; the teeth

become large, strong, and thick distally, with broad V-shaped bases separated by deep pits. In the posterior series, which is a little the longer, there are eleven teeth corresponding in form and arrangement with those of the anterior series. The exterior surface is regularly sculptured with prominent, sharp, concentric, raised lines separated by wider intervals. Interior very glossy. Muscular scars and pallial line not visible. Exterior sculpture clearly seen through the shell.

Length, 4.2 mm.; height, 2.8 mm.

One valve, among Foraminifera, station 2150, N. lat. $13^{\circ} 34' 45''$, W. long. $81^{\circ} 20' 10''$, in 382 fathoms, 1884.

ORTHOYOLDIA Verrill and Bush, 1897.

Orthoyoldia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 55, 62, January, 1897.

Type.—*Orthoyoldia scapina* (Dall).

Shell oblong, gaping, blunt or rounded at both ends, without a distinct rostrum; no carina. Pallial sinus large and broad. Teeth numerous in both series. *O. scapina* (Dall), from off Brazil and *O. solenoides* (Dall) from the West Indies.

MEGAYOLDIA Verrill and Bush, 1897.

Megayoldia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 55, 62, fig. 17, January, 1897.

Type.—*Megayoldia thraciæformis* (Storer).

We have established a new generic group for this large and well-known species, which has sometimes been referred to *Yoldia* and sometimes to *Portlandia*. No closely allied species is known. It is probably the largest known species of this family and is remarkable for its broad, short, compressed form, with a very short, blunt, indefinite, postero-dorsal rostrum, and with a low radial ridge, ending in a postero-ventral marginal lobe. The chondrophore is remarkably large and strong, concave, striated within, and projects much within the margin of the hinge-plate. The pallial sinus is large and deep. In outline it somewhat resembles typical *Portlandia*, but differs in being broader, flatter, and gaping at both ends, and in having a strongly developed external ligament. From *Yoldia* it also differs in the last character, as well as in outline, but agrees with it in its compressed gaping shell.

The postero-ventral margin of the mantle forms a pouch-like protrusion, corresponding to the radial ridge. The siphon tubes are long and united; the posterior pallial tentacle is long and slender. The palpi are very large. The palpal tentacles originate from the body-wall at the base of the outer palpi; they are long and thick, with a large furrow on one side.

MICROYOLDIA Verrill and Bush, 1897.

Microyoldia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 56, 62, January, 1897.

Type.—*Microyoldia regularis* (Verrill).

Shell small, tightly closed, veneriform, with the anterior end shortest and with the beaks turned forward. A posterior marginal ligament in a distinct groove, continued under the beaks. Hinge-plate and teeth rather strong; the anterior series of teeth the shorter, forming a marked angle with the posterior series. Resilium supported by a relatively large and strong chondrophore, placed on the surface of the hinge-plate, distinctly behind the beaks and at the proximal end of the posterior series of teeth. Pallial line indistinct.

The curious little shell for which this genus is proposed is remarkable for its form and the size and position of the cartilage and chondrophore, as well as for its few blunt teeth. If we are correct in our conclusions as to the anterior and posterior ends, the beaks turn forward as in *Tindaria*. The principal reason for considering the longer end posterior is the existence of a well-formed ligament and groove along that end and not on the shorter one.

MICROYOLDIA REGULARIS (Verrill).

(Plate LXXVIII, figs. 5, 6.)

Yoldia regularis VERRILL, Trans. Conn. Acad., VI, pp. 228, 279, 1884.

Microyoldia regularis VERRILL and BUSH, Amer. Journ. Sci., III, p. 56, figs. 5, 6, January, 1897.

This species closely resembles the very young of *Megayoldia thraciaciformis* (Storer) Verrill and Bush, in the character of the hinge. Specimens of the latter measuring 3.5 mm. in length have the relatively large, concave, cartilage-plate just before the beaks, which curve strongly backward and are nearer the center of the shell, and the teeth are more numerous and more slender.

In *M. regularis* the shell is cordate-ovate or veneriform. The beaks curve strongly toward the short (anterior?) end. There is on this end a sunken lunular area defined by a slight groove which indents the hinge-margin. The anterior (?) part of the hinge-margin is thickened and incurved along the lunule and bears an inner ridge and four or five, small, blunt teeth of which the proximal two project above the margin in a dorsal view, the others are low and rather obscure. Under the beak the hinge-plate is thickened, sinuous, edentulous for a short distance; back (?) of this there is a large, thick, oblique, concave chondrophore which occupies the whole breadth of the hinge-margin and projects inward beyond it as a shelf-like border; beyond this there is a series of six or seven prominent, blunt teeth. The external ligament lies in a distinct groove along a large part of the edge of the longer (posterior?) dorsal margin and runs under the beak, but fades out in front of it. The pallial sinus is not visible, consequently it is not possible to decide which is the anterior end.

But one specimen from station 199, off Thatchers Island, in 98 fathoms, 1878, has been referred to this species, besides the type specimens (No. 38420) station 1093, off Marthas Vineyard, in 349 fathoms, 1882.

YOLDIELLA Verrill and Bush, 1897.

Yoldiella VERRILL and BUSH, Amer. Journ. Sci., III, pp. 55, 63, January, 1897.

Type.—*Yoldiella lucida* (Lovén).

This group includes a large number of small, mostly deep-sea species with glossy, iridescent, ovate, and usually wedge-shaped shells, nearly always having a slight antero-ventral sinuosity, which feebly defines an obscure, blunt, rostral region, without any definite carination. The shells do not gape, but close tightly except that at the rostral angle of some species there may be a slight divergence. The internal cartilage, which is often relatively large, occupies a simple notch which interrupts the hinge-margin more or less completely and generally shows externally in a dorsal view; the notch usually terminates within, on the inner or inferior surface of the hinge-plate and is often bounded within by a slight ridge. A weak external ligament is present on the postero-dorsal margin. A relatively small pallial sinus has been observed in several of the species, but is usually indistinct. The siphon tubes, as observed in a few of the species, are slender and united for more than half their length.

The following are some of the species: *Y. lucida* (Lovén) Verrill and Bush, *Y. iris* Verrill and Bush, and var. *stricta* Verrill and Bush, *Y. inflata* Verrill and Bush, *Y. inconspicua* Verrill and Bush, and *Y. jeffreysi* (Hidalgo) Verrill and Bush, off Cape Hatteras, North Carolina, northward; *Y. dissimilis* Verrill and Bush, north of Cape Hatteras, North Carolina, northward; *Y. fraterna* Verrill and Bush, off Chesapeake Bay, northward; *Y. minuscula* Verrill and Bush, and *Y. subequilatera* Verrill and Bush, off Delaware Bay, northward; *Y. frigida* (Torell) Verrill and Bush, and *Y. curta* Verrill and Bush, off Marthas Vineyard, northward; *Y. subangulata* Verrill and Bush, and *Y. lenticula* (Möller) Verrill and Bush, var. *amblia* Verrill and Bush, Gulf of Maine; *Y. expansa* (Jeffreys) Verrill and Bush, off Grand Banks; *Y. pachia* Verrill and Bush, southern; *Y. hoylei* (Smith) Verrill and Bush, North Pacific.

YOLDIELLA LUCIDA (Lovén) Verrill and Bush.

(Plates LXXVII, fig. 2; LXXX, fig. 3.)

Yoldia lucida LOVÉN, Index Molluscorum, p. 34, 1846.

?*Leda obesa* STIMPSON, Proc. Boston Soc. Nat. Hist., IV, p. 113, 1851; Shells New Eng., p. 10, pl. II, fig. 1, 1851.

Leda lucida JEFFREYS, British Conchology, V, p. 173, pl. C, fig. 1, 1869.

Yoldia obesa GOULD, Rep. on Invert. of Mass., Binney's ed., p. 155, fig. 463, 1870.

Leda obesa TRYON, Amer. Mar. Conch., p. 184, pl. XXXVIII, figs. 500, 501, 1873.

- Yoldia obesa* VERRILL, Amer. Journ. Sci., VII, pp. 46, 412, 503, 1874.—SMITH and HARGER, Trans. Conn. Acad., III, pp. 18, 23, 1874.—VERRILL, Explorations Casco Bay, pp. 352, 368, 1874; Invert. Anim. Vineyard Id., p. 396, 1874.
- Portlandia lucida* G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 37, pl. 4, figs. 8a, 8b, 1878.
- Leda lucida* JEFFREYS, Proc. Zool. Soc., London, p. 578, 1879.
- Yoldia lucida* VERRILL, Trans. Conn. Acad., V, pl. XLIV, fig. 1, 1882; VI, p. 279, 1884 (in part); Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (in part).—BUSH, Bull. Mus. Comp. Zool., XXIII, p. 233, 1893.
- Yoldiella lucida* VERRILL and BUSH, Amer. Journ. Sci., III, p. 55, fig. 14, January, 1897.

Shell small, swollen, subovate, with a posterior angle, smooth, or more or less striolate, iridescent. The umbos are but little prominent, in front of the middle; the beaks interrupted or obliterated by the dark central cartilage which occupies a relatively large notch intersecting the entire thickness of the hinge-margin. The antero-dorsal margin is convex with the edge a little expanded; it slopes rapidly from the beak to the anterior end which is obtusely rounded; the ventral margin is hardly and regularly curved nearly to the posterior end where there is a slight protrusion corresponding to a faint undulation of the surface; the posterior end is somewhat wedge-shaped, a little compressed and tapered, and makes a distinct but obtuse angle where it joins the dorsal margin in line with a rounded posterior ridge running from the convex part of the umbos; just below the angle the margin is usually convex or subtruncate and without any definite lower angle; the posterior dorsal margin slopes less rapidly than the anterior, is nearly straight with the edge compressed and a little expanded into a thin keel which is usually slightly convex in the middle. The hinge-margin is strong, somewhat prolonged, scarcely angulated in the middle; the part in front of the chondrophore is well-arched and bears, in the largest specimens, nine or ten, sharp, prominent, angular teeth, of which two or three nearest the beak are quite small; the posterior portion is nearly straight, a little longer and narrower than the anterior and bears about eleven thin, sharp, erect teeth, counting one or two minute proximal ones; a thin smooth margin extends outside both series of teeth. The cartilage-pit is relatively large, in the form of a notch, and cuts through the hinge-margin into the substance of the beak itself; it is occupied by a dark brown resilium which usually shows plainly externally. Just in front of the cartilage-pit on its border within the series of teeth, there is a small conical, tooth-like process in both valves. The ligament is thin and delicate. Externally the shell is covered with a glossy, yellowish, or pale olive epidermis which reflects brilliant prismatic colors; the surface is marked by faint lines of growth and frequently also with fine concentric grooves or sulci, especially toward the ventral and anterior margins; in many specimens these are absent.

Length of one of the largest specimens, 7 mm.; height, 4.25 mm.; breadth, 3.2 mm.

Found in small numbers, at many stations, between N. lat. 43° 39',

W. long. $69^{\circ} 22'$, and N. lat. $35^{\circ} 12' 10''$, W. long. $74^{\circ} 57' 15''$, in 22 to 516 fathoms, 1872-1885.

The most prominent character of this species is the relatively large size of the cartilage-pit which intersects both the hinge-margins and the beaks and is therefore plainly visible from the exterior. In outline it is similar to *Y. iris* and *Y. inflata* but is more pointed and narrower posteriorly than either of them. They differ also in having much smaller cartilage-pits and in the number of the teeth.

Specimens formerly identified as *Yoldia obesa* Stimpson, agree perfectly with authentic specimens of *lucida* sent by Doctor Friele from Spitzbergen. As none of the species known to us agree sufficiently well with the description and figure of *Leda obesa* Stimpson, for us to decide definitely as to its correct position, unless we are to consider the figure a very incorrect representation, we prefer to let it remain doubtfully, as a synonym of *Y. lucida*, where Jeffreys and others have placed it.

YOLDIELLA IRIS, new species.

(Plates LXXX, figs. 1, 2; LXXXII, fig. 11.)

Shell small, thin, rather delicate, long-ovate or ovate-elliptical, with the beaks in front of the middle, not much swollen; surface smooth, or nearly so, with brilliant iridescence. The antero-dorsal margin is convex and slightly arched, sloping gradually to the obtusely rounded and slightly produced anterior end; ventral margin very broadly and evenly curved; posterior end obliquely ascending, obtusely pointed or rounded at the tip with a slight dorsal angulation; postero-dorsal margin slightly convex, sloping but little, pinched up into a thin, rather prominent keel. The umbos are small and prominent with the beaks small, curved inward and backward, closely appressed to the margin. The epidermis is grayish or greenish yellow, smooth and shining; the surface is brilliantly iridescent, covered with faintly marked, fine, concentric lines, most distinct near the ventral margin and anteriorly; under the lens these appear like faint, close undulations over most of the surface. Escutcheon defined by a well-marked depression.

The hinge-margin is thickened and forms a very obtuse angle at the beaks; the posterior portion which is only slightly curved distally is longer than the anterior which is nearly straight. In the largest specimens there are twelve or thirteen acute erect V-shaped teeth in each series, including one or two minute, proximal ones. The resilial pit is minute, situated on the inner face of the thin edentulous hinge-plate, beneath the beaks, and faces ventrally so that it is scarcely visible in a front view and but partially interrupts the hinge-plate. Outside the series of teeth, on both sides of the beak there is a smooth, raised margin.

Length of one of the larger specimens, 7.5 mm.; height, 5 mm.; from beak to posterior end, 4.5 mm.

Found in considerable numbers, at about forty-five stations, between N. lat. $47^{\circ} 40'$, W. long. $47^{\circ} 35' 30''$, and N. lat. $35^{\circ} 12' 10''$, W. long. $74^{\circ} 57' 15''$, in $20\frac{1}{2}$ to 781 fathoms, 1872-1886.

This species is more elongated and more regularly elliptical than any of the allied species; the hinge-margin is also less angulated.

A single specimen (No. 74325), station 43, off Cape Sable, in 90 fathoms, 1877, at first thought to be a distinct species, differs from the typical form in being more oblong with the ventral margin less curved, the posterior end more evenly rounded with only a slight indication of a superior angulation, so that the shell has a pretty regular, narrow elliptical form. In all other respects, however, it agrees well with the ordinary form. This specimen, which receives the varietal name *stricta*, is figured on Plate LXXX, fig. 1.

Length, 5 mm.; height, 3 mm.; breadth, 1.3 mm.; length from beak to posterior end, 3 mm.

YOLDIELLA INFLATA Verrill and Bush.

(Plates LXXX, fig. 8; LXXXII, figs. 5, 6.)

Yoldia lucida VERRILL, Trans. Conn. Acad., VI, p. 279, 1884 (in part).

Yoldiella inflata VERRILL and BUSH, Amer. Journ. Sci., III, p. 56, figs. 3, 4, 11, January, 1897.

Shell small, swollen, rather short, subovate, with the posterior end broad, angulated postero-dorsally; beaks at about the anterior third; surface smooth. Antero-dorsal margin regularly convex and sloping rapidly to the anterior end which is evenly rounded, very obtuse, and passes insensibly into the evenly curved ventral margin which is decidedly convex, although the degree of convexity varies considerably in different specimens; the posterior end is obliquely subtruncated, with an obtuse curve below and an obtusely rounded angle at its upper extremity where it joins the nearly straight postero-dorsal margin. The umbos are full and well-rounded but not very prominent; the beaks are small, directly incurved, appressed to the margin. There is no distinct lunule but the margin is slightly pinched up in a small crest both before and behind the beaks. The ligament is delicate and shows slightly on both sides of the beak. Epidermis pale olive yellow or straw color; surface smooth, shining, reflecting prismatic colors, showing more or less distinct lines of growth which sometimes become regular, concentric, very fine striations, especially anteriorly. Hinge-margin well developed, moderately broad and considerably thickened, forming an obtuse angle at the beak where it is thin, encroached upon by the beak and interrupted by the cartilage-pit; the two portions are nearly equal in length, the anterior somewhat arched, the posterior nearly straight, each having a thin, smooth border above the teeth, about equal in breadth to the hinge-plate. In the largest specimens there are nine to eleven (most frequently ten) rather stout, angular teeth and about ten very similar posterior ones; the cartilage-pit is small and

just beneath the beak, forms a notch which completely interrupts the hinge-margin.

Length of one of the largest specimens, 6 mm.; height, 4.5 mm., thickness, 3 mm.; from beak to posterior angle, 4 mm.

Found in considerable numbers, at about twenty stations, between N. lat. $41^{\circ} 53'$, W. long. $65^{\circ} 35'$, and N. lat. $35^{\circ} 9' 50''$, W. long. $74^{\circ} 57' 40''$, in 516 to 1,608 fathoms, 1883-1886. Several live specimens, at station 2079, in 75 fathoms.

This species is closely related to *Y. lucida* (Lovén), from which it is easily separated by its shorter, broader, more swollen form, its strongly curved ventral margin, and very distinct postero-dorsal angle. It is shorter and has a broader posterior end than most of the related species. The resilium is not visible externally.

YOLDIELLA SUBANGULATA, new species.

(Plates LXXVII, fig. 3; LXXIX, fig. 6.)

Very similar to the preceding species in form but less pointed posteriorly and larger. The umbos are small, not prominent; beaks are small, directly incurved, appressed to the hinge-margin but not distinctly notched by the resilial pit. The antero-dorsal margin is convex, arched; the anterior end is a little produced, obtusely rounded; ventral margin evenly and broadly rounded, slightly produced posteriorly, forming an obscure obtuse angle as it merges into the posterior end which is obliquely subtruncated or a little inflexed in the middle, with a prominent dorsal angle; the postero-dorsal margin slopes but little, and is nearly straight, with the compressed edges forming a slight keel, which is a little convex in the middle. A well-marked ridge runs to the postero-dorsal angle, and a less distinct one to the postero-ventral angle; between these there is a slight depression of the surface. Surface nearly smooth, lustrous, reflecting prismatic colors, and covered with faint lines of growth and a few inconspicuous irregular sulci; epidermis pale olive yellow. The hinge-margin is narrow, very obtusely angled, and is interrupted under the beaks by the small notch-like resilial pit. The anterior series of teeth is slightly arched and contains about seventeen teeth, including three or four minute proximal ones; the larger ones are high and sharp. The posterior series is a little longer and contains about eighteen, similar, but somewhat more slender teeth. A thin, smooth margin extends along outside both series. There is a small internal denticle at the front edge of the resilial pit. Pallial sinus narrow, considerably inflexed.

Length, 8 mm.; height, 5 mm.; thickness, about 4 mm.; from beak to anterior end, 3 mm.; posterior end, 5 mm.

One live specimen was dredged by the *Bache* at station 46, N. lat. $43^{\circ} 3'$; W. long. $70^{\circ} 4'$, in 51 fathoms, 1874.

YOLDIELLA JEFFREYSI (Hidalgo).

(Plates LXXXI, fig. 5; LXXXIII, fig. 3.)

Leda lata JEFFREYS, Ann. Mag. Nat. Hist., p. 431, November, 1876.*Leda jeffreysi* JEFFREYS, Proc. Zoöl. Soc. London, p. 579, pl. XLVI, fig. 2, June, 1879.—SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 234, 1885.Not *Yoldia jeffreysi* VERRILL, Trans. Conn. Acad., VI, p. 229, 1884.

Shell small, ovate-elliptical, somewhat thick for its size, rather swollen, covered with a glossy, iridescent, brownish yellow epidermis. The posterior end is considerably the longer, somewhat narrowed, bluntly rounded without any distinct rostrum. Umbos rather prominent, somewhat swollen; beaks prominent, curved inward and backward. The antero-dorsal margin is broadly convex, slopes a little and becomes continuous with the rather regularly curved outline of the rounded anterior end; ventral margin is broadly and regularly curved without any distinct flexure; the posterior end is obtusely rounded and not defined by any radial lines or ridges, with the dorsal margin nearly straight at first, usually slightly convex in the middle, and sloping gradually. The surface beneath the epidermis is nearly smooth but shows more or less distinct lines of growth, which sometimes have the form of fine parallel striations. The hinge-plate is thickened and rather strong; the two series of teeth are long and form a very obtuse angle at the beak; the anterior is somewhat the shorter and more oblique and a little curved. In our type specimen there are thirteen anterior teeth of which three or four proximal ones are very small; and fifteen posterior ones, including four or five small proximal ones; a somewhat larger specimen has fifteen in the anterior series and eighteen in the posterior. The two series are interrupted beneath the beak by a small, well-defined, concave, triangular resilial pit supported on the inner side by a distinct shelf-like projection.

Length of the type-specimen, 5 mm.; height, 3.1 mm. Length of the largest specimen, 5.6 mm.; height, 4.2 mm.

Six separate valves, at three stations, between N. lat. $37^{\circ} 38' 40''$, W. long. $73^{\circ} 16' 30''$, and N. lat. $36^{\circ} 42'$, W. long. $74^{\circ} 30'$, in 727 to 1,423 fathoms, 1884–1886.

As all of our specimens are much larger than the measurements given by Jeffreys, they are referred to *Y. jeffreysi* (Hidalgo) with some doubt, although they appear to agree well with Jeffreys's figure of that species in form and in the character of the hinge.

YOLDIELLA LENTICULA (Möller) variety AMBLIA, new.

(Plates LXXX, fig. 9; LXXXI, fig. 4.)

Nucula lenticula MÜLLER, Ind. Moll. Grøn., p. 17, 1842.*Yoldia abyssicola* TORELL, Spitzbergens Molluskfauna, p. 149, pl. I, figs. 4, a-b, 1859.*Portlandia lenticula* G. O. SARS, Mollusca Reg. Arcticæ Norvegiæ, p. 39, pl. 4, figs. 10, a-b, 1878.*Leda lenticula* JEFFREYS, Proc. Zoöl. Soc., London, p. 577, June, 1879.

Our specimens, which are worn and imperfect, referred to this northern species, differ somewhat from the typical specimens from Spitzbergen, received from Doctor Friele. They are relatively shorter, higher, and somewhat less swollen, with a thicker and heavier shell. The posterior end is less produced and less tapered, so that it has a more ovate form. The hinge-teeth are stouter; the posterior series is shorter but contains the same number of teeth in specimens of similar size. With the amount of material that we have for examination, the differences, however, seem hardly sufficient to warrant the separation of our shells as a distinct species. We therefore propose the varietal name *amblia* for our specimens.

A few separate valves, at two stations, north of Cape Cod, in 110 to 122 fathoms, 1878-79.

YOLDIELLA FRATERNA, new species.

(Plates LXXX, fig. 5; LXXXII, fig. 8.)

Yoldia frigida VERRILL, Trans. Conn. Acad., VI, p. 279, 1884; Expl. *Albatross*, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (in part).

Shell small, thin, delicate, irregularly elliptical in form, the posterior end being a little the longer, unusually broad, and slightly produced above, but not distinctly angulated, with a glossy, iridescent, yellowish green epidermis. Umbos a little swollen; the beaks small, scarcely prominent, and subcentral. The anterior end is broad, a little produced in the middle, and obtusely rounded; the dorsal margin is nearly horizontal in the region of the teeth; distally, sharp, and convex, then sloping rapidly to the middle of the anterior end. The ventral margin is broadly rounded, expanding a little posteriorly and then ascending pretty rapidly to the posterior tip which is obtusely rounded superiorly; postero-dorsal margin slightly convex and nearly horizontal for the greater part of its length. The surface beneath the epidermis is marked only by faint lines of growth. The hinge-margin is thin, rather delicate, with the two series of teeth of nearly equal length and diverging from the beaks at a broad angle; each series contains about ten rather thin and delicate teeth, of which the one or two proximal ones are very small and rather indistinct. Beneath the beak the margin is attenuated and interrupted by a small, oblong resilium which occupies the entire thickness of the margin and a slight notch in the beak. The pallial sinus is relatively rather large and deep, but in most specimens is invisible.

Length of the figured specimen, 4 mm.; height, about $2\frac{1}{2}$ mm.

A comparatively small number of specimens, at about twenty stations, between N. lat. $47^{\circ} 40'$, W. long. $47^{\circ} 35' 30''$, and N. lat. $37^{\circ} 8'$, W. long. $74^{\circ} 33'$, in 90 to 1,608 fathoms, 1873-1886.

This is a deep-water form formerly identified by us as *Yoldia frigida* Torell.

YOLDIELLA CURTA, new species.

(Plate XCVII, fig. 8.)

Phascolus ovatus (?) VERRILL, Trans. Conn. Acad., VI, p. 230, 1884; Expl. *Albatross*.
Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (not Seguenza).

Shell small, short-ovate, rather swollen in the middle, with rather prominent umbos, somewhat inequilateral, the posterior end the longer and slightly produced. Beaks small, incurved, with a slight posterior twist and a little separated from the margin. The dorsal margin is nearly straight medially, both before and behind the beaks, anteriorly it merges gradually into the broadly rounded anterior end, which usually has an obscure, blunt angulation in the middle; ventral margin broadly and evenly rounded, merging gradually into the more abrupt curve of the posterior end which is a little tapered, but obtusely rounded without any distinct rostrum or angulation; the postero-dorsal margin is a little prominent, pinched up and convex, with a considerable slope, so that the tip of the shell is but little above the middle. The surface is polished and somewhat iridescent, marked only by fine, irregular lines of growth. Epidermis pale greenish or brownish yellow. There is a relatively very large resilium, appearing yoke-shaped or wide W-shaped in the separated valves, and covering a relatively long, edentulous space beneath the beaks. The teeth are compressed, oblique, imperfectly V-shaped, especially posteriorly, and but slightly elevated. There are six or seven in the posterior series, of which the proximal ones are rather indistinct; and four distinct and two or three indistinct ones in the anterior series. In a dorsal view five are visible above the margin behind the beak and four before. They are not very long and rather blunt, with the distal side sloping and the side next the beak a little incurved and concave.

Length, 2.6 mm.; height, 1.8 mm.; thickness, about 1 mm.

A few live specimens, at three stations, between N. lat. $41^{\circ} 11' 30''$, W. long. $66^{\circ} 12' 20''$, and N. lat. $39^{\circ} 38'$, W. long. $70^{\circ} 22'$, in 499 to 1,290 fathoms, 1883-1886.

This species somewhat resembles *Y. frigida* in form, but it is relatively shorter, higher and less distinctly rostrated. Its hinge is also quite different. The present species is peculiar in having fewer and blunter teeth and a much larger resilium than most of the related species.

YOLDIELLA PACHIA, new species.

Shell very broad, oval, considerably swollen in the middle, with the length and height nearly equal; umbos rather prominent. The posterior end is narrowed and slightly produced, but not defined by any groove or carination. The dorsal margin is very obtusely angulated, anteriorly it is convex and slopes pretty rapidly to the broadly and evenly rounded anterior end; posteriorly it is nearly straight at first, then slopes gradually to the posterior end. The ventral margin is very

broadly rounded and slightly produced in the middle; it joins the curve of the posterior end with a scarcely perceptible incurvature in some specimens; the posterior end is obtusely rounded and situated about midheight of the shell. The dorsal edges of the valve are thin and a little pinched up, but there is no distinct lunule and only a very narrow ligamental furrow. The epidermis is polished and somewhat iridescent, and marked with fine, somewhat irregular lines of growth, in some places showing faint, microscopic, radial striations. Color of the dead valves, brownish yellow. Hinge-plate strong, narrow near the beak, wide distally, strongly angled, with the outer edge naked and rather broad, especially anteriorly. Teeth large and prominent distally, with about three small proximal ones; about eight in the anterior and ten in the posterior series. The resilial pit is a distinct, triangular fossette, or chondrophore, on the face of the margin, covering its whole breadth, and bordered internally by a thickened edge which causes an excurvature of the margin. There is a distinct marginal external ligament and furrow, or escutcheon.

Length, 4.6 mm.; height, 4.8 mm.

Three separate valves, among Foraminifera, at station 2385, N. lat. $28^{\circ} 51'$, W. long. $88^{\circ} 18'$, in 730 fathoms, 1885.

In outline this species resembles *Y. curta*, but differs in its wider and stouter hinge-plate, more numerous and more highly developed teeth, and especially in the form and structure of the resilial pit.

YOLDIELLA INCONSPICUA, new species.

(Plate LXXIX, figs. 3, 5.)

Shell small, thin, delicate, compressed, subovate; posterior end a little produced and narrowed medially. Surface lustrous and iridescent. Umbos scarcely prominent; beaks small, projecting but little above the dorsal margin. The antero-dorsal margin is slightly convex and nearly horizontal at first, then slopes gradually to the evenly rounded anterior end; ventral margin broadly rounded, slightly swollen posteriorly, ascending more rapidly to the narrow and bluntly rounded posterior end; postero-dorsal margin nearly straight toward the beak, then slightly convex and sloping very gradually. The surface is covered with fine, pretty regular, concentric grooves and raised lines, visible only under the microscope. Epidermis thin, shining, iridescent, greenish yellow. The hinge-margin is thin and delicate, nearly straight; the two series of teeth form a very obtuse angle at the beaks and are interrupted, for a considerable space, by the resilium which does not lie in a distinct pit. The ligament shows as a delicate, continuous marginal line, both in front of and behind the beaks. The teeth are small, oblique, V-shaped. In the anterior series there are about six distinct ones with one or two minute proximal ones; in the posterior, about seven distinct ones with one or two rudimentary ones near the beak.

The pallial sinus is rather wide and moderately deep, but is invisible in most specimens.

Length of the largest specimen, 3.6 mm.; height, 2.3 mm.

A number of specimens, at about fifteen stations, between N. lat. $42^{\circ} 33'$, W. long. $69^{\circ} 58.5'$, and N. lat. $35^{\circ} 12' 10''$, W. long. $74^{\circ} 57' 15''$, in 100 to 705 fathoms, 1878-1886.

This species is distinguished from *Yoldiella frigida*, and most of the other small species which it resembles, by its narrower, or lower, and more compressed form, more delicate shell, straighter dorsal margin, and the more central prolongation of the posterior end. It is apparently more nearly related to the smaller species, *Y. minuscula*, than to any other. The latter has a smaller, shorter, and more swollen shell, more convex ventrally, with the hinge-margin somewhat more angulated.

YOLDIELLA MINUSCULA, new species.

(Plate LXXIX, figs. 2, 7.)

Yoldia jeffreysi VERRILL, Trans. Conn. Acad., VI, pp. 229, 279, 1884; Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.

Shell minute, broad-ovate, covered with microscopic, pretty regular concentric striations, with a very lustrous, somewhat iridescent, yellowish epidermis. The two ends are nearly equal in length; the posterior somewhat narrowed and obtuse at the end, the anterior well-rounded. The umbos are not prominent and the beaks are very small and project but slightly above the margin. The antero-dorsal margin is slightly convex at first, and nearly horizontal, and passes gradually into the curve of the anterior end; ventral margin is broad and nearly uniformly convex; the posterior end is a little produced in the middle and forms there a slight obtuse angle; the postero-dorsal margin is a little convex and nearly horizontal at first and then slopes rather rapidly to the tip. The hinge-margin is thin and delicate; the two series of teeth lie nearly in a straight line but the anterior one is a little oblique, so that they form a very wide angle at the beaks where the resilium entirely interrupts the hinge-margin forming a wide notch without any definite pit or shelf; the teeth are small, very oblique, and only slightly prominent; there are only about five in the anterior and six in the posterior series.

Length, about 2.3 mm.; height, about 1.5 mm.

Only a few specimens, at four stations, between N. lat. $41^{\circ} 53'$, W. long. $65^{\circ} 35'$, and N. lat. $38^{\circ} 27'$, W. long. $73^{\circ} 2'$, in 705 to 1,290 fathoms, 1883-1885.

This very minute species may, with a larger series, prove to be the young of some of the preceding species.

YOLDIELLA SUBEQUILATERA (Jeffreys).

Leda subequilatera JEFFREYS, Proc. Zoöl. Soc., London, p. 579, pl. XLVI, fig. 3, 1879.

Yoldia subequilatera VERRILL, Trans. Conn. Acad., VI, pp. 229, 279, 1884 (in part); Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (in part).

Leda subequilatera DALL, Bull. Mus. Comp. Zoöl., XII, p. 252, 1886.

Yoldia subequilatera DALL, Bull. U. S. Nat. Mus., No. 37, p. 44, 1889.

Several live specimens (No. 35204), from station 2037, N. lat. $38^{\circ} 53'$, W. long. $69^{\circ} 23' 30''$, in 1,731 fathoms, 1883, have been referred to this species. Although younger or smaller than Jeffreys's type, they agree very closely with his figures and description. The shell is very small, very thin and transparent, polished, lustrous, but scarcely iridescent and marked only by microscopic lines of growth. It is rather compressed, nearly elliptical in form, with the beaks prominent above the dorsal margin and turned almost directly inward. Both ends are obtusely rounded and nearly equal in length, so that it is impossible to determine which is anterior and which is posterior by the external characters; one end, supposed to be the anterior, is however slightly broader than the other. There is no distinct ligament visible externally. The hinge plate is nearly straight, the two series of teeth forming but a slight angle. Interior not seen.

Our specimens measure from 1.5 to 2.5 mm. in length. South to Grenada, in 92 fathoms.—Dall.

YOLDIELLA EXPANSA (Jeffreys).

(Plate XCVII, fig. 3.)

Leda expansa JEFFREYS, Ann. Mag. Nat. Hist., p. 431, November, 1876; Proc. Zoöl. Soc., London, p. 580, pl. XLVI, fig. 4, June, 1879.

Not *Yoldia expansa* VERRILL, Trans. Conn. Acad., VI, p. 279, 1884.

Shell oblong-ovate, nearly equilateral, with the posterior end a little more broadly rounded than the anterior; both regularly obtuse. Both dorsal margins are slightly convex and slope but little. The hinge-plate is moderately wide, gently arched, with sharp dorsal margins, and is completely interrupted in the middle by a deep, angular notch for the resilium which is rather large and dark and is attached to the inner surface of the shell below the beak. In the right valve, there are nine posterior teeth, including one or two very small proximal ones, separated from the margin by a rather wide, smooth space; those in the middle of the series are long, with tapered, acute tips which are bent upward and toward the beaks, and at base are V-shaped. In the anterior series, which is a little the longer, there are ten teeth, including two or three very small, proximal ones; the larger ones are nearly erect with the tips less inclined than those in the posterior series; they are separated from the margin by a plain space about as wide as

the teeth. In the left valve, there are eleven anterior and nine posterior teeth. The surface of the shell is dull yellowish green, only slightly iridescent, and covered with irregular lines of growth which, in some places, form irregular raised lines. The umbos are but little prominent; the beaks are small and turn backward.

Length, 3.6 mm.; height, 2.5 mm.

One specimen (No. 78363), station 2697, N. lat. $47^{\circ} 40'$, W. long. $47^{\circ} 35' 30''$, in 206 fathoms, 1886.

This species is peculiar in its nearly equilateral, elliptical form, with the dorsal margins gently convex and only slightly sloping both sides of the beaks, and especially in its large resilial notch which cuts entirely through the hinge-plate. It agrees pretty closely with Jeffreys' type, but the latter was much smaller and his figures and diagnosis are too imperfect to make its identity certain.

YOLDIELLA FRIGIDA (Torell).

(Plate LXXIX, fig. 4.)

Yoldia frigida VERRILL, Trans. Conn. Acad., V, p. 573, pl. XLIV, fig. 2, 1882; VI, p. 279, 1884 (in part); Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (in part).

A very few specimens, at about ten stations, between N. lat. $43^{\circ} 5'$, W. long. $70^{\circ} 11' 30''$, and N. lat. $39^{\circ} 53' 30''$, W. long. $71^{\circ} 13' 30''$, in 88 to 312 fathoms, 1874-1881.

YOLDIELLA DISSIMILIS, new species.

(Plates LXXVIII, fig. 8; LXXXII, fig. 7.)

Yoldia expansa VERRILL, Trans. Conn. Acad., VI, p. 279, 1884; Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885 (not of Jeffreys).

Shell small, oblong-ovate, nearly equilateral, with the anterior end the broader and bluntly rounded, the posterior end somewhat narrowed medially and bluntly rounded, without any distinct angulation. Umbos somewhat prominent; beaks small and strongly incurved. Surface straw-colored, not lustrous, covered with fine concentric lines. Antero-dorsal margin but little curved, sloping very gradually to the anterior end which is curved nearly in the arc of a circle; ventral margin very broadly rounded with a very slight obtuse angulation behind the middle; postero-dorsal margin slightly excavated just behind the beaks, then sloping very gradually to the obtuse posterior end. The hinge-margin is moderately stout; the two portions form a very wide angle at the beak with the anterior, which faces obliquely downward, considerably the more arched. In the center the margin becomes very thin and is interrupted by the resilium which occupies a deep notch and an internal shelf of considerable size, situated far back and directed downward to such an extent that it is only partially visible in a direct front view; there are about eleven or twelve anterior, and eight to ten poste-

rior acute, curved, V-shaped teeth; at the proximal end of the posterior series, in the left valve, there is an oblong, prominent, tooth-like process, much larger than the adjacent teeth. Three or four of the distal teeth, on each side, are decidedly large, prominent and acute with the tip curved outward, but the size decreases regularly toward the center. There is a well developed dark ligament, visible externally, both before and behind the beaks. The surface is covered by relatively rather large, distant, concentric ridges and furrows, easily visible under a lens, which are everywhere covered by very regular microscopic lines and grooves of about equal width.

Length of the largest valve, 4.25 mm.; height, 2.8 mm.

A few specimens, at four stations, between N. lat. $39^{\circ} 49'$, W. long. $68^{\circ} 28' 30''$, and N. lat. $36^{\circ} 47'$, W. long. $73^{\circ} 9' 30''$, in 1,451 to 1,685 fathoms, 1883-1886.

This species is remarkable for its oblong-ovate form and very regular concentric sculpture, consisting of fine ridges and furrows which are in turn everywhere covered with regular microscopic lines. This species was at first thought to be *Y. expansa* (Jeffreys) which it resembles in form, but additional specimens and more careful study show that the species are very distinct. In *Y. expansa* the hinge-margin is much straighter, the teeth fewer and different in form, the resilial pit very different, the two ends of the shell more nearly equal, and the sculpture quite different.

Our species differs considerably from the typical forms of *Yoldiella* in having a more oblong form with both ends evenly rounded, a well-developed ligament, and a more evident resilial fossette or chondrophore which, however, is situated decidedly below the hinge-plate. The existence of a peculiar tooth-like process adjacent to the resilial notch would be a character of considerable importance were it constant, but the specimens show great variation in its development; in some, it is even almost abortive. These distinctive characters, although important, seem hardly worthy of generic distinction.

Subfamily MALLETTINÆ.

MALLETIA Desmoulins, 1832 (restricted).

Malletia VERRILL and BUSH, Amer. Journ. Sci., III, pp. 56, 63, January, 1897.

Type.—*Malletia chilensis* Desmoulins.

We have restricted this group to those species having a nearly smooth, somewhat compressed, oblong or elliptical shell, blunt posteriorly, without any definite rostrum or carination. The carinated and rostrated species that have been placed in it will thus be referred to *Neilo* H. and A. Adams. The resilium is wanting, or else represented by a special part of the ligament, external to the teeth. The ligament is well developed and prominent. The siphon tubes are long and united nearly to the tips.

The subgenus *Pseudomalletia*, proposed by Fischer for *M. obtusa*, was based on an erroneous description of the siphon tubes.

The following are some of the known species:

M. chilensis Desmoulins, Valparaiso (Type); *M. obtusa* (Sars) Mörch, from off Cape Fear, North Carolina, northward; *M. polita* Verrill and Bush, off Delaware Bay; *M. abyssorum* Verrill and Bush, off Chesapeake Bay; *M. cuneata* Jeffreys, North Atlantic; *M. pallida* Smith, Mid-South Atlantic; *M. arrouana* Smith and *M. dunkeri* Smith, Pacific; and *M. bellardii* Seguenza, fossil.

MALLETIA OBTUSA (M. Sars) Mörch.

(Plate XCVII, fig. 4.)

Yoldia obtusa G. O. Sars, Remarkable Forms of Animal Life, p. 23, pl. III, figs. 16-20, 1872.

Malletia obtusa G. O. Sars, Mollusca Reg. Arcticæ Norvegiæ, p. 41, pl. 19, figs. 3, a-b, 1878.—JEFFREYS, Proc. Zool. Soc., London, p. 586, June, 1879.—VERRILL, Trans. Conn. Acad., VI, pp. 226, 280, 1884; Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.—SMITH, E. A., Report Voy. Challenger, Zool. Lamellibranchiata, XIII, p. 245, 1885.—DALL, Bull. U. S. Nat. Mus., No. 37, p. 46, 1889.—BUSH, Bul. Mus. Comp. Zool., XXIII, p. 234, 1893.—LOCARD, Campagne du Caudan, Annales de l'Université de Lyon, p. 202, 1896.—VERRILL and BUSH, Amer. Journ. Sci., III, p. 57, fig. 9, 1897.

The soft parts of several specimens, rather poorly preserved in alcohol, have been examined. They have a large foot with an ovate disk pointed in front and minutely crenulated. The siphon tube is rather long and slender, in some cases not entirely retracted within the shell; it appears to contain both the branchial and anal tubes which are closely united quite to the simple tips; at the inner base, there is a well-marked siphonal septum. The gills are small, elongated, pointed posteriorly, and have the structure usual in the family. The palpi are rather large, elongated, with revolute margins; the palpal tentacle is very long and slender, and in the contracted state variously bent with the edge much convoluted. No pallial tentacle was found at the base of the siphon.

In our collection there is a large series of this species; the form is pretty constant and in nearly all cases is more oblong than the European species, as figured by G. O. Sars. The small specimens are compressed while the large ones are a little swollen. The umbos are small, but slightly elevated; the beaks are very small, turned directly inward, and are almost in contact with the margin, so that they are generally worn away in the larger specimens. Directly under, and partly in the beaks, and also cutting more or less into the thickness of the external side of the hinge-margin, there is a small notch, or shallow excavation, which is occupied by a special portion of the ligament that probably represents a remnant of a degenerated resilium. The true ligament is well developed and prominent for about one-half the length of the hinge-margin, then becomes abruptly thinner and nar-

rower; its groove is narrow and inconspicuous. The hinge-margin itself is rather thin and bears very numerous, erect, V-shaped, acute teeth which number, in the large specimens, about sixteen or seventeen in the anterior series and about thirty-two or thirty-three in the posterior, including a number of small proximal ones; beneath the beaks there is a smooth, edentulous space, often a little thickened at the inner margin and projecting a little inward in the middle, and continuing inside the series of small proximal teeth on each side. In some cases this thickened border seems to arise anteriorly and to pass under the posterior series, as a slight fold; in other cases it is continued directly from one series to the other. The posterior series is nearly straight and about twice as long as the anterior which is strongly curved and distally somewhat recedes from the thin dorsal margin. The anterior end of the shell is rather short and evenly rounded; the posterior is about twice as long, a little wider owing to a slight ventral expansion, compressed and obtusely rounded or subtruncated at the margin, but without any distinct carination or angulation. The pallial sinus is very broad and deep, extending nearly to the middle of the shell. The inner surface is smooth, white or grayish white. The exterior is smooth, except for the delicate lines of growth, and covered with a thin, brilliantly iridescent epidermis which, in live specimens, is pale yellowish green, but in dead valves is pale straw color.

Our larger specimens measure about 15 or 16 mm. in length and 9 or 9.5 mm. in height.

Found at many stations between N. lat. $41^{\circ} 28'$, W. long. $65^{\circ} 35'$, and N. lat. $35^{\circ} 16'$, W. long. $75^{\circ} 2' 30''$, in 516 to 1,781 fathoms, 1883-1887.

MALLETIA ABYSSORUM, new species.

(Plate XCVII, fig. 7.)

Shell small, not much compressed, lustrous, iridescent, subovate, not gaping, decidedly inequilateral, with the posterior end the longer, broader, obtusely rounded, without any distinct rostration. Umbos rather prominent, rising above the outline of the dorsal margin, with small beaks turned backward at the tip. Lunule and escutcheon abortive. The short antero-dorsal margin is slightly concave, and slopes rapidly to the slightly angulated anterior end; the ventral margin is very broadly and evenly convex, the curvature receding somewhat posteriorly, so that the greatest height of the shell is somewhat back of the middle, posteriorly there is a slight extension of the edge corresponding to an indistinct radial ridge; the posterior end is very broad, obtuse, not angulated, with the dorsal margin nearly horizontal, slightly convex, compressed and forming a slight angle where it joins the posterior curve. A very slight groove defines a very faint escutcheon, along the edge of which the teeth can be seen through the substance of the shell. The surface is polished, brilliantly iridescent, and is marked by faint, raised, concentric lines, or ridges parallel with the lines of growth;

near the ventral margin these become more elevated, clearly defined, and are separated by wider, slightly concave grooves. The hinge-plate is rather thin and delicate, regularly curved, without any angle at the beaks, with the posterior portion considerably the longer. There is a small, median, specialized ligament which occupies a lunate, or nearly semicircular notch in the hinge-plate directly beneath the beak, which does not extend through its entire width although it is here quite narrow. The posterior ligament is pretty well developed and extends from the beak, where it is closely connected with the median portion, nearly to the distal end of the series of teeth, and occupies a distinct marginal groove; the portion nearest the beaks, opposite the smaller teeth, is thicker and darker colored than the rest and projects slightly, in a dorsal view; a delicate, inconspicuous portion continues a little in front of the beak, in a thin groove. The median portion of the ligament is so closely connected with the posterior portion that it appears to be a specialized, thickened portion of it, but is evidently homologous with the resilium of other genera; it is situated, however, outside the series of teeth and must serve as a ligament. The larger teeth are delicate, subacute, V-shape, compressed in a direction parallel with the dorsal margin, with deep pits between them. There are about ten in the anterior series, including three or four, very small, scarcely raised ones next the beak; and fourteen in the posterior series, of which the seven distal ones are decidedly larger than the rest, the tenth to the thirteenth being the largest; about four, next the proximal end of the series, are like small, rounded tubercles or granules without a V-shape form; following these are three of intermediate form, increasing in size distally, the seventh being more or less V-shaped; these smaller teeth form a series along the inner edge of the hinge-plate. An edentulous ridge, about as long as the space occupied by the first three teeth, extends from the first tooth to the ligament-pit and is continuous with a similar, thinner ridge running below the ligament-pit to the anterior series of teeth. The pallial sinus is of moderate size and triangular in form.

Length, 5 mm.; height, 4 mm.

One live specimen (No. 52159), station 2566, off Chesapeake Bay, in 2,620 fathoms, 1885.

MALLETIA POLITA, new species.

(Plate LXXXII, fig. 10.)

Shell of moderate size, irregularly ovate, somewhat swollen, the ventral region convex and the posterior end somewhat produced with a short rostrum. Epidermis light yellow, lustrous and iridescent. Umbos not prominent, beaks small, strongly incurved, only slightly elevated above the margin. The antero-dorsal margin is slightly convex and slopes gently to the short, obtusely rounded anterior end which is slightly angulated in the middle; the ventral margin is strongly con-

vex, a little produced in the middle, and with a slight incurvature toward the posterior end, below the rostrum; the posterior end is narrowed and produced into a short obtuse rostrum with a nearly straight dorsal margin. The surface is covered with rather fine, somewhat uneven, concentric lines and undulations. The hinge-margin is but little thickened; the anterior portion is the shorter and the more curved and forms a very obtuse angle with the posterior portion which is nearly straight. There are about twelve conspicuous, rather elevated, sharp teeth in the anterior series besides three or four minute, proximal ones; and more than twenty in the posterior series, the number being indeterminable owing to an injury to the margin close to the beak. The external ligament is large and conspicuous and occupies a marginal groove extending the entire length of the posterior series of teeth. There appears to have been no chondrophore, but whether the line of teeth was continuous is uncertain.

Length, 14.5 mm.; height, 9 mm.

One valve (No. 78972), station 2718, N. lat. $38^{\circ} 24'$, W. long. $71^{\circ} 52'$, in 1,569 fathoms, 1886.

NEILO Adams, 1838.

Neilo H. and A. ADAMS, Genera of Recent Mollusca, II, p. 549; III, pl. CXXVI, figs. 7, 7a, 7b, 1858.—VERRILL and BUSH, Amer. Journ. Sci., III, pp. 57, 63, January, 1897.

Type.—*Neilo cumingii* Adams.

The type species of this genus has an oblong shell, with a straight postero-dorsal margin and a well-defined rostrum, bounded beneath by a pronounced furrow and a marginal indentation, while more ventrally, the margin protrudes somewhat, the pouting of the margin corresponding with special lobes of the margin of the mantle. *N. cumingii* from New Zealand is concentrically grooved, but *N. goniura* (Dall)¹ from off the coast of Ecuador is smooth or nearly so.

NEILONELLA Dall, 1881.

Saturnia SEGUENZA, Nuculidi terziarie merid. d' Ital., R. Accad. Lincei, I, p. 1178, 1877 (not Schrank, 1802).

Leda (section *Neilonella*) DALL, Bull. Mus. Comp. Zoöl., IX, p. 125, 1881; XII, p. 254, 1886. + *Saturnia* Dall, p. 263.

Neilonella VERRILL and BUSH, Amer. Journ. Sci., III, pp. 57, 63, January, 1897.

Type.—*Neilonella corpulenta* Dall.

Shell small, swollen, short-ovate, with both ends obtuse; the posterior somewhat the longer, blunt at tip, without any distinct rostrum or carina. Exterior usually concentrically grooved. Ligamental area not defined. Beaks usually prominent and turned inward and slightly backward. Ligament well developed, extending under and before the beaks in a distinct groove, more prominent behind. Resilium very

¹Dall, Proc. U. S. Nat. Mus., XII, p. 251, pl. x, fig. 10, 1889.

minute or nearly abortive, occupying a slight notch in the dorsal margin under the beak, external to the series of teeth, which are interrupted only by a small, thin edentulous space. Pallial sinus small. Siphon tubes short. Labial palpi large, broad, crescent-shaped, with long tentacular appendages. Gills small, triquetral.

We consider this group worthy of generic rank. It appears to be more nearly allied to *Malletia* than to *Yoldia* or *Leda*. We can find no generic characters to distinguish Dall's typical species (*N. corpulenta*) from *N. pusio*, which was the type of the section, *Saturnia*, proposed by Seguenza. They agree closely in form, external sculpture, arrangement of the teeth, and structure of ligament and resilium. The name, *Saturnia*, being preoccupied by Schrank, 1802, we have adopted Dall's name for both of his sections.

The following species appear to belong here:

N. corpulenta Dall (type), and *N. quadrangularis* (Dall), West Indies; *N. sericea* (Jeffreys), Ireland and Portugal; *N. pusio* (Philippi), Mediterranean and West Indies; *N. subovata* Verrill and Bush, from off Cape Hatteras, North Carolina, northward.

NEILONELLA SUBOVATA Verrill and Bush.

(Plates LXXX, fig. 10; LXXXII, figs. 3, 4.)

Yoldia sericea JEFFREYS, var. *striolata* VERRILL, Trans. Conn. Acad., VI, p. 226, 1884.—VERRILL, Expl. Albatross, Report U. S. Com. Fish and Fisheries for 1883, p. 576, 1885.

Neilonella subovata VERRILL and BUSH, Amer. Journ. Sci., III, p. 57, figs. 7, 8, 22, January, 1897.

Shell somewhat swollen, subovate, with the dorsal margin angulated and the umbos somewhat prominent. The antero-dorsal margin is somewhat convex, pinched up at the edge, and sloped gradually to the evenly rounded anterior end; ventral margin is broadly and nearly evenly rounded throughout, without any sinuosity, and forms a blunt point at its junction with the postero-dorsal margin, which is nearly straight or slightly convex for the greater part of its length, with the edge thin and pinched up. The umbos are somewhat prominent and the beaks curve strongly inward and incline a little backward at the tip. The ligament is well developed, dark brown, and as seen in a dorsal view, fills a narrow, lanceolate excavation in the margin just behind the beaks. In an interior view it is conspicuous behind the beaks and occupies a curved notch immediately under them, and extends forward for a short distance in a thin, marginal groove. The resilium is abortive or nearly so; in many cases it appears to be represented by a minute black speck, adherent to the ligament, and occupying a minute indentation in the edge of the hinge-margin directly beneath the beak, external to the series of teeth. The hinge-margin is broad and rather strong, becoming very narrow below the beak but without a distinct notch or chondrophore; the posterior portion is

nearly straight, the less oblique and considerably the longer, and forms a broad angle with the anterior. There are in the largest examples about eleven or twelve teeth in the anterior series, counting four or five very small proximal ones; and in the posterior series, fifteen or sixteen teeth of which the five or six proximal ones are minute. In many specimens the two series are not distinctly separated under the beak, in others there is a very minute, edentulous space in line with the minute ligamental notch. The largest teeth in the middle of each series are very elongated, erect, acute, with the tips turned upward toward the margin. The surface of the shell is covered with very regular, concentric sulcations separated by narrow, evenly rounded ridges of about the same width; in most cases this sculpture is faint or nearly obsolete toward the postero-dorsal margin and on the umbos. In many specimens, a number of faint radiating striae run from the umbos to the antero-ventral margin, similar lines sometimes occur posteriorly. The epidermis is without much luster, of either greenish yellow, light yellow, or straw color, more or less iridescent, especially near the umbos. Along the dorsal margin the outline of the teeth can be imperfectly seen through the substance of the shell. The interior in fresh specimens is lustrous bluish white and in some cases is distinctly tinged with pale flesh-color. The muscular and pallial impressions are usually indistinct but some specimens show a small, but distinct, angular pallial sinus.

The alcoholic specimens when dissected were found to have a short siphon and a large, stout foot with a broad disk having strongly crenulated edges. The labial palpi were long, crescent-shaped and the tentacle-like appendages arising from the outer bases of the external palpi were very long, slender, and coiled in a spiral. The gills were long, narrow, and prismatic, one on each side.

Length of one of the largest specimens, 6.5 mm.; height, 4.6 mm.; thickness, about 3.5 mm.

Young specimens about 2 mm. long are more equilateral than the adults and have the posterior end less produced and more evenly rounded, the umbos decidedly prominent, and the surface covered with fine, regular, concentric grooves, the epidermis showing distinct iridescence.

Found in large numbers, at many stations, between N. lat. $42^{\circ} 47'$, W. long. $61^{\circ} 4'$, and N. lat. $35^{\circ} 9' 50''$, W. long. $74^{\circ} 57' 40''$, in $125\frac{1}{2}$ to 1,731 fathoms, 1883-1887.

This species shows considerable variation in form when a large series of specimens from the same locality are compared. Some are decidedly more elongated and tapered posteriorly than the typical form, others are somewhat shorter and more regularly ovate with the posterior end blunter or more rounded; all agree essentially in sculpture and in the peculiar structure of the hinge and ligament.

This species has some resemblance to *N. sericea* Jeffreys, of which it

was formerly thought to be a variety. It differs, however, in its larger size, more ovate form, the posterior end being more produced and tapered, and in its stronger sculpture. *N. corpulenta* Dall is narrower, more elongated, with more prominent beaks. *N. quadrangularis* (Dall) is shorter and more triangular in form, with the postero-dorsal margin more oblique.

Subfamily TINDARINÆ Verrill and Bush.

Cucullellina FISCHER, Manuel Conch., p. 981, 1887 (in part).

Tindarina VERRILL and BUSH, Amer. Journ. Sci., III, pp. 58, 63, January, 1887.

The genus *Tindaria* differs so widely from *Malletia* and other genera that it seemed necessary to establish a new subfamily for it.

In this group the shell is rather thick, short-ovate or veneriform, with the posterior end the longer, and with the beaks turned forward. The resilium is wanting. The ligament is well developed and prominent. The teeth are numerous, V-shaped, in two series which are frequently continuous proximally. There is neither pallial sinus nor true siphons. The mantle is broadly open ventrally, but there is a separate anal or efferent orifice surrounded by small sense papillæ. The palpi are large, with long, slender appendages. The foot has a large, terminal, crenulated disk.

This group agrees with *Malletinæ* in having no resilium, but the latter has well developed siphons and a pallial sinus.

TINDARIA Bellardi, 1875.

Tindaria VERRILL and BUSH, Amer. Journ. Sci., III, pp. 58, 63, January, 1897.

Type.—*Tindaria arata* Bellardi.

Several recent writers on these shells have regarded *Tindaria* as a subgenus of *Malletia*. In reality they form two widely diverse genera and have little resemblance except that in both the resilium is wanting. In typical *Tindaria* the shell is swollen, short-ovate or subcordate, without any rostration, with prominent umbos and with the beaks turned forward. In fact the shell may be described as veneriform. The surface is usually concentrically grooved. The series of teeth are often continuous medially. There is no pallial sinus.

A specimen of *T. amabilis* Dall¹ from station 2385, among Foraminifera, in 730 fathoms, not very well preserved in alcohol, has the mantle closed for a short distance behind the anal orifice which is large and surrounded by twelve or more, rather large, unequal papillæ, but does not appear to be capable of being protruded in a tubular form, unless a very short one. The mantle is otherwise freely open along the whole ventral margin to the oral area, with its edges nearly plain,

¹*Malletia (Tindaria) cytherea* Dall, Bull. Mus. Comp. Zoöl., XII, p. 254, 1886; XVIII, p. 438, 1889; = *Malletia amabilis* Dall, p. 438; = *Tindaria amabilis* Dall, pl. XL, fig. 8.

showing only very minute papillæ posteriorly. The foot is large and strong, with a broad, strongly crenulated and striated, concave disk, pointed in front. The gills are well developed and somewhat triquetral. The palpal tentacles are rather large, long, tapered, triquetral, strongly grooved, curved in sickle-shape. The palpi are rather broad and short.

The following are some of the known species:

T. arata Bellardi, and *T. solida* Seguenza, fossil, in the Italian tertiary formation; *T. cytherea* Dall = *T. veneriformis* (Smith), *T. amabilis* Dall, *T. virens* Dall, *T. acinula* Dall, *T. cuneata* (Smith) = *T. smithii* Dall, *T. lata* Verrill and Bush, all Florida and West Indian species; and *T. callistiformis* Verrill and Bush, off Chesapeake Bay.

TINDARIA CALLISTIFORMIS Verrill and Bush.

(Plates LXXVIII, fig. 1; LXXX, figs. 6, 7.)

Tindaria callistiformis VERRILL and BUSH, Amer. Journ. Sci., III, p. 59, figs. 10, 20, 21, January, 1897.

Shell small, stout, thick, regularly ovate, sculptured with very regular, fine, concentric grooves, and having a broad, thick hinge-margin with a continuous line of teeth and no chondrophore. Umbos swollen, beaks prominent, strongly curved inward and somewhat forward, with the nuclear shell (prodissoconch) smooth and glossy. The lunular area is somewhat excavated but has no definite boundary. Anterior end considerably shorter than the posterior, both equally and evenly rounded. Antero-dorsal margin convex, sloping rather rapidly and forming a continuous curve with the anterior margin which is also continuous with the more broadly convex ventral margin: the posterior end is evenly rounded, with the dorsal margin strongly convex, sloping gradually, without any definite angulation. The surface is covered with very regular, fine, close, concentric, rounded ridges, separated by semicircular furrows about twice their width, except on the umbos where the two are about equal. The inner ventral margin is plain, sharp, and slightly beveled. The hinge-margin is wide and thick, narrowest just behind the beaks, gradually widening and thickening toward both ends. The anterior portion is much the shorter and somewhat the wider and slopes more rapidly; along the narrow middle portion the teeth are quite small, but regular, transverse, and separated by narrow intervals; owing to the absence of a chondrophore, there is no definite center, but in front of the tip of the beaks there are about eight teeth which increase rapidly in size and prominence, the four distal ones being large, elevated, and somewhat V-shaped; behind the beak there are about twenty-three teeth, of which nine or ten proximal ones are small; they then commence to increase in size and length so that eight or nine are larger and higher than the rest; these are, however, smaller and more acute than the larger ones in the anterior portion; two or three distal ones are a little less elevated than

those which precede them and a little different in form. Above the teeth there is a distinct and rather deep submarginal groove for the ligament which extends continuously both in front of, and behind the beaks. Behind the beaks there is a distinct rounded ridge running outside of, and parallel with the ligamental groove and terminating at the distal end of the row of teeth. Pallial line entire; no siphon; anal opening separated, surrounded by about twelve unequal papillæ; elsewhere the open mantle edge is nearly plain; foot large with a crenate disk.

Epidermis pale yellowish brown; interior glossy bluish white without pearly luster.

Length, 8 mm.; height, 6 mm.; thickness, about 4.5 mm.

A small specimen (3 mm. long, 2.5 mm. high) from station 2714, is doubtfully referred to this species. Externally it is covered with very fine regular, concentric, raised lines and grooves, agreeing well with the corresponding umbonal portion of the type. The epidermis is thin, pale straw color. The outline is also similar but the posterior half of the shell is relatively a little broader, owing to a slight expansion of the postero-ventral margin. The beaks appear to be relatively less prominent. The external ligament is well developed both sides of the beaks, and is slightly thickened just under them, and fills a very slight notch in the edge of the hinge margin above the teeth. The hinge-plate is relatively broad and strong, especially anteriorly. There are thirteen posterior and nine anterior teeth, the two series separated by a small edentulous space. Some of the distal teeth in the anterior series are unusually large and stout and exceed any of those in the posterior series. The pallial line is distinct and entire.

One live specimen (station 2566), N. lat. $37^{\circ} 23'$, W. long. $63^{\circ} 8'$, in 2,620 fathoms, 1885. One, very young, live specimen (station 2714), N. lat. $38^{\circ} 22'$, W. long. $70^{\circ} 17' 30''$, in 1,825 fathoms, 1886.

This species is remarkable for its thick, firm shell, regular ovate form, and very even, concentric sculpture. In form and general appearance it resembles some species of *Callista*.

TINDARIA LATA, new species.

Shell rather thick, somewhat compressed, broad-ovate, equilateral, narrowest in front of the beaks, the posterior end somewhat produced and very broad. Umbos only slightly prominent. Beaks small, rather acute, turned directly forward and closely appressed to the margin. No lunule nor escutcheon. The antero-dorsal margin is nearly straight and slopes but little, but becomes a little convex and passes insensibly into the evenly rounded curvature of the anterior end; the ventral margin is very evenly and broadly rounded but the curve recedes as it passes backward so that the highest part of the shell is distinctly behind the middle; the posterior end is very evenly and broadly rounded without any angulation; the postero-dorsal margin is consid-

erably longer than the anterior and slopes pretty regularly and gradually from the beaks to the posterior extremity. The surface is covered with very regular, rather coarse, rounded, concentric ridges separated by deep furrows of about the same breadth. The epidermis is light straw color, only slightly lustrous and scarcely iridescent. The hinge-plate is large and strong, much elongated posteriorly, the two parts forming a very obtuse, curved angle at the beaks. The anterior portion is the broader, much the shorter, and bears about nine teeth, of which the three distal ones are much the larger and occupy about one-half the length of the series, the proximal ones being very small. The posterior portion is narrower and curved throughout; it bears seventeen or eighteen teeth of which seven or eight proximal ones are very small and acute. The hinge-plate becomes quite narrow under the beaks where the two series of teeth are interrupted by a very small edentulous space, scarcely wider than the adjacent teeth. All the larger teeth are rather crowded and compressed in the direction at right angles to the line of the hinge so that they are only slightly V-shaped. Seen in a dorsal view they appear thin and not very prominent above the margin of the shell, when the tips are broken they often appear three-lobed. The ligament is well developed and occupies a distinct, sub-marginal furrow behind the beaks. The muscular scars are well marked, small and nearly round; the pallial line is interrupted at a point a short distance from the posterior muscular scar but there is no visible sinus. The interior of the shell is grayish white but not pearly; the ventral edge is slightly beveled.

Length of the largest specimen, 7 mm.; height, 5.5 mm.

Two specimens, among Foraminifera, at station 2385, N. lat. $28^{\circ} 51'$, W. long. $88^{\circ} 18'$, in 730 fathoms, 1885.

TINDARIA CUNEATA (Smith) Dall.

Malletia cuneata SMITH, E. A., Report Voy. *Challenger*, Zoöl. Lamellibranchiata, XIII, p. 247, pl. XX, figs. 10, 10a, 1885 (not Jeffreys).

Malletia (Tindaria) smithii DALL; Bull. Mus. Comp. Zoöl., XII, p. 255, 1886.

A single young valve, among Foraminifera, at station 2655, N. lat. $27^{\circ} 22'$, W. long. $78^{\circ} 7' 30''$, in 338 fathoms, 1886. Off Grenada and the West Indies, in 390 to 1,140 fathoms.—Smith and Dall.

As the species described and figured by Mr. Smith under the name of *Malletia cuneata* is a true *Tindaria*, his name does not conflict with the *Malletia cuneata* of Jeffreys which is a true *Malletia*, and therefore should remain unchanged.

Subgenus TINDARIOPSIS Verrill and Bush, 1897.

Tindariopsis VERRILL and BUSH, Amer. Journ. Sci., III, pp. 59, 63, January, 1897.

Type.—*Tindariopsis agathida* (Dall).¹

¹ *Malletia (Tindaria) agathida* Dall, Proc. U. S. Nat. Mus., XII, p. 252, pl. XIII, fig. 10, 1889.

This division was proposed for those species which have a short rostrum, defined by a radial ridge and a furrow. The type has a well-marked dorsal ligamental furrow and a small notch or "socket" under the beak for the specialized part of the ligament. It is uncertain whether it has a siphon and a pallial sinus. In case these are present, it should form a distinct genus and be placed under Malletinæ.

ANALYTICAL TABLE OF RECENT SUBFAMILIES, GENERA, AND SUBGENERA OF LEDIDÆ
AND NUCULIDÆ HERE ADOPTED.

- A. Shell not gaping, short-ovate, subtrigonal, or rounded; posterior end without a rostrum; beaks usually curved backward; no siphon tubes nor pallial sinus.
Nuculidæ d'Orbigny.
- B. Shell more or less trigonal, usually oblique; posterior end usually shorter; beaks turned backward.....*Nuculina* Verrill and Bush.
- c. Teeth numerous, transverse, V-shaped, forming two convexly arched or angulated series; a distinct median chondrophore; no lateral teeth.
Nucula Lamarck.
- cc. Teeth few, not forming long series; a long lateral tooth in each valve; no median chondrophore.....*Nuculina* d'Orbigny
- AA. Shell ovate, oblong or lanceolate; posterior end generally the longer and usually more or less rostrated; siphon tubes and pallial sinus generally present.
Ledidæ H. and A. Adams.
- C. Cartilage or resilium present, not closely united with the external ligament.
Ledinæ H. and A. Adams.
- a. Resilium supported by a definite concave chondrophore extending inward to, or beyond, the inner edge of the hinge-plate.
- b. Shell not gaping unless at the end of the rostrum.
- c. Shell distinctly rostrated and carinated posteriorly.
Leda Schumacher (sense extended).
- d. Shell elongated and tapered posteriorly, rostrum long, bicarinate, blunt; ligamental area or escutcheon long and well-defined; pallial sinus and siphon tubes developed.....*Leda* (sense restricted).
- dd. Shell shorter, swollen, ovate or oblong, posteriorly not much elongated; rostrum short, usually acute, unicarinate.
- e. Shell ovate, rostrum small, acute; ligamental area or escutcheon distinctly bordered by a carina.
- f. Rostrum short, subacute, submedian, defined below by a ventral sinuosity or emargination.....*Junonia* Seguenza = *Ledella* Verrill and Bush.
- ff. Rostrum short, dorsal, not defined below by a ventral sinuosity; postero-dorsal margin concave; escutcheon sunken.....*Jupiteria* Bellardi.
- ce. Shell oblong, angular, subtruncate, rostrum short, angular, dorsal, defined below by a marginal sinuosity; escutcheon well-defined....*Portlandia* Mörch.
- ccc. Shell not rostrated, small, ovate or elliptical, rounded at both ends, anterior end the shorter, no carina, lunule, nor escutcheon; cartilage posterior, inter-nymphal.....*Microyoldia* Verrill and Bush.
- bb. Shell oblong or lanceolate, compressed, nearly plain, more or less gaping at both ends; rostrum not well-defined; pallial sinus large and broad; tubes long, united.
- g. Teeth transverse, -shaped, numerous, in two long series; chondrophore large, concave, projecting strongly inside the hinge-plate.
Yoldia Möller (sense extended).
- h. Shell large, compressed, rounded anteriorly, broadest posteriorly with a postero-ventral protrusion and radial ridge; rostrum short, broad, poorly defined; external ligament well developed, prominent both sides of the beaks, occupying a continuous furrow; no lunule nor escutcheon.
Megayoldia Verrill and Bush.

- hh. Shell lanceolate or long-ovate, posteriorly narrowed and somewhat elongated, more or less sinuous below; rostrum slightly defined, smooth or slightly carinate; external ligament feebly developed. *Yoldia* (sense restricted).
- hhh. Shell oblong, smooth, plain, blunt and rounded at both ends, without any distinct carina, sinuosity or rostrum *Orthoyoldia* Verrill and Bush.
- hhhh. Shell thin, compressed, narrow-lanceolate or long-elliptical, nearly equilateral, and gaping at both ends; sculpture oblique.
Adrana H. and A. Adams.
- hhhhh. Shell hyaline, oblong-ovate, broad posteriorly, concentrically sculptured, rostrum nearly obsolete *Adranella* Verrill and Bush.
- gg. Shell thin, oblong, inequilateral, blunt at both ends, not rostrated nor carinated; teeth few, lamellar, very oblique. Type, *S. fragilis* Jeffreys.
Silicula Jeffreys.
- aa. Shell small, nearly plain, not much rostrated nor carinated; resilium without a prominent chondrophore, situated in a notch in the hinge-margin, interrupting the series of teeth.
- l. Teeth V-shaped, numerous in both series.
- m. Shell oblong or subovate, blunt posteriorly, with a slightly sinuous margin, sometimes subrostrate, not carinate. *Yoldiella* Verrill and Bush.
- mm. Shell regularly ovate, rounded at both ends, not sinuous nor carinate, (?) no pallial sinus. *Sarepta* A. Adams.
- ll. Shell short-ovate, not sinuous nor angulated; teeth few, oblique, not regularly V-shaped. Type, *P. ovatus* Seguenza. *Phaseolus* Seguenza.
- CC. No true resilium; ligament well developed, often prominent behind the beaks which are usually turned forward.
- D. Siphon tubes and pallial sinus present; teeth mostly V-shaped, in two long series, often interrupted by a median edentulous space.
Malletina H. and A. Adams.
- o. Siphon tubes long; pallial sinus large; shell elongated, gaping.
- p. Shell oblong or elliptical, blunt posteriorly, not distinctly rostrate; series of teeth unequal; those in the anterior series fewer. *Malletia* Desmoulin.
- pp. Shell long-ovate or oblong, broadly angulated and sinuous posteriorly; distinctly rostrate and carinate; two series of teeth nearly equal.
Neilo H. and A. Adams.
- oo. Siphon and pallial sinus small, shell ovate, not gaping; a rudimentary marginal resilium *Neilonella* Dall.
- DD. Shell short-ovate or subcordate, closed at both ends, umbos prominent; ligament entirely external; series of teeth generally continuous.
Tindarina Verrill and Bush.
- s. Shell regularly ovate, grooved, without rostrum or carina; beaks turned forward; no pallial sinus. *Tindaria* Bellardi.
- ss. Shell ovate, with a distinct posterior sinuosity and a short rostrum.
Tindariopsis Verrill and Bush.

Family SOLENOMYIDÆ.

SOLEMYA GRANDIS, new species.

(Plate LXXXVI, figs. 1, 2.)

Shell large, considerably broader anteriorly than posteriorly, dorsal margin in front of the beaks straight and thickened by an internal ridge and a strong epidermal fold. At the anterior end the valves gape widely, and the edge of each is divided into six or seven long, nearly regular, digitate processes of nearly uniform width, and obtusely rounded at the ends, separated by notches, rounded proximally. The

general outline of this end is broadly truncate; the ventral margin is somewhat convex but slopes upward toward the posterior end and is nearly straight along the middle; the posterior end is short, evenly rounded, with the dorsal margin, behind the beaks, strongly incurved; the large black ligament which occupies this area is continuous with the epidermis, so that its outline forms a curve nearly in line with that of the anterior end, and shows but a slight angle, or lobe, at the outer end of the dorsal line. The umbos are flattened, and scarcely prominent. The whole surface is covered with a thick, smooth, glossy epidermis, chestnut-brown in the young and brownish black in adult, which anteriorly is divided into several rather broad digitations that are shorter and somewhat wider ventrally, their length diminishing from the middle of the anterior end to the ventral margin, along the middle of which there are no digitations, but short and broad ones again appear posteriorly. The shell is sculptured by radiating ribs and furrows which are but slightly developed on the middle region but become large and strong anteriorly and smaller and closer posteriorly. On the anterior part these ribs are broad and flat, separated by wide, flat-bottomed, furrows often nearly as wide as the ribs; on the middle area, the furrows are shallow and rounded while the intervening spaces are flat, sometimes broad, at others narrow, this region appearing comparatively smooth, some specimens showing but slight indications of grooves and ribs; posteriorly these are somewhat more numerous, narrower, often about equal in width. In specimens of medium size, there are from six to eight of the large anterior furrows and as many ribs; the edges of the latter are somewhat elevated above the middle portion and these thickened margins extend out along the edges of the digitations which otherwise correspond to the furrows. Internally the shell is white, moderately thick, the anterior portion oblong with obtusely truncated end, the dorsal and ventral margins nearly parallel, and the posterior much narrower and tapered to an obtusely rounded end, with the dorsal margin excavated for the ligamental area. The surface shows distinct but not very prominent grooves and ridges corresponding to the exterior ones; at the anterior end the margin shows slight lobes, corresponding to the intervals between the epidermal digitations. The anterior muscular scar is large and rounded, the posterior one is smaller and subovate. Anteriorly the hinge-margin is thickened in both valves, running from near the beak nearly to the end; posteriorly it is more strongly thickened by a sinuous callus to which the ligament is attached, while under and just in front of the beak the margin is excavated for the reception of the cartilage which continues forward in a groove and is continuous with the broad, dorsal, epidermal margin which unites the two valves throughout their length. The posterior ligament and anterior cartilage appear to blend just beneath the beaks; the commencement of the cartilage is, however, indicated by a slight notch in the callus-margin, in both valves, and the ligament appears

to extend forward in a point between the two sides of the cartilage. There are no transverse costæ or buttresses for strengthening the hinge-margin.

Entire length, including epidermal lobes, 54 mm.; entire height, opposite the beaks, 22 mm.; height of the anterior third, 26 mm.; breadth, in the middle, 12 mm.; length of longest digitations, about 10 or 12 mm.; length of the shell itself, 42 mm.; height at the middle, 15 mm.; length from beak to anterior end, 30 mm.; to posterior end, 14 mm. Fragments of specimens more than twice as large as the one measured have been taken. In one of these the height of the shell without the epidermis is 25 mm.

Two good specimens and some fragments, at four stations, between N. lat. $39^{\circ} 58' 30''$, W. long. $70^{\circ} 30'$, and N. lat. $37^{\circ} 24'$, W. long. $74^{\circ} 17'$, in 300 to 1,600 fathoms, 1880-1884.

EXPLANATION OF PLATES.

The figures on Plate IV, fig. 2, Plate VI, figs. 1, 2, Plate VII, fig. 9, Plate XXI, figs. 1, 2, and Plate XXV, fig. 8, were drawn by Mr. J. H. Blake. Plate XV, figs. 9, 10, 11, were drawn by Mr. J. H. Emerton. The other figures are all camera-lucida drawings by Mr. A. H. Verrill.

PLATE LXXI.

- Fig. 1. *Cardiomya glypta* Bush, p. 810. Dorsal view of type specimen No. 35362; $\times 10$ diameters.
2. *Cuspidaria arctica* (M. Sars) Dall, p. 803. Interior of a left valve from station 70; \times about 3. Broken outline restored by lines of growth.
3. *Cardiomya gemma* Verrill and Bush, p. 809. Dorsal view of specimen No. 41456; $\times 10$.
4. The same. Interior of left valve of the same specimen; \times about 13.
5. *Cuspidaria media* Verrill and Bush, p. 800. Dorsal view of specimen No. 49020; $\times 5$.
6. The same. Interior of left valve of type specimen No. 49018; $\times 5$.
7. *Cuspidaria fraterna* Verrill and Bush, p. 803. Dorsal view of specimen No. 48962; $\times 5$.
8. The same. Interior of left valve of type specimen from station 892; $\times 5$.
9. *Cuspidaria glacialis* (G. O. Sars) Dall, p. 800. Dorsal view of specimen No. 49023; $\times 5$.

PLATE LXXII.

- Fig. 1. *Cuspidaria undata* Verrill, p. 798. Hinge of both valves of specimen No. 52547; \times about 3.
2. *Halonympha striatella* Verrill and Bush, p. 810. Hinge of a right valve from station 2655; $\times 25$.
3. The same. Turned up to show anterior tooth; $\times 25$.
4. *Myourea ruginosa* (Jeffreys) Verrill and Bush, p. 811. Hinge of right valve of specimen No. 52544; \times about 16.
5. *Cuspidaria ventricosa* Verrill and Bush, p. 802. Hinge of a right valve No. 52548; $\times 5$.
6. *Cuspidaria rostrata* (Spengler) Dall, p. 800. Hinge of both valves of specimen No. 49067; $\times 5$.
7. *Cuspidaria turgida* Verrill and Bush, p. 799. Hinge of both valves of type specimen No. 78789; \times about 6.

PLATE LXXIII.

- Fig. 1. *Cuspidaria subtorta* (Sars), p. 806. Hinge of both valves of specimen No. 52545; $\times 9$.
2. *Cardiomya perrostrata* Dall, p. 809. Hinge of both valves of specimen No. 48933; $\times 22$.
3. *Cardiomya multicostata* Verrill and Smith, p. 808. Hinge of both valves of specimen No. 48947; $\times 4\frac{1}{2}$.
4. *Cardiomya abyssicola* Verrill and Bush, p. 806. Hinge of two separate valves No. 78896; $\times 4\frac{1}{2}$.
5. *Cuspidaria glacialis* (G. O. Sars) Dall, p. 800. Hinge of right valve of specimen No. 49011; $\times 4\frac{1}{2}$.
6. *Cuspidaria media* Verrill and Bush, p. 803. Hinge of both valves of type specimen No. 49018; $\times 9$.

PLATE LXXIV.

- Fig. 1. *Cardiomya abyssicola* Verrill and Bush, p. 806. Exterior of right valve of a young specimen No. 78935; $\times 9$.
2. *Myonera ruginosa* (Jeffreys) Verrill and Bush, p. 811. Exterior of right valve of specimen No. 52514; \times about 8.
3. *Cardiomya perrostrata* Dall, p. 809. Interior of right valve of specimen No. 78933; $\times 9$.
4. *Cuspidaria subtorta* (Sars), p. 806. Hinge of left valve of specimen No. 52545; $\times 9$. Turned up to show posterior tooth.
5. The same. Interior of the same valve; $\times 4\frac{1}{2}$.
6. *Cuspidaria formosa* Verrill and Bush, p. 803. Hinge of both valves of type specimen No. 78313; $\times 4\frac{1}{2}$. The right valve is badly broken.
7. *Cuspidaria arctica* (M. Sars) Dall, p. 803. Hinge of a left valve from station 70; $\times 4\frac{1}{2}$.
8. *Myonera limatula* Dall, p. 812. Dorsal view of specimen No. 38171; $\times 9$.
9. *Cuspidaria parva* Verrill and Bush, p. 801. Hinge of both valves of type specimen from station 2203; $\times 30$.
10. *Cuspidaria lamellosa* (M. Sars) Dall, p. 799. Hinge of both valves of specimen No. 51292; $\times 30$. Resilium and ossicle are attached in the right valve.
11. *Cardiomya gemma* Verrill and Bush, p. 809. Hinge of both valves of type specimen No. 41456; $\times 22$. Resilium and ossicle attached in the left valve.

PLATE LXXV.

- Fig. 1. *Limopsis minuta* (Philippi), p. 846. Hinge of right valve of specimen No. 76320; $\times 9$.
2. *Limopsis affinis* Verrill, p. 846. Hinge of right valve of specimen No. 44829; $\times 9$.
3. *Limopsis aurita* (Brocchi), p. 846. Hinge of a right valve from station 2385; \times about 11.
4. *Limopsis profundicola* Verrill and Bush, p. 817. Hinge of right valve of a young specimen No. 52410; $\times 9$.
5. *Limopsis plana* Verrill, p. 846. Hinge of right valve of specimen No. 35238; $\times 9$.
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7. *Cuspidaria obesa* (Lovén) Smith, p. 804. Hinge of right valve of specimen No. 48967; $\times 9$.
8. *Cuspidaria pellucida* (Stimpson) Verrill and Bush, p. 805. Hinge of both valves of specimen No. 48977 from Grand Manan; $\times 22$.
9. *Cuspidaria glacialis* (G. O. Sars) Dall, p. 800. Hinge of right valve of a fully grown specimen No. 49032 to show truncated end of tooth; $\times 4\frac{1}{2}$.

PLATE LXXVI.

- Fig. 1. *Poromya subleris* Verrill, variety *microdonta* Dall, p. 813. End view of right valve of specimen No. 52533; $\times 3$.
2. The same. Interior of the same; $\times 3$.
3. *Cardiomya glypta* Bush, p. 810. Hinge of right valve of an adult specimen from station 2108; $\times 22$.
4. *Myonera gigantea* Verrill, p. 811. Hinge of right valve of type specimen No. 35255; $\times 1\frac{1}{2}$.
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- Fig. 7. *Cardiomya glypta* Bush, p. 810. Hinge of both valves of a young specimen No. 35362; $\times 22$.
8. *Cuspidaria pellucida* (Stimpson) Verrill and Bush, p. 805. Interior of left valve of specimen No. 48977; $\times 12$.
9. *Bathyarca abyssorum* Verrill and Bush, p. 843. Interior of left valve of specimen No. 78793; $\times 6$.

PLATE LXXVII.

- Fig. 1. *Macoma inflata* Dawson, p. 778. Hinge of both valves of specimen No. 52429; $\times 5\frac{1}{2}$.
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3. *Foldiella subangulata* Verrill and Bush, p. 865. Hinge of left valve of type specimen from station 46 *Bache*; \times about 13.
4. *Cuspidaria turgida* Verrill and Bush, p. 799. Interior of left valve of type specimen No. 78789; $\times 4$.
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8. *Bathyarca anomala* Verrill and Bush, p. 844. Hinge of right valve of type specimen No. 74081; $\times 10$.
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2. *Bathyarca profundicola* (Verrill), p. 844. Interior of right valve of specimen No. 52174; $\times 6$.
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PLATE LXXIX.

- Fig. 1. *Periploma undulata* Verrill, p. 823. Hinge of left valve of type specimen No. 44840; $\times 7\frac{1}{2}$.
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- Fig. 5. *Yoldiella inconspicua* Verrill and Bush, p. 869. Interior of left valve of a specimen from station 947; $\times 15$.
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7. *Yoldiella minuscula* Verrill and Bush, p. 870. Interior of left valve of specimen No. 38415; $\times 22$.
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9. *Cuspidaria formosa* Verrill and Bush, p. 803. Interior of left valve of type specimen No. 78313; $\times 3$.
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2. *Yoldiella iris* Verrill and Bush, p. 863. Interior of a left valve from station 895; $\times 11$.
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5. *Yoldiella fraterna* Verrill and Bush, p. 867. Exterior of left valve of type specimen from station 947; \times about 13.
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PLATE LXXXI.

- Fig. 1. *Lédella parva* Verrill and Bush, p. 857. Interior of a right valve No. 78365; $\times 25$.
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3. *Nucula cancellata* Jeffreys, p. 854. Hinge of right valve of specimen No. 45795; \times about 13.
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6. *Nucula proxima* Say (?) variety *ovata* Verrill and Bush, p. 852. Hinge of right valve of specimen No. 73467; \times about 16.
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6. The same. Front view.
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11. *Foldiella iris* Verrill and Bush, p. 863. Hinge of left valve of a young specimen; \times 20.

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- Fig. 1. *Crenella fragilis* Verrill, p. 847. Interior of right valve of type specimen No. 41543; \times about 3.
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- Figs. 1 and 2. *Chlamys benedicti* Verrill and Bush, p. 834. Exterior of both valves of a young specimen found among Foraminifera; \times 20.

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- Fig. 1. *Cyclopecten leptaleus* Verrill, p. 839. Portion of upper or left valve of type specimen No. 38413 to show character of sculpture; \times 10.
2. *Cyclopecten nanus* Verrill and Bush, p. 837. Exterior of lower or right valve of a young specimen from station 2265; \times 5.
3. The same. Exterior of left valve of a larger specimen from the same station; \times 5.
4. The same. Hinge of the same valve; \times 13.
5. *Cyclopecten pustulosus* Verrill, p. 839. Portion of left valve of specimen No. 48765 to show character of sculpture; \times 10.
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- Fig. 8. *Cyclopecten subimbrifer* Verrill and Bush, p. 840. Portion of left valve of specimen No. 48762 to show character of sculpture; $\times 10$;
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11. The same. Exterior of right valve of another specimen; $\times 3$.

PLATE LXXXVI.

- Fig. 1. *Solemya grandis* Verrill and Bush, p. 885. Exterior of left valve of type specimen No. 51345; $\times 1\frac{1}{2}$.
2. The same. Interior of right valve of an imperfect specimen No. 40103; $\times 1\frac{1}{2}$. Epidermal fringe restored from other specimen.
3. *Cryptodon (Axinulus) pygmaeus* Verrill and Bush, p. 792. Exterior of left valve of specimen No. 78368 from station 2697; $\times 22$.
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5. *Nucula cancellata* Jeffreys, p. 854. Exterior of left valve of specimen No. 45795; $\times 12$.
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- Fig. 1. *Poromya subleris* Verrill, variety *microdonta* Dall, p. 813. Hinge of a left valve No. 78799; $\times 5$.
2. *Forticordia granulifera* (Verrill) Dall, p. 816. Interior of a left valve (type specimen) No. 44838; $\times 4$.
3. *Lyonsiella subquadrata* (Jeffreys), p. 817. Interior of a left valve No. 78800; $\times 10$.
4. *Periploma affinis* Verrill and Bush, p. 822. Exterior of right valve of type specimen from station 873; $\times 4$.
5. *Periploma undulata* Verrill, p. 823. Exterior of left valve of type specimen No. 44840; $\times 4$.
6. *Propeamusium thalassinum* (Dall) Verrill, p. 841. Exterior of upper or left valve of a specimen from station 949; $\times 16$.
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PLATE LXXXVIII.

- Fig. 1. *Cryptodon croulinensis* (Jeffreys) Smith, variety *altus* Verrill and Bush, p. 787. Exterior of a left valve from Eastport, Maine, 1870; \times about 8.
2. The same. Interior of a right valve from the same locality; \times about 8.
3. *Cryptodon planus* Verrill and Bush, p. 788. Interior of left valve of type specimen from station 254; $\times 14$.
4. The same. Exterior of right valve of the same specimen.
5. *Nucula proxima* Say (?) variety *ovata* Verrill and Bush, p. 852. Exterior of left valve of specimen No. 73467; \times about 12.
6. *Macoma inflata* Dawson, p. 778. Exterior of left valve of specimen No. 52427; $\times 3$.
7. *Kennerlia brevis* Verrill and Bush, p. 821. *a*, Exterior of left valve of specimen No. 40232; *b*, interior of right valve of another specimen No. 45884; $\times 4$.
8. *Nucula granulosa* Verrill, p. 853. Exterior of left valve of type specimen No. 38451; \times about 26.

PLATE LXXXIX.

- Fig. 1. *Cryptodon obsoletus* Verrill and Bush, p. 789. Exterior of right valve of a specimen from station 949; \times about 20.
2. The same. Interior of left valve of the same specimen.
3. *Leptaxinus minutus* Verrill and Bush, p. 797. Hinge of left valve of type specimen No. 45686; \times 45.
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5. The same. Interior of the same valve; \times 30.
6. *Cryptodon plicatus* Verrill, p. 786. Interior of left valve of a young specimen No. 44826; \times 9.
7. *Cryptodon (Axinulus) brevis* Verrill and Bush, p. 790. Exterior of left valve of type specimen from station 2208; \times about 22.
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PLATE XC.

- Fig. 1. *Cryptodon (Axinulus) inequalis* Verrill and Bush, p. 791. Exterior of right valve of type specimen from stations 98-99; \times about 10.
2. The same. Interior of left valve of the same specimen.
3. *Cryptodon croulinensis* (Jeffreys) Smith, p. 786. Interior of left valve of a specimen from stations 62-65; \times about 13.
4. The same. Exterior of right valve of the same specimen.
5. *Axinodon ellipticus* Verrill and Bush, p. 796. Exterior of right valve of type specimen No. 35175; \times about 13.
6. The same. Interior of left valve of the same specimen.
7. *Tellimya ferruginosa* (Montagu), p. 783. Interior of left valve of specimen No. 49588; \times 20. a, Cartilage.
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PLATE XCI.

- Fig. 1. *Cryptodon insignis* Verrill and Bush, p. 785. Interior of a left valve No. 52733 from station 2499; \times about $1\frac{1}{2}$.
2. The same. Exterior of a left valve from the same station; \times about $1\frac{1}{2}$.
3. *Montacuta triquetra* Verrill and Bush, p. 782. Interior of right valve of type specimen from station 2307; \times 24.
4. *Montacuta cuneata* Verrill and Bush, p. 782. Exterior of right valve of a specimen from station 2278; \times 17.
5. *Cryptodon equalis* Verrill and Bush, p. 788. Hinge of both valves of a specimen from station 18 *Bache*; \times about 5.
6. The same. Exterior of left valve of specimen No. 74302; \times about 5.
7. *Cryptodon (Axinulus) oratus* Verrill and Bush, p. 793. Interior of left valve of type specimen from station 949; \times 35.
8. *Kelliella nitida* Verrill, p. 778. Interior of left valve of specimen No. 37971; \times 14.

PLATE XCII.

- Fig. 1. *Axinodon ellipticus* Verrill and Bush, p. 796. Hinge of left valve of type specimen No. 35175; \times about $26\frac{1}{2}$.
2. *Limopsis sulcata* Verrill and Bush, p. 845. Interior of a right valve from station 2199; \times 4.
3. *Cryptodon (Axinulus) simplex* Verrill and Bush, p. 791. Hinge of right valve of type specimen from station 1093; \times about 13.
4. The same. Interior of left valve of the same specimen.
5. *Axinopsis orbiculata* Sars, variety *inequalis* Verrill and Bush, p. 794. Interior of left valve of type specimen from Eastport, Maine, 1872; \times about 13.

Fig. 6. The same. Hinge of both valves of the same specimen; \times about 26.

7. *Montacuta bidentata* (Montagu) variety *tenuis* Verrill and Bush, p. 779. Interior of a right valve from station 2277; \times about 13.
8. *Montacuta bidentata* (Montagu) variety *fragilis* Verrill and Bush, p. 780. Interior of a right valve No. 46134; \times 17.
9. *Montacuta ovata* Jeffreys, p. 781. Interior of a right valve No. 46136; \times 20.
10. The same. Interior of a left valve No. 46137; \times 20.

PLATE XCIII.

Fig. 1. *Cryptodon* (*Axinulus*) *oratus* Verrill and Bush, p. 793. Hinge of both valves of type specimen from station 949; \times 45.

2. *Kelliopsis elevata* (Stimpson) Verrill and Bush, p. 784. Hinge of a right valve No. 74333 from Naushon; \times 30. *a*, Resilium and ossicle.
3. The same. Hinge of another right valve from the same station, to show variation; \times 30.
4. The same. Hinge of both valves of another specimen from the same station; \times 30.
5. *Montacuta cuneata* Verrill and Bush, p. 782. Hinge of both valves from station 2278; \times 30.
6. *Montacuta tumidula* Jeffreys, p. 781. Hinge of a left valve No. 35412; \times 30. *a*, Resilium and ossicle.
7. *Montacuta bidentata* (Montagu), p. 779. Hinge of a right valve No. 74328 from Naushon; \times 30.
8. The same. Hinge of both valves of a smaller specimen from the same station; \times 30.
9. *Montacuta striatula* Verrill and Bush, p. 780. Hinge of a left valve from station 2276; \times 30. Hinge of a right valve from station 2273; \times 30.
10. *Kelliella nitida* Verrill, p. 778. Hinge of both valves of specimen No. 37971; \times 12. Right valve turned down, left turned up

PLATE XCIV.

Fig. 1. *Montacuta tumidula* Jeffreys, p. 781. Interior of a left valve No. 35412 from station 2103; \times 20. *a*, Resilium and ossicle.

2. The same. Interior of a right valve from the same station; \times 20.
3. *Kellia suborbicularis* (Montagu), p. 779. Interior of left valve of a specimen from off Salem, Massachusetts, 1877; \times 10.
4. The same. Interior of right valve of the same specimen.
5. *Montacuta casta* Verrill and Bush, p. 781. Exterior of a left valve from station 2283; \times 20.
6. *Montacuta bidentata* (Montagu), p. 779. Interior of a right valve No. 74328; \times about 13.
7. *Kelliopsis elevata* (Stimpson) Verrill and Bush, p. 784. Interior of a right valve No. 74333 from Naushon; \times about 13. *a*, Resilium and ossicle.
8. The same. Exterior of a left valve from the same station; \times about 13.

PLATE XCV.

Fig. 1. *Lyonsia granulifera* Verrill and Bush, p. 818. Exterior of a left valve (type specimen) No. 52561; \times about $2\frac{1}{2}$.

2. *Vorticordia granulifera* (Verrill) Dall, p. 816. Hinge of a left valve (type specimen) No. 44838; \times 8.
3. The same. Hinge of both valves of a fully grown specimen No. 78679; \times 4. Turned up to show ossicle, *a*.
4. The same. Hinge of a right valve of another specimen No. 78929; \times $6\frac{1}{2}$.

- Fig. 5. *Clidiophora inornata* Verrill and Bush, p. 819. Hinge of both valves of specimen No. 49760 from station 327; \times about $2\frac{1}{2}$.
6. The same. Exterior of a left valve of a specimen from the same station; \times about $2\frac{1}{2}$.
7. *Lyonsiella cordata* Verrill and Bush, p. 818. Hinge of left valve of type specimen No. 52540; \times 8. *a*, Ossicle; *b*, ligament.
8. The same. Exterior of right valve of the same specimen; \times about 4.
9. *Limopsis sulcata* Verrill and Bush, p. 845. Hinge of a right valve from station 2199; \times about $10\frac{1}{2}$.
10. *Nucula verrillii* Dall, p. 853. Hinge of left valve of specimen No. 45752; \times about 26.

PLATE XCVI.

- Fig. 1. *Limopsis sulcata* Verrill and Bush, p. 845. Exterior of a right valve from station 2199; \times 16.
2. *Choristodon* (?) *cancellatus* Verrill, p. 778. Hinge of a left valve (type specimen) No. 44839; \times 16.
3. The same. Exterior of the same valve; \times 6.

PLATE XCVII.

- Fig. 1. *Glomus nitens* Jeffreys, p. 848. Interior of left valve of specimen No. 78784; \times 12.
2. The same. Hinge of the same; \times 20.
3. *Foldiella expansa* (Jeffreys), p. 871. Interior of right valve of specimen No. 78363; \times 16.
4. *Malletia obtusa* (M. Sars) Mörch, p. 874. Interior of left valve of a very young specimen from station 2706; \times 20.
5. *Axinopsis cordata* Verrill and Bush, p. 795. Interior of a left valve from station 2307; \times 16.
6. The same. Interior of a right valve from station 1092; \times 16.
7. *Malletia abyssorum* Verrill and Bush, p. 875. Interior of right valve of type specimen No. 52159; \times 12.
8. *Foldiella curta* Verrill and Bush, p. 868. Interior of right valve of type specimen No. 38457; \times 20.
9. *Hyalopecten dilectus* Verrill and Bush, p. 836. A portion of the exterior of both valves of type specimen No. 52539; \times 8.

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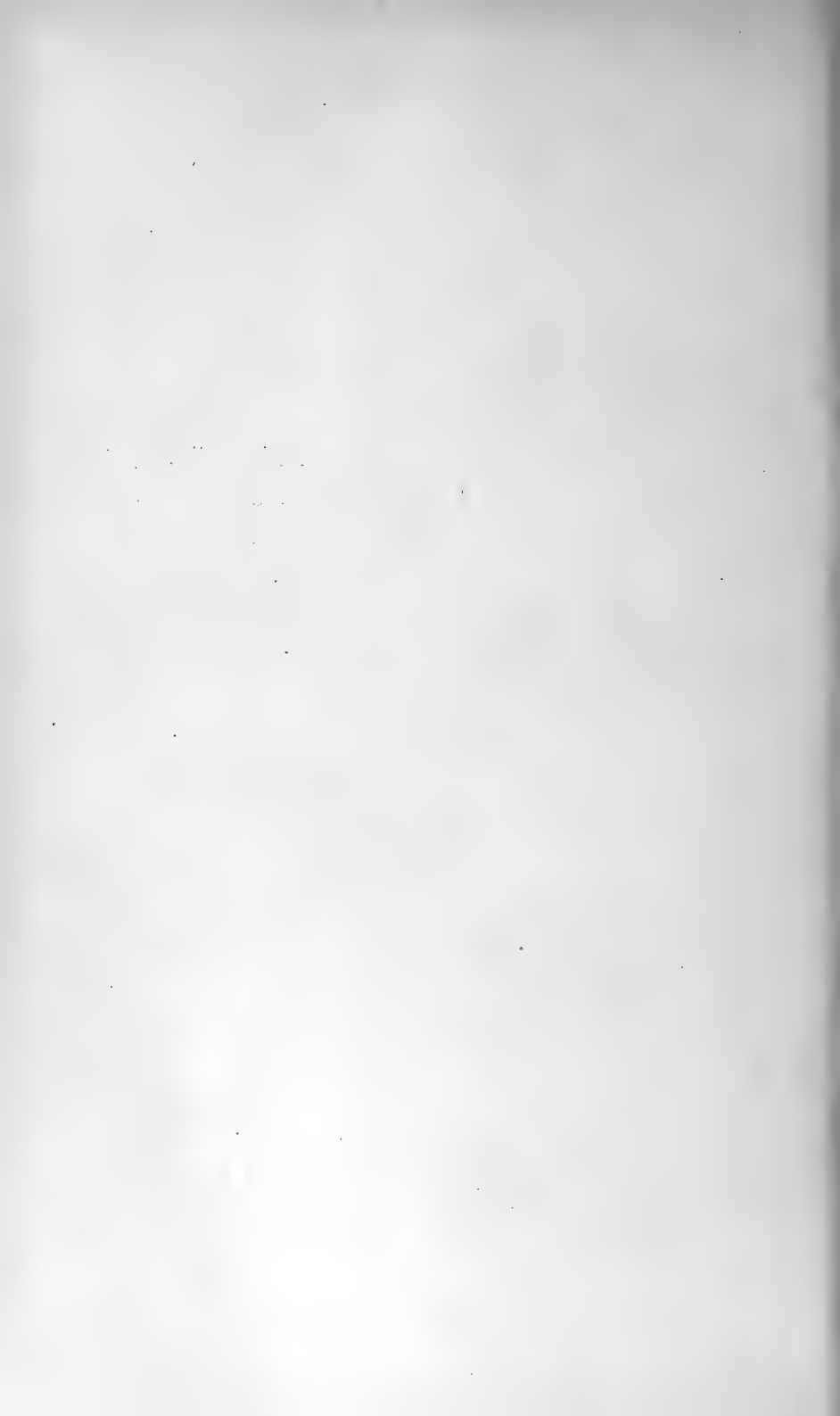
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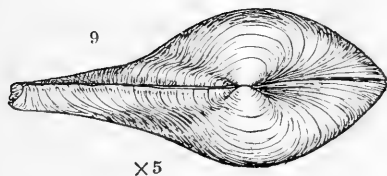
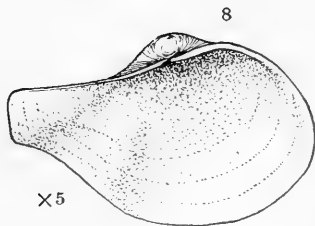
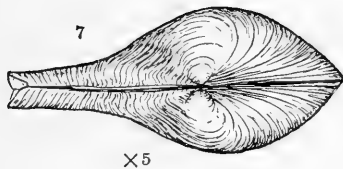
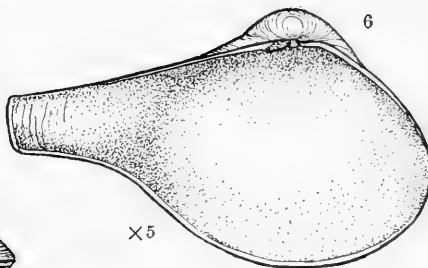
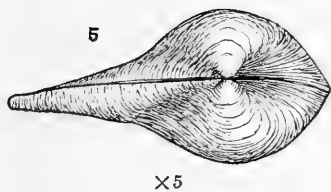
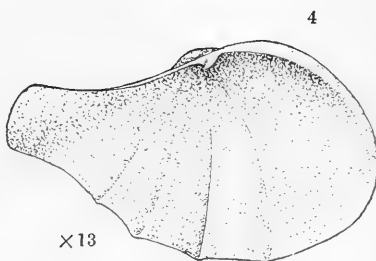
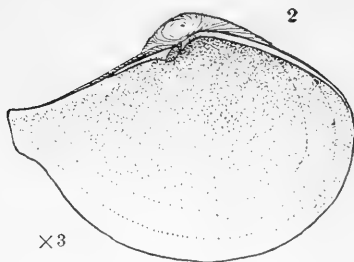
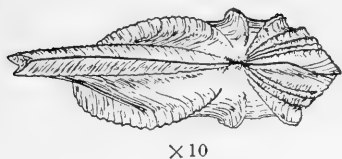
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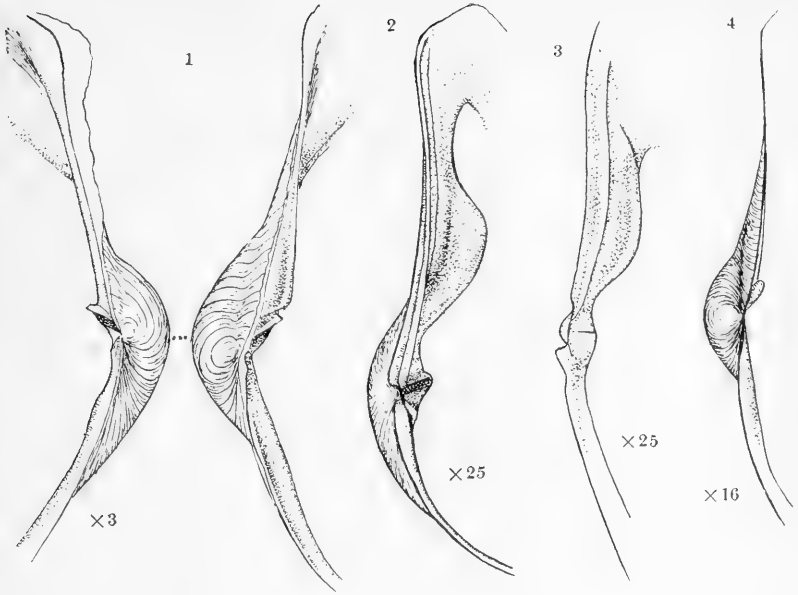




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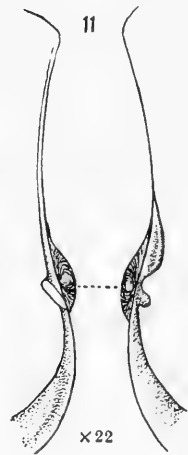
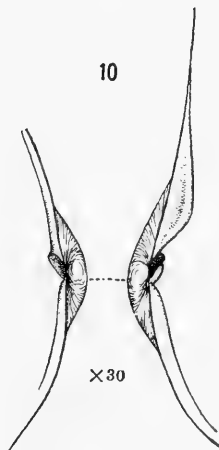
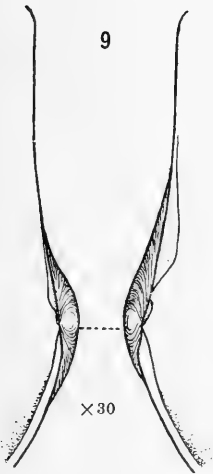
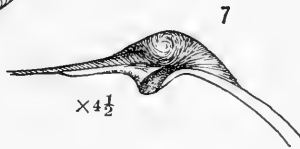
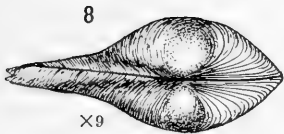
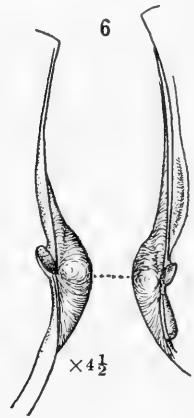
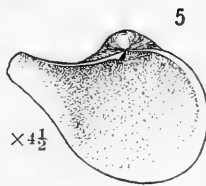
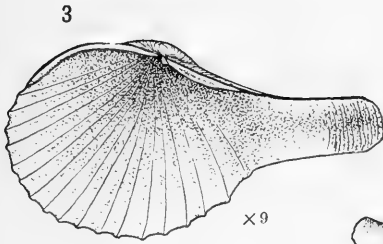
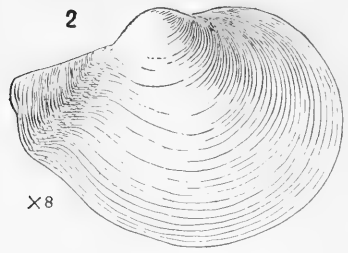
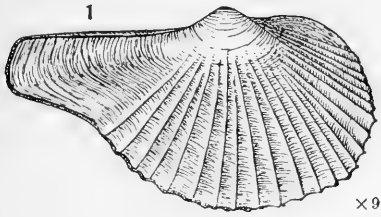




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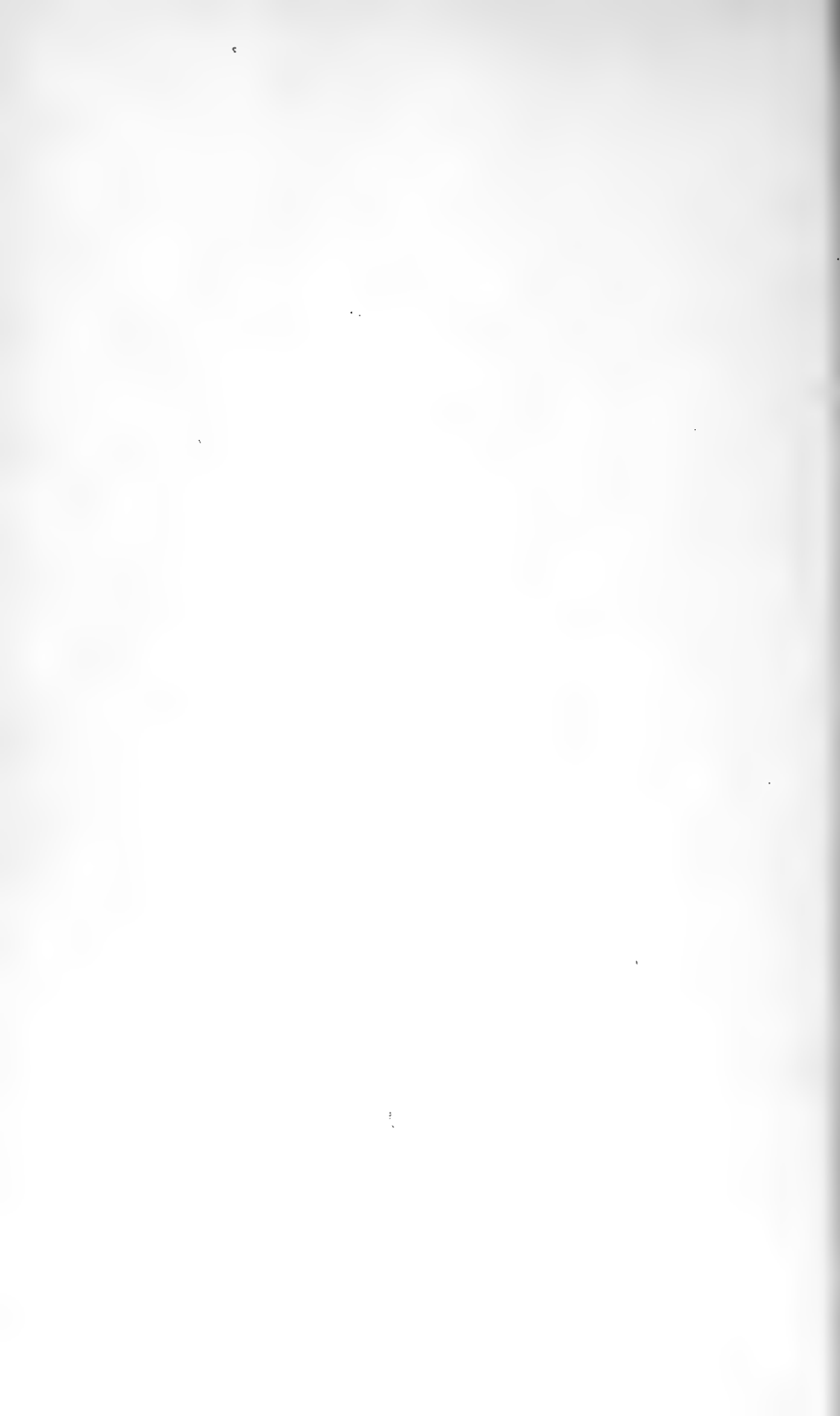
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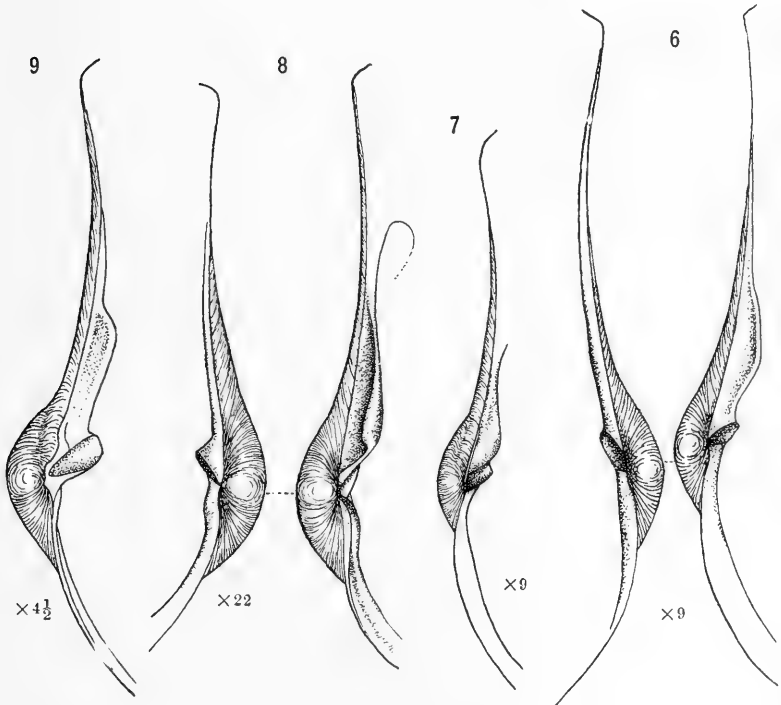
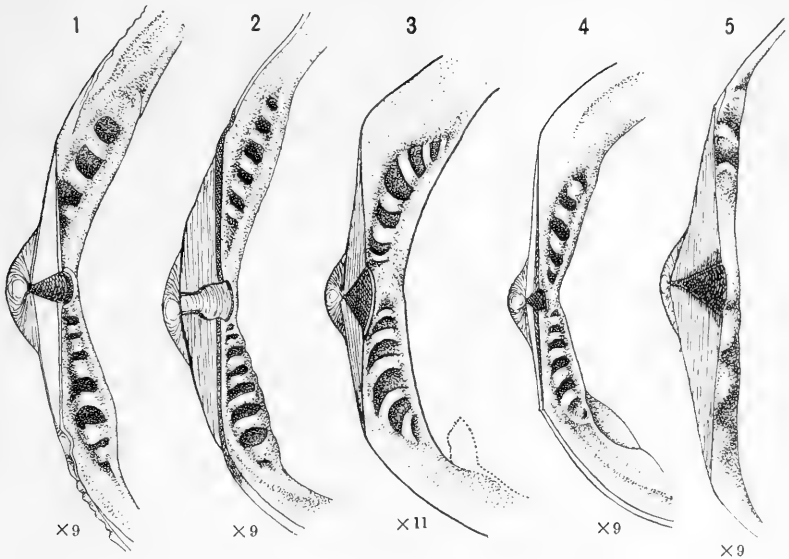




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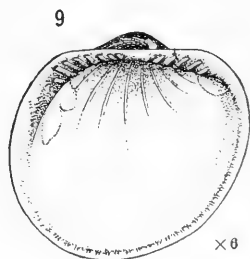
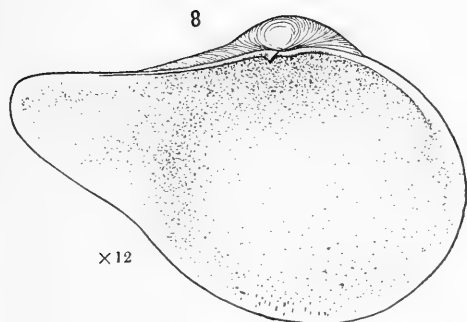
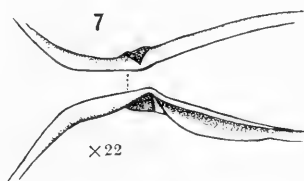
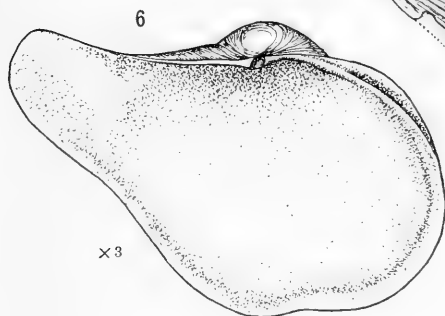
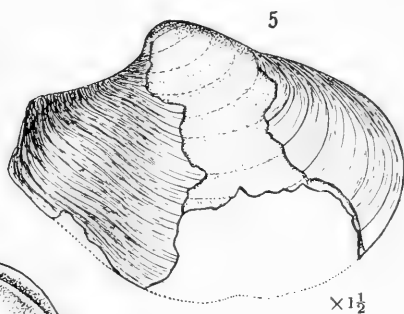
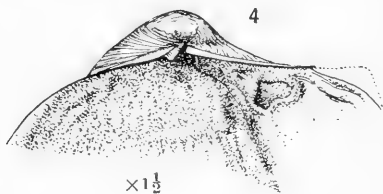
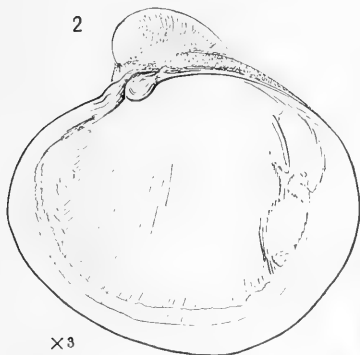
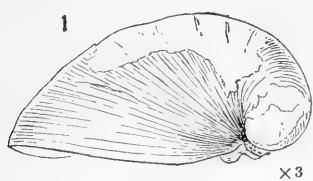




DEEP SEA BIVALVES.

FOR EXPLANATION OF PLATE SEE PAGE 889.

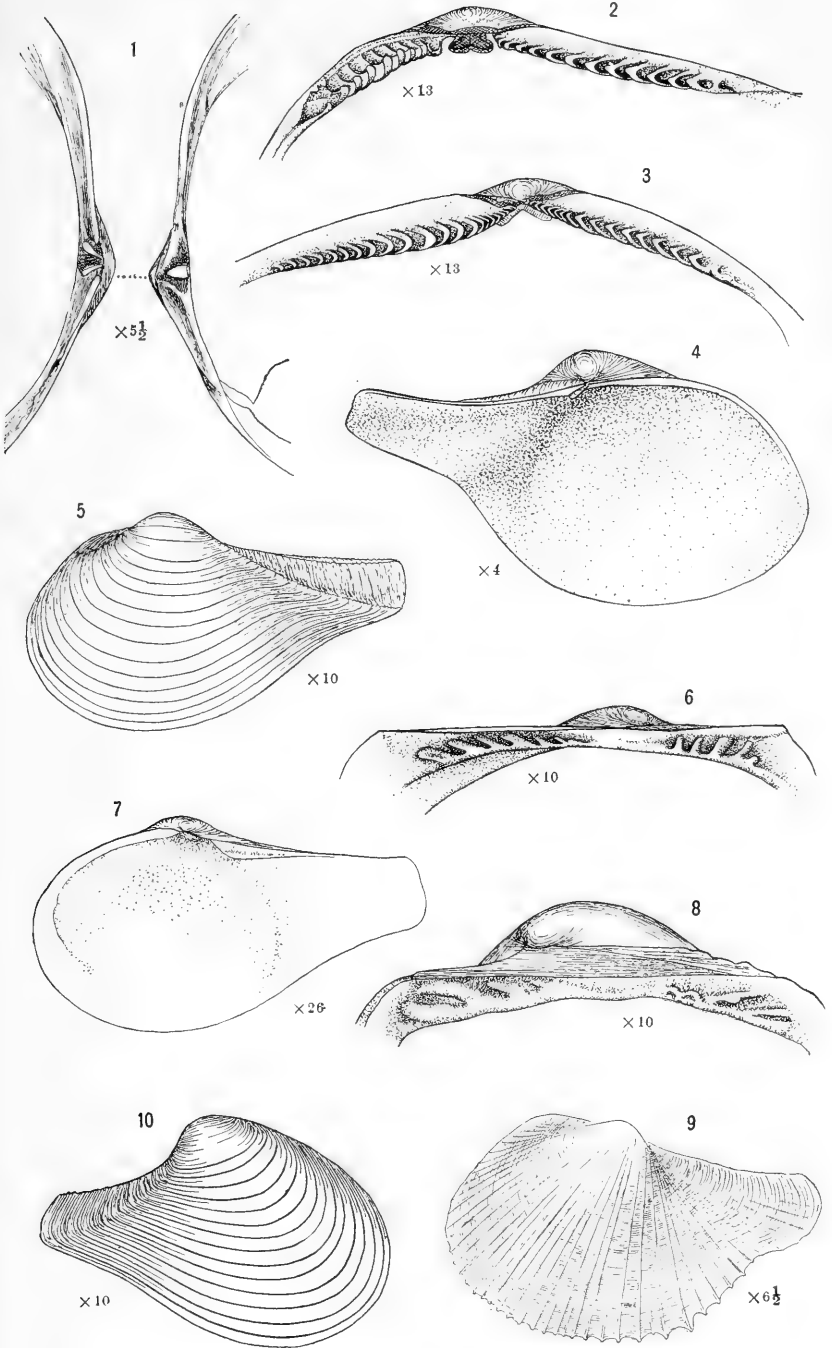




DEEP SEA BIVALVES.

FOR EXPLANATION OF PLATE SEE PAGES 889, 890.

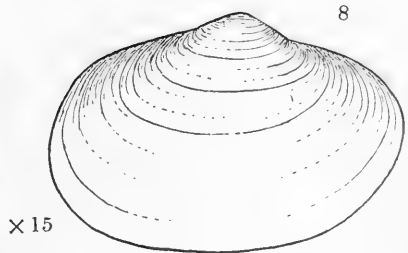
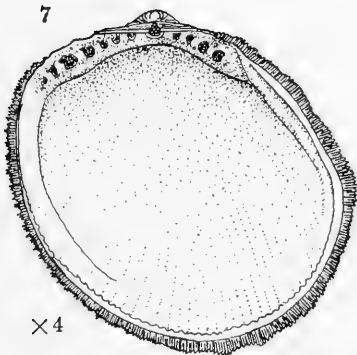
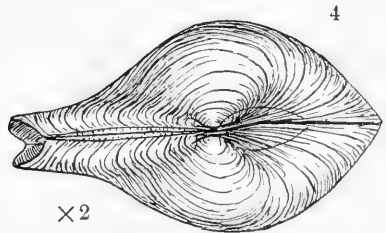
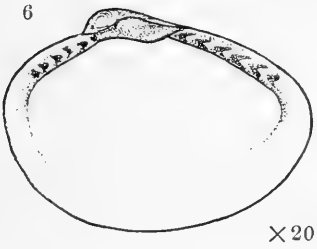
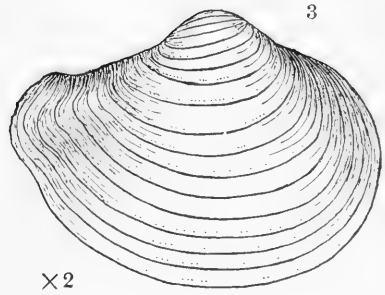
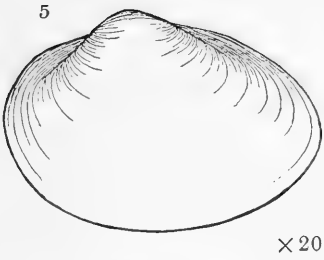
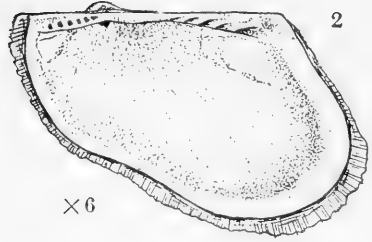
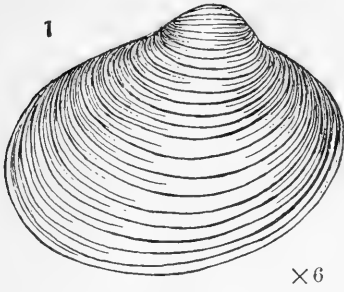




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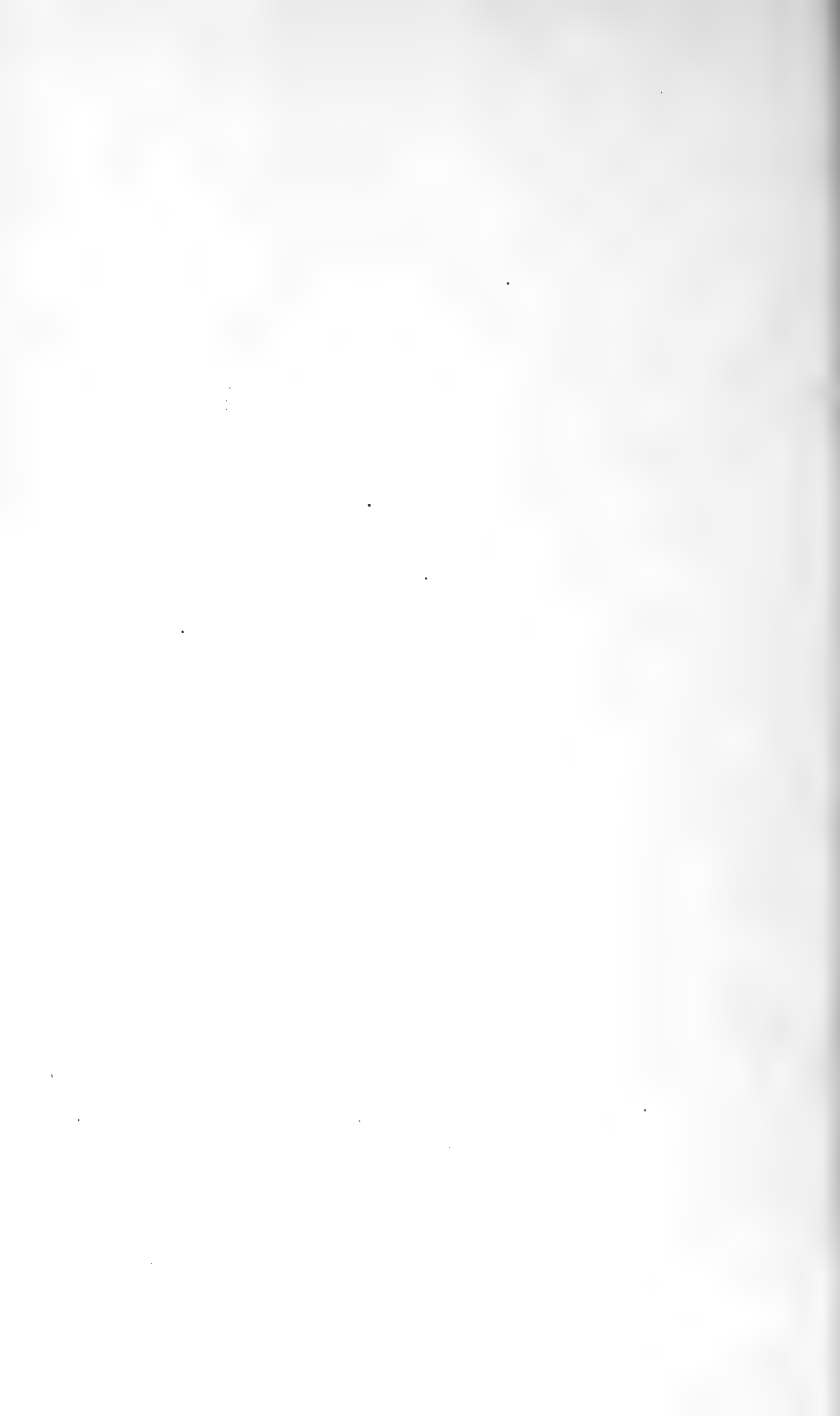
FOR EXPLANATION OF PLATE SEE PAGE 890.

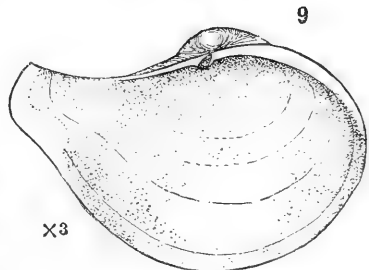
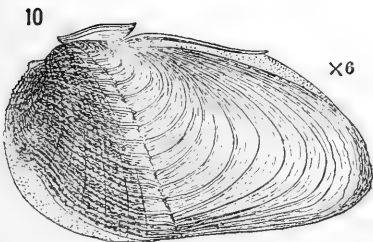
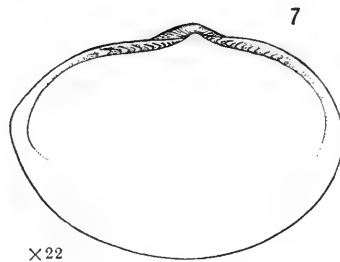
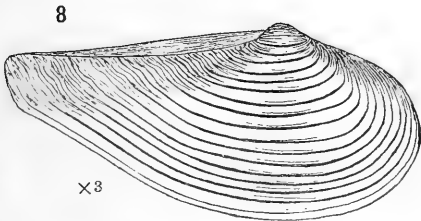
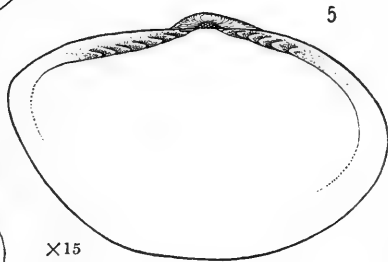
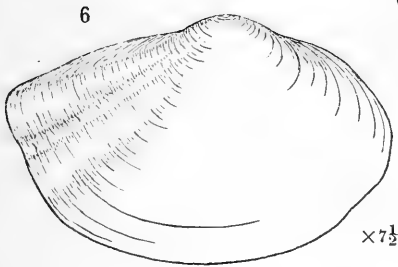
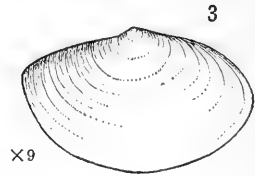
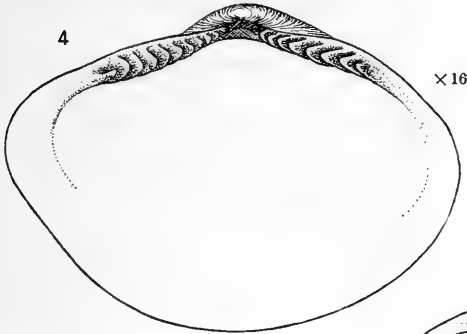
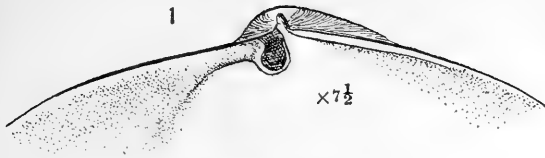




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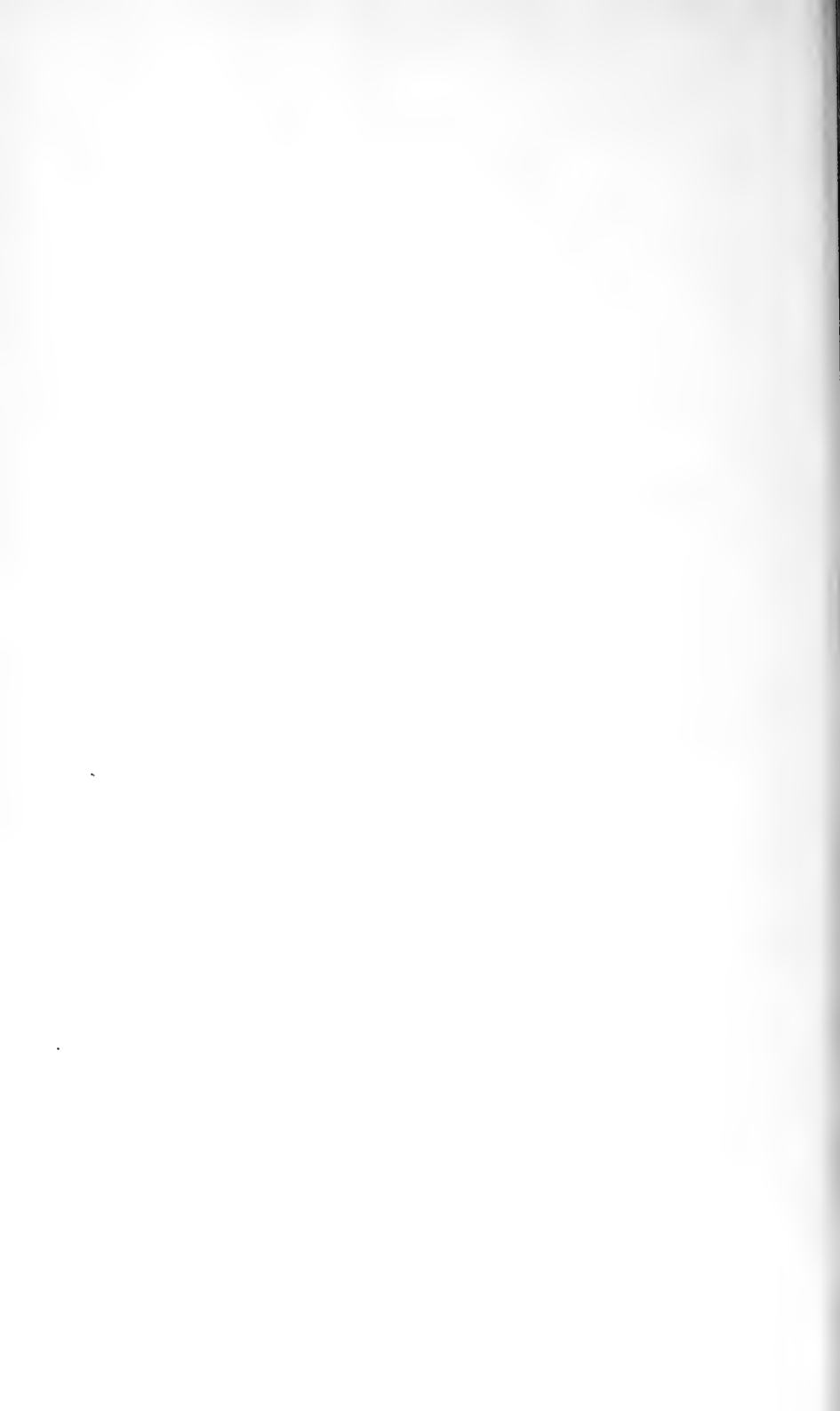
FOR EXPLANATION OF PLATE SEE PAGE 890.

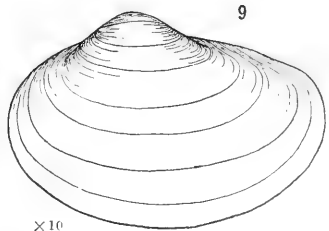
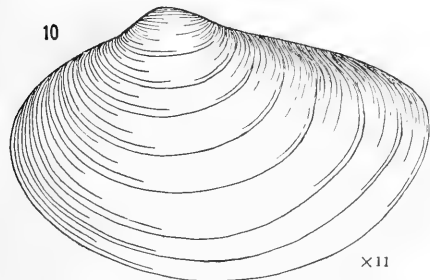
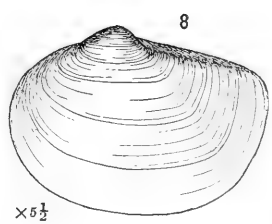
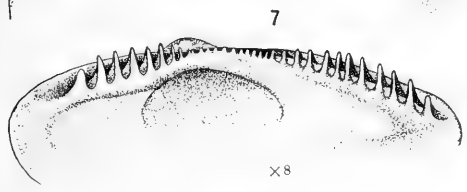
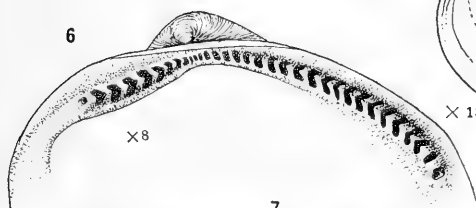
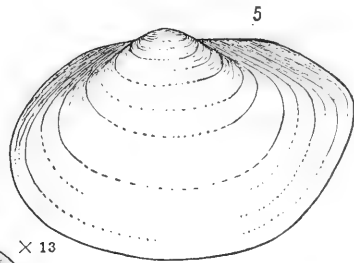
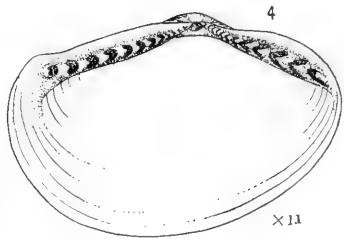
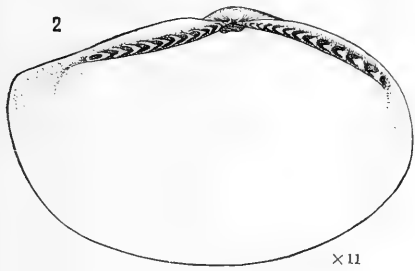
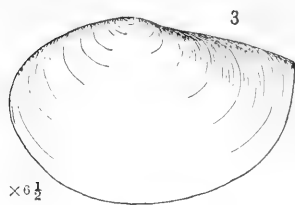
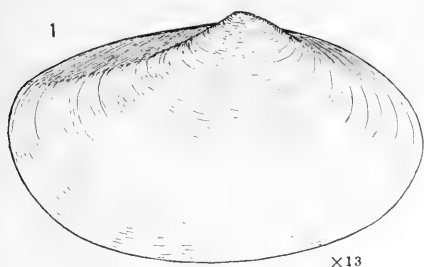




DEEP SEA BIVALVES.

FOR EXPLANATION OF PLATE SEE PAGES 890, 891.

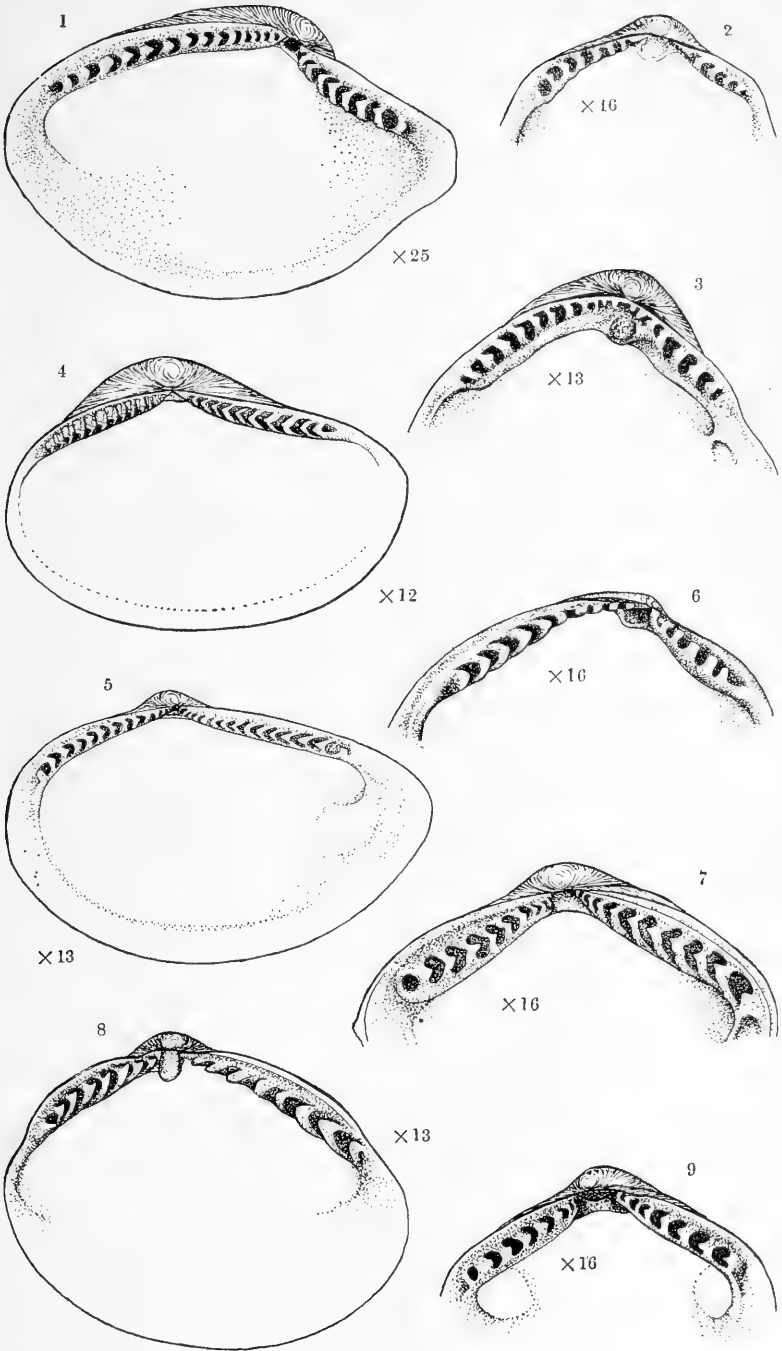




DEEP SEA BIVALVES.

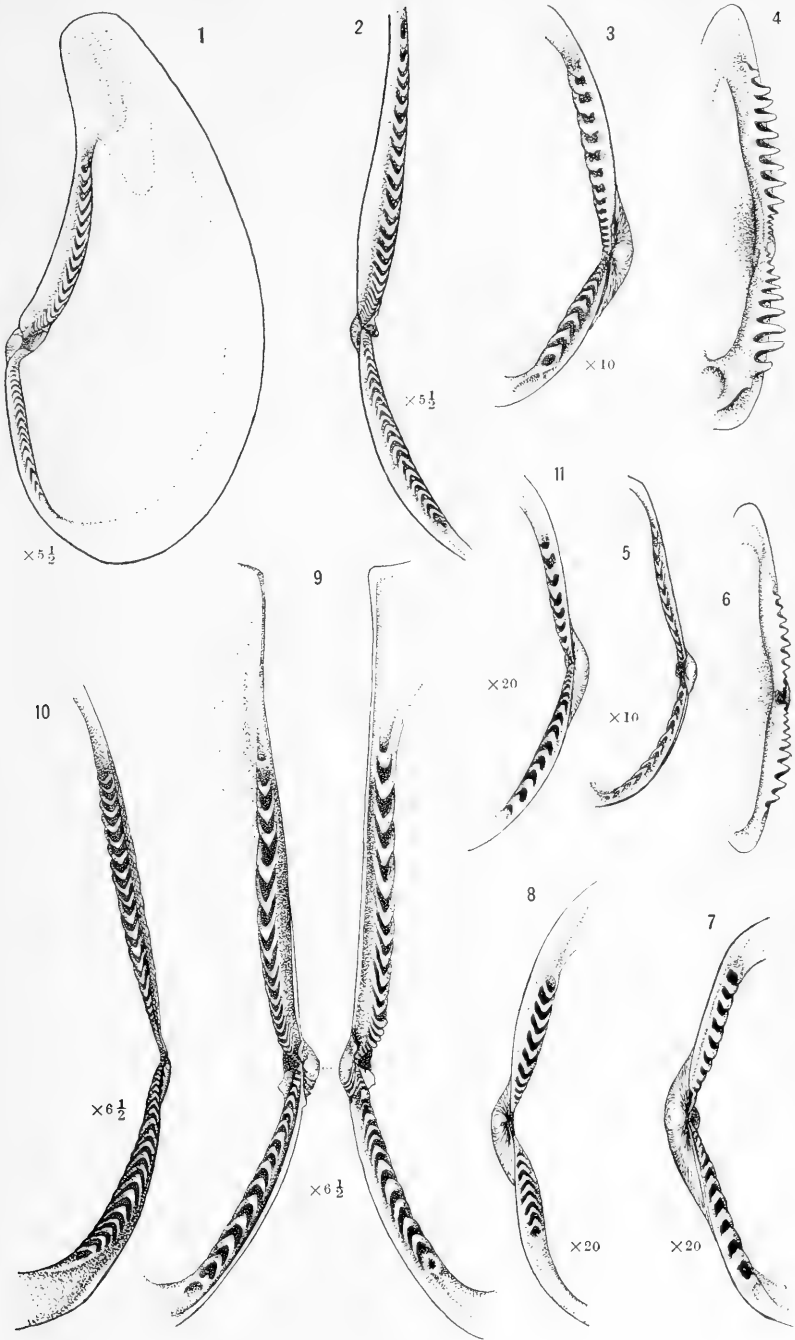
FOR EXPLANATION OF PLATE SEE PAGE 891.





DEEP SEA BIVALVES.

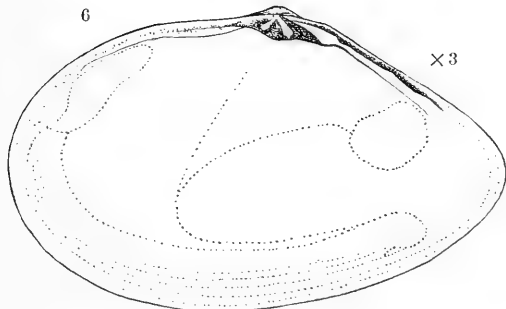
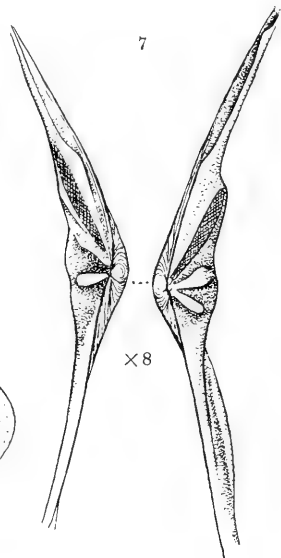
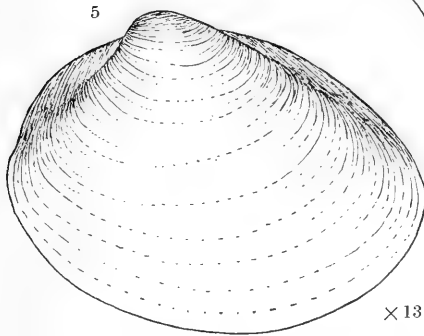
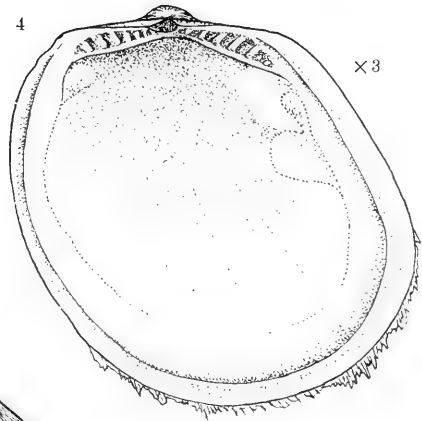
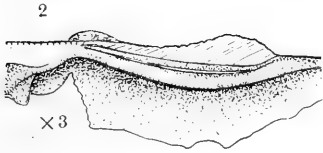
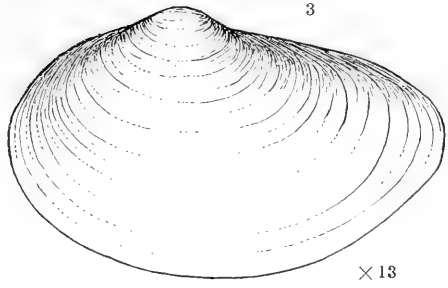
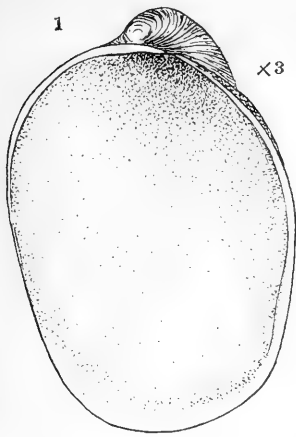
FOR EXPLANATION OF PLATE SEE PAGE 891.



DEEP SEA BIVALVES.

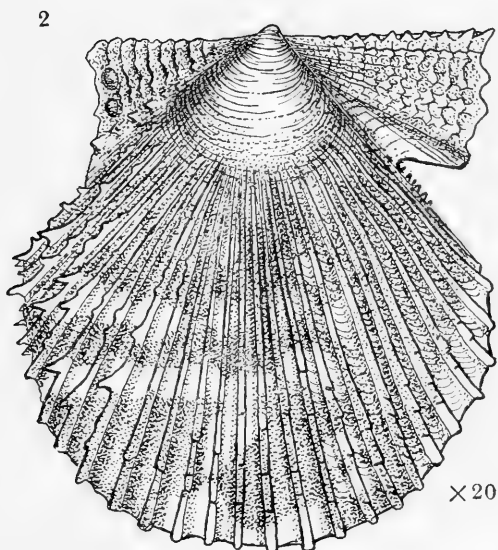
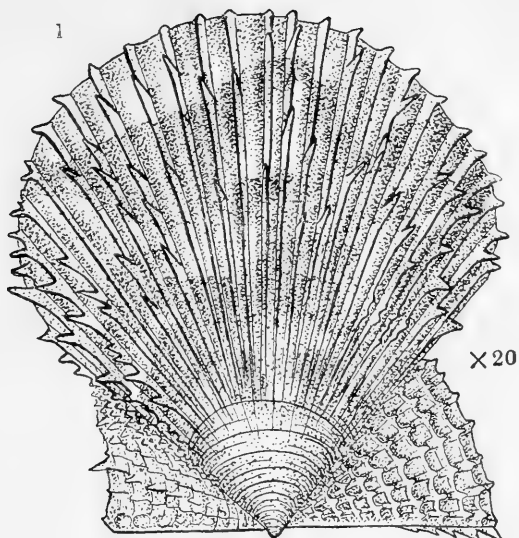
FOR EXPLANATION OF PLATE SEE PAGE 892.





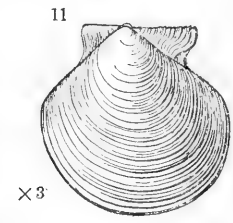
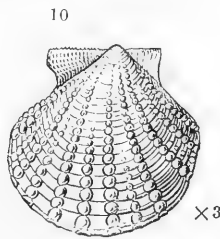
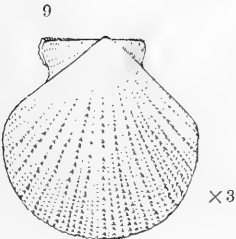
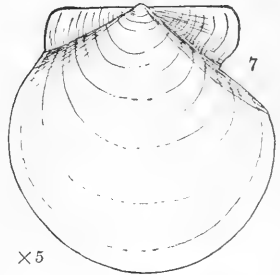
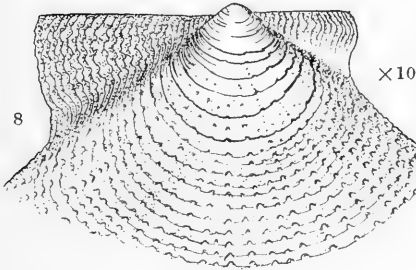
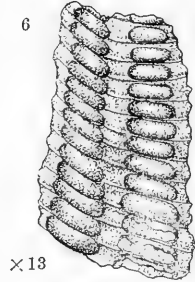
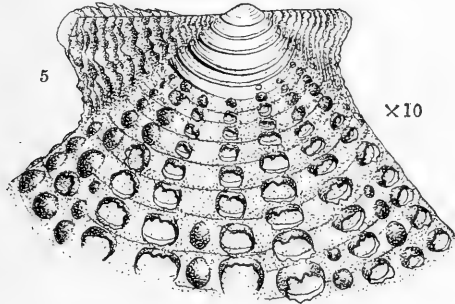
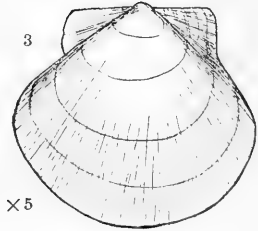
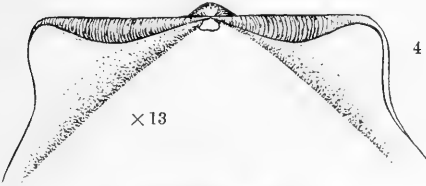
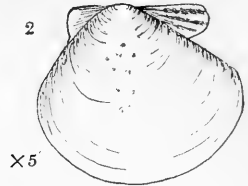
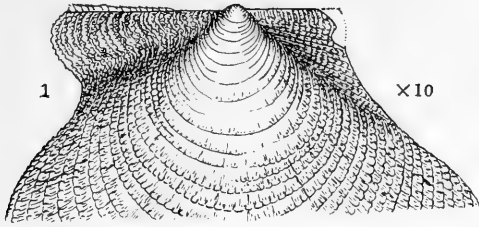
DEEP SEA BIVALVES.





DEEP SEA BIVALVES.

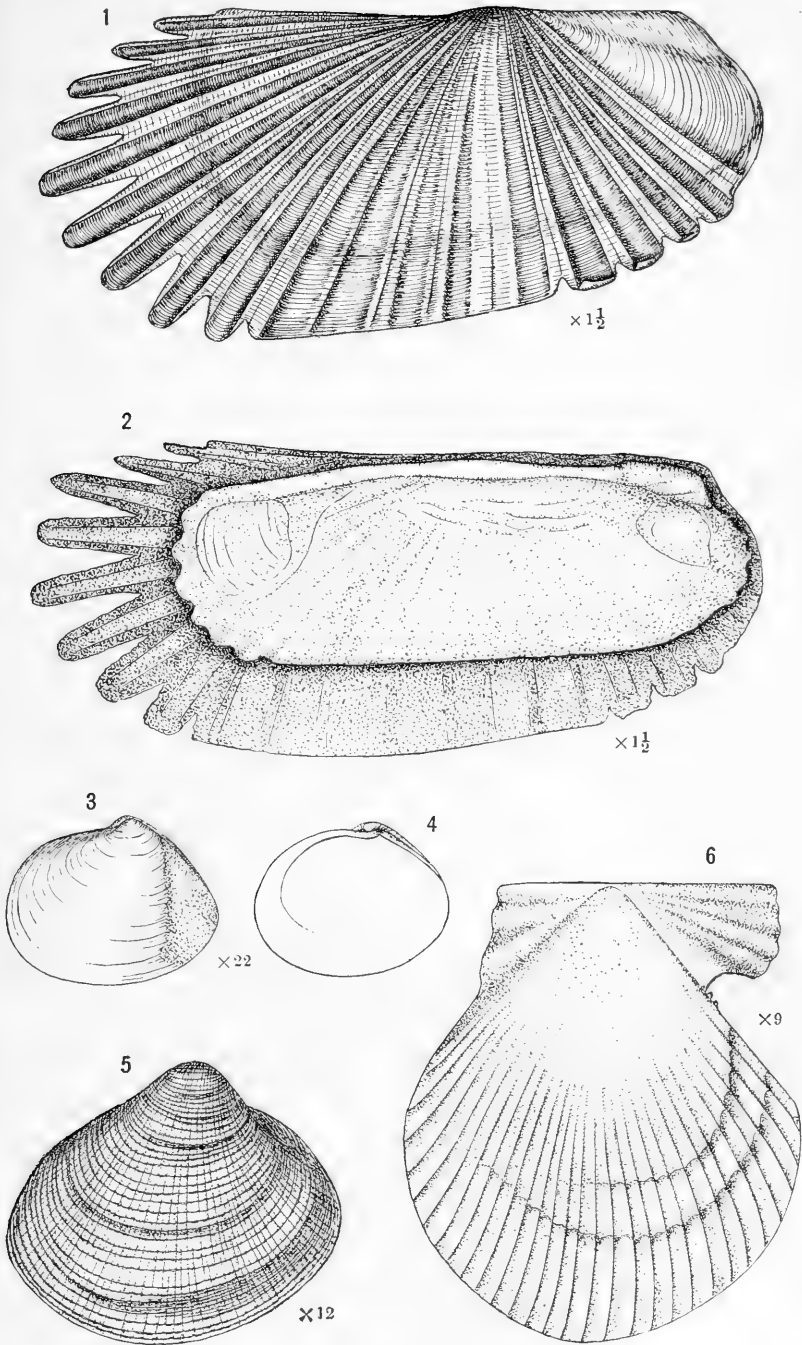
FOR EXPLANATION OF PLATE SEE PAGE 892.



DEEP SEA BIVALVES.

FOR EXPLANATION OF PLATE SEE PAGES 892, 893.

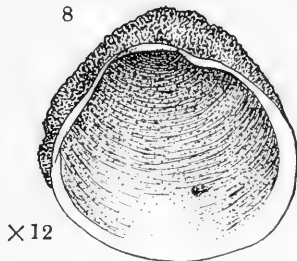
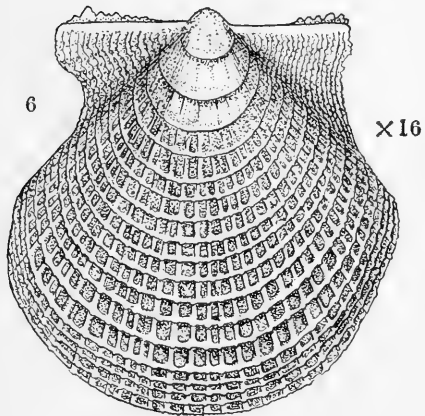
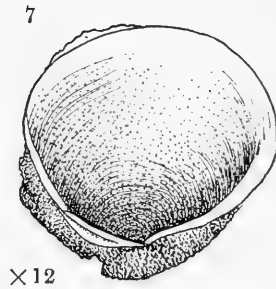
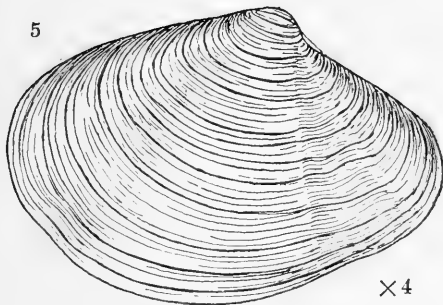
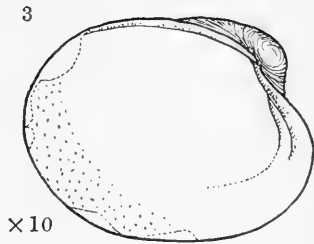
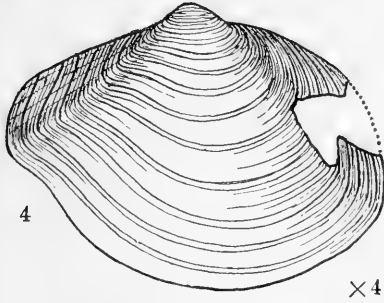
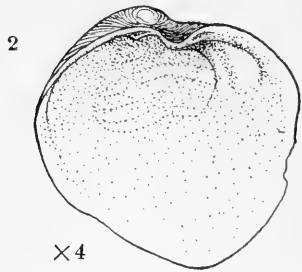




DEEP SEA BIVALVES.

FOR EXPLANATION OF PLATE SEE PAGE 893.

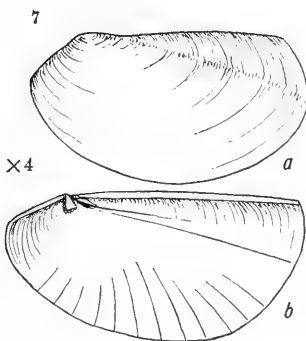
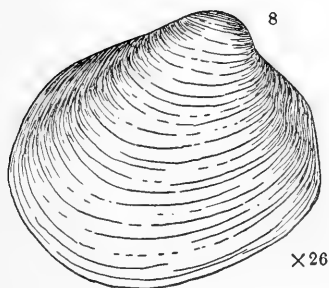
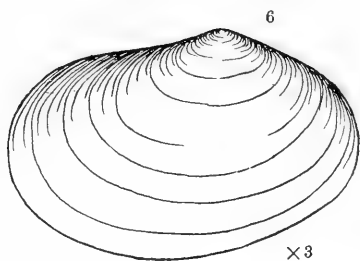
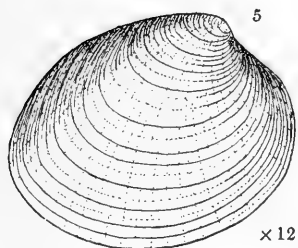
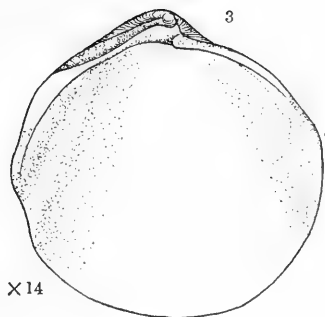
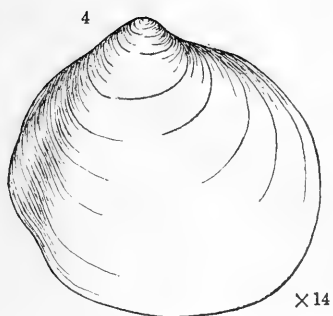
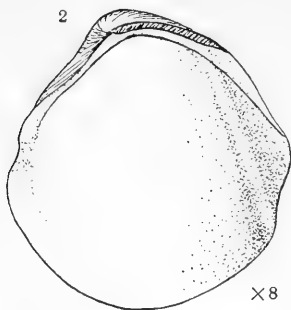
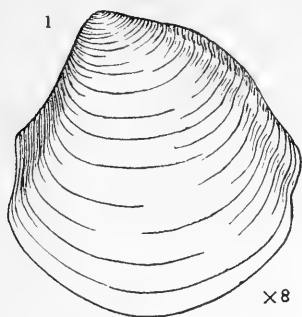




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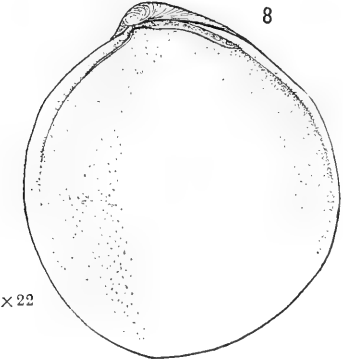
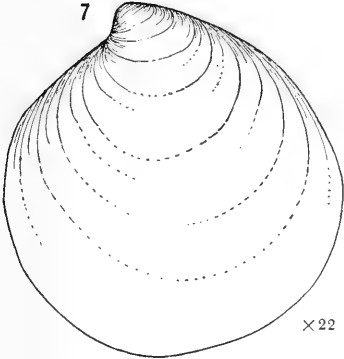
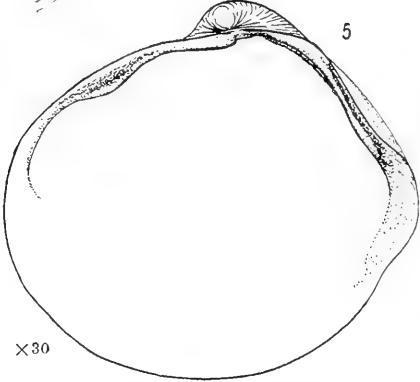
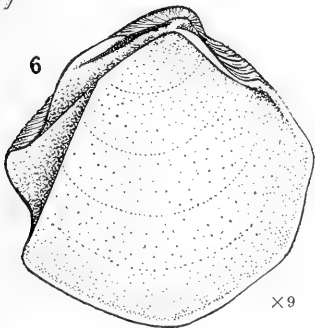
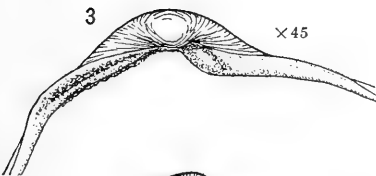
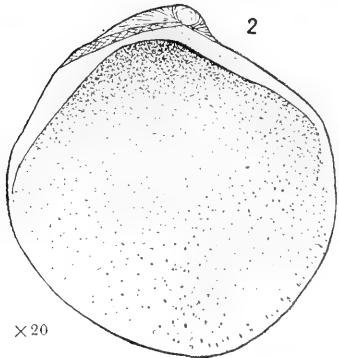
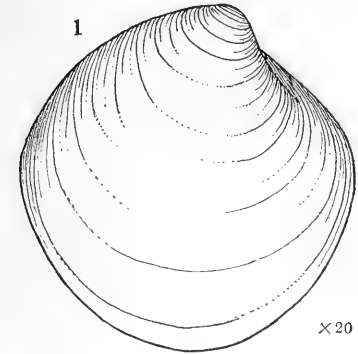
FOR EXPLANATION OF PLATE SEE PAGE 893.





DEEP SEA BIVALVES.

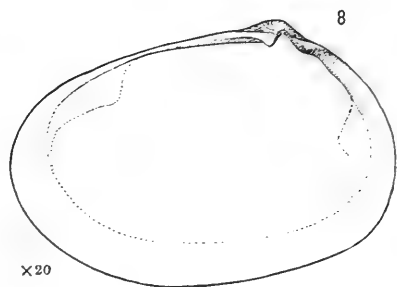
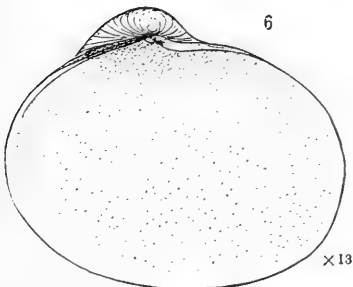
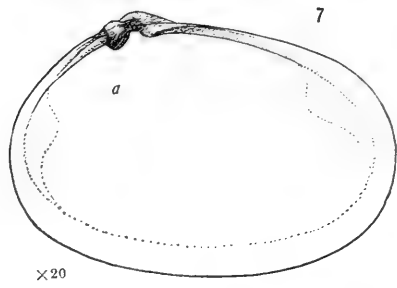
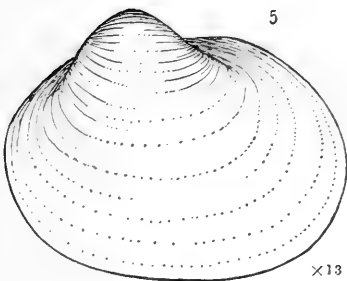
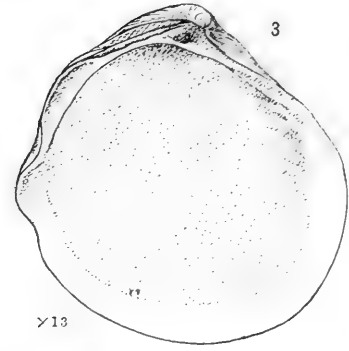
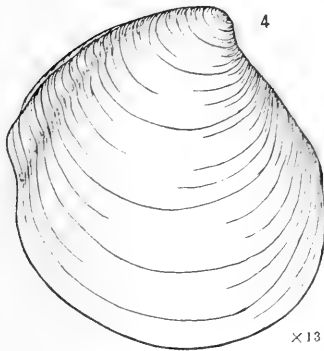
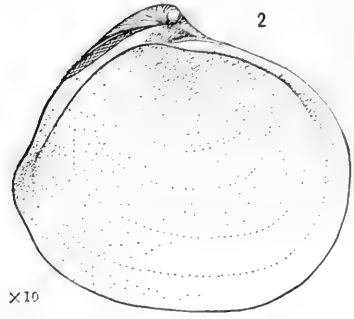
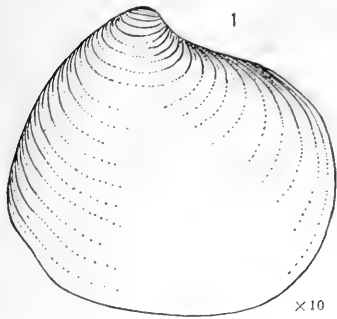
FOR EXPLANATION OF PLATE SEE PAGE 893.



DEEP SEA BIVALVES.

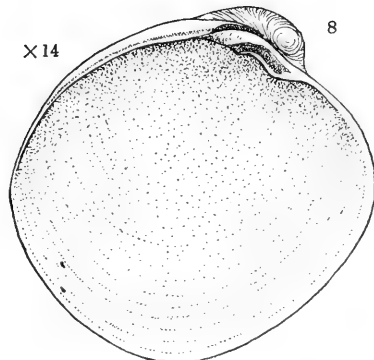
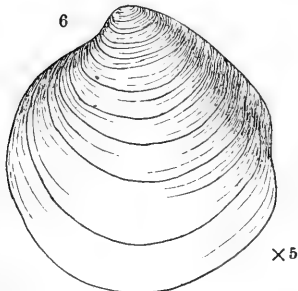
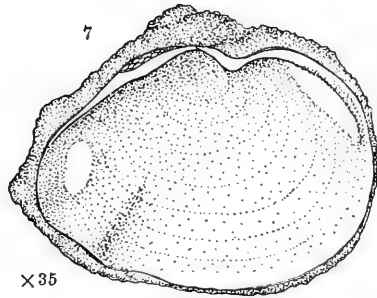
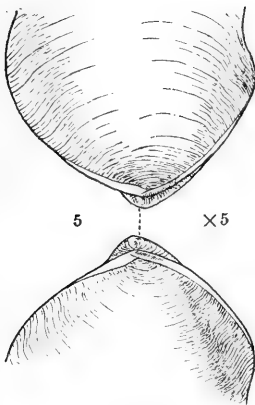
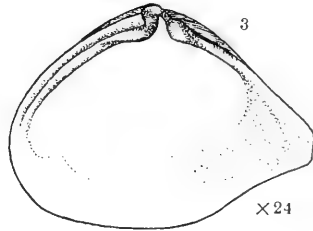
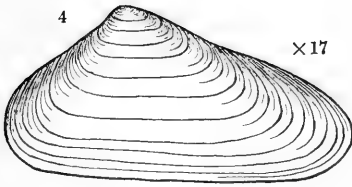
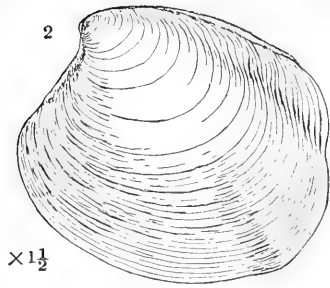
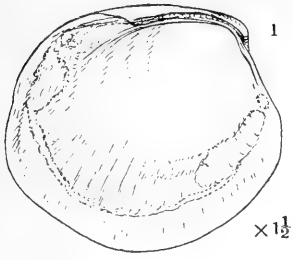
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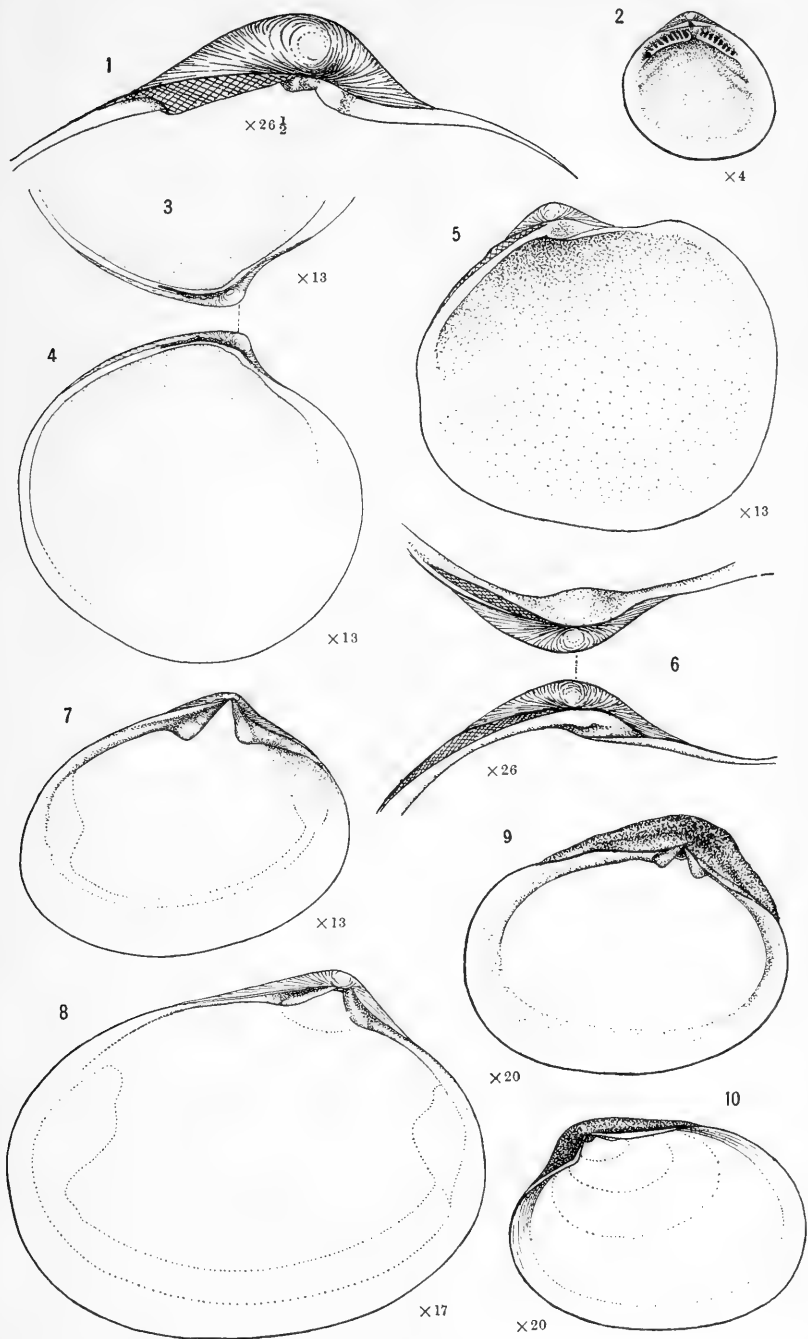
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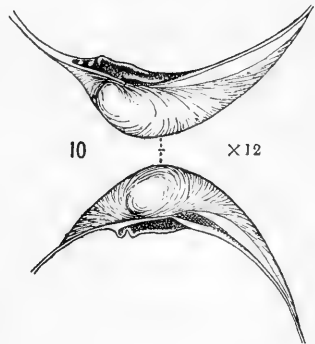
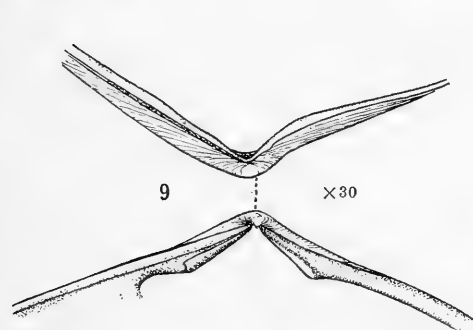
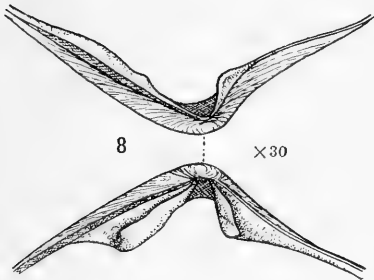
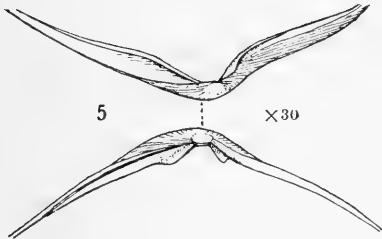
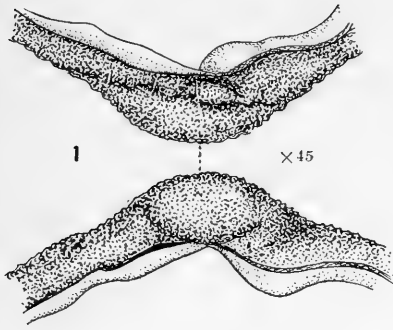




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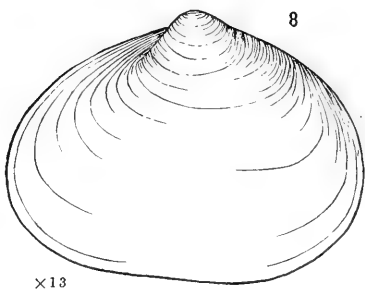
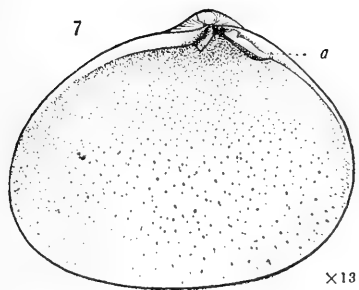
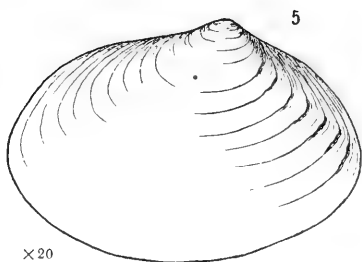
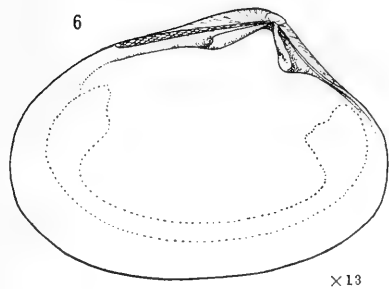
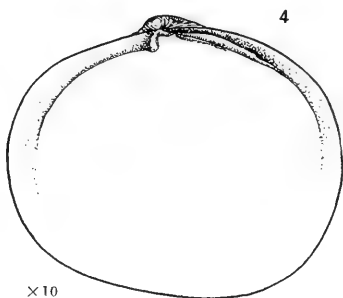
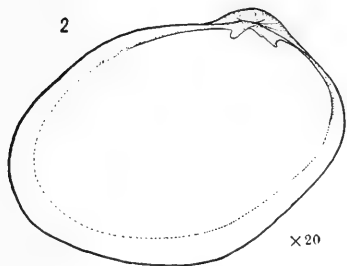
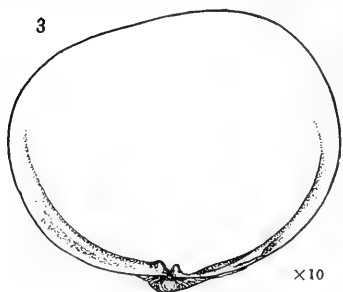
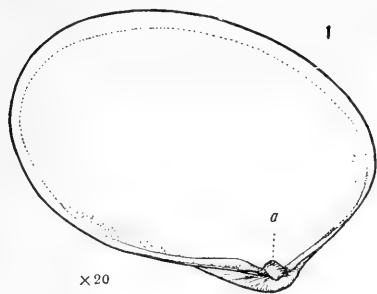




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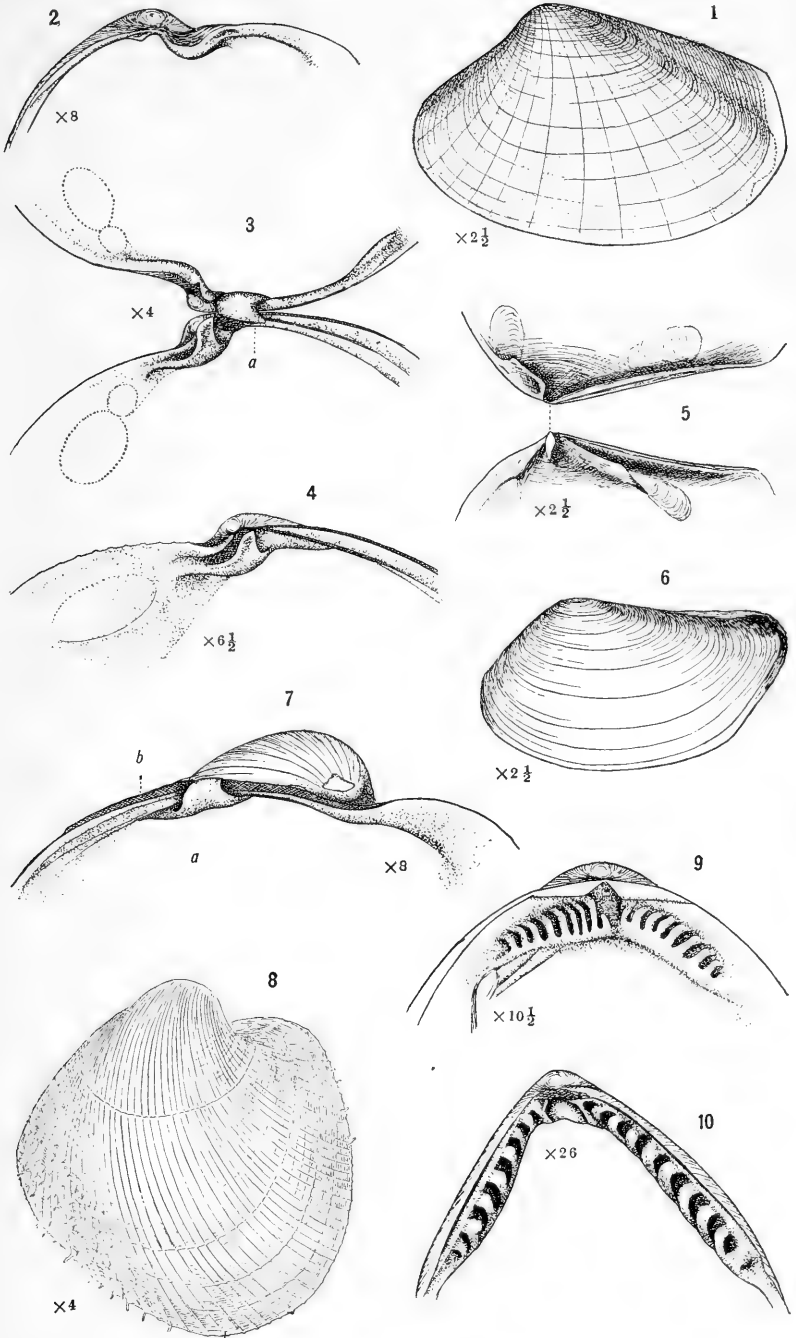




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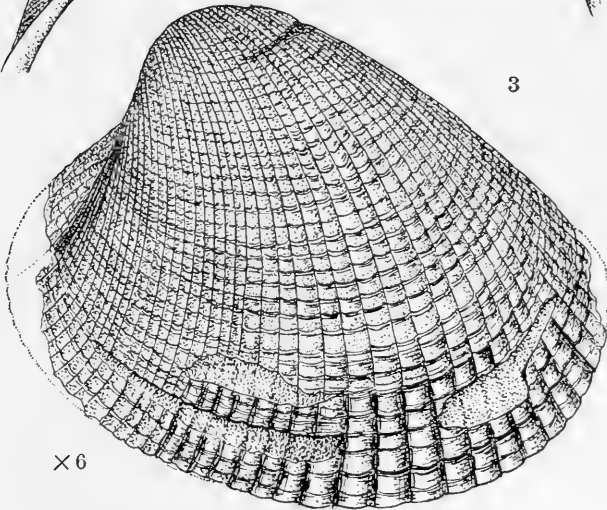
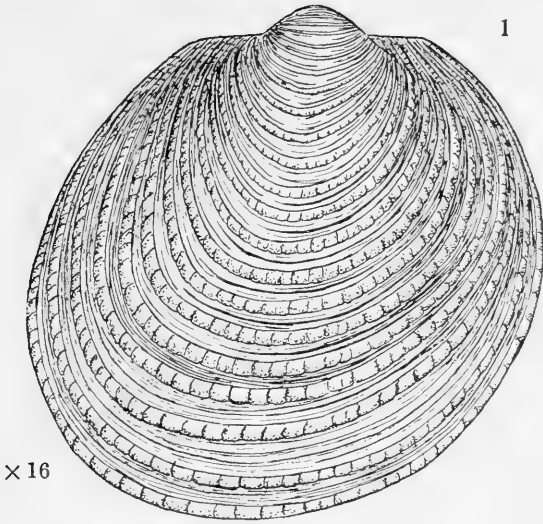




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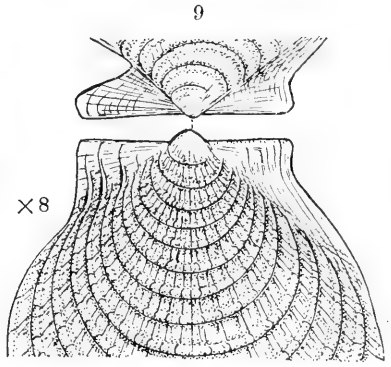
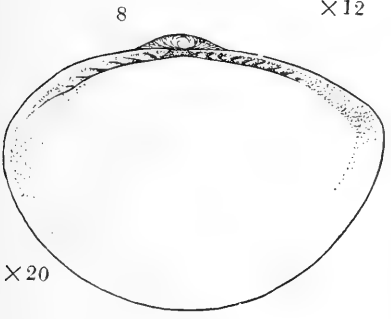
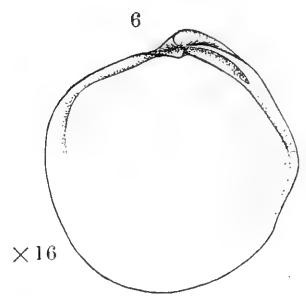
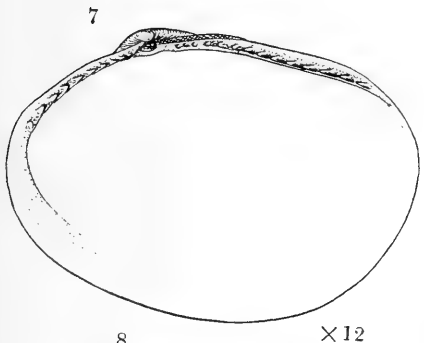
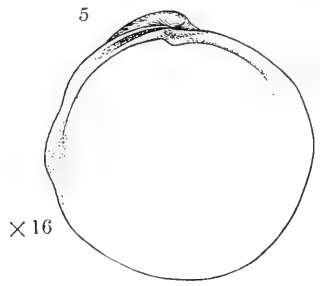
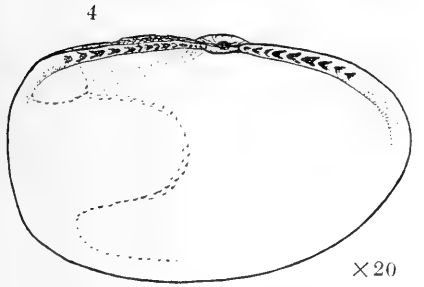
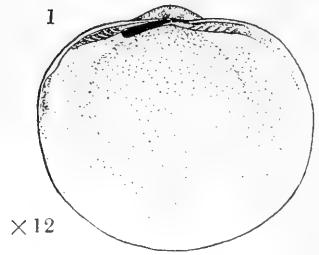
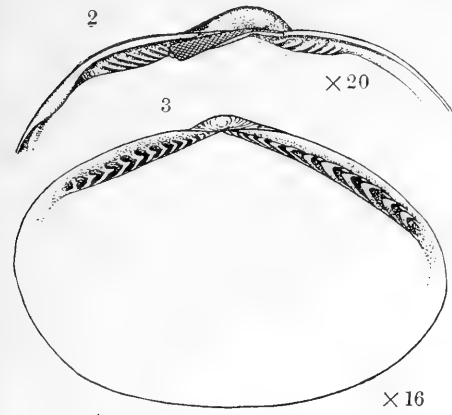
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