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ENTOMOLOGICA AMERICANA

A JOURNAL OF ENTOMOLOGY.

Volume XVII (New Series)
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PUBLICATION COMMITTEE

J. R. DE LA TORRE-BUENO Editor

CARL G. SIEPMANN

G. P. ENGELHARDT

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ENTOMOLOGICA AMERICANA

VOL. XVII

JANUARY, 1937

No. 1

THE MUTILLID WASPS OF THE GENUS TIMULLA WHICH OCCUR IN NORTH AMERICA NORTH OF MEXICO*

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The Mutillid wasps discussed in this paper form a part of the genus *Timulla* Ashmead. The species of this genus occurring in North America north of Mexico have long been a problem to students of Mutillidae not only as to their generic affinities but especially with regard to the recognition, diagnosis and relationships of the various species. The latter difficulty has been especially acute in the case of the female sex. The two sexes are so different in appearance that they have been described as different species and the two sexes of a single species have been correlated heretofore in only a few instances. The identification of the described females has been exceedingly difficult on account of the failure to recognize the morphological criteria by which they may be separated. This state of affairs was well expressed by Bradley (1916) as follows: "The only character by which I have been able to separate the females is the shape of the thorax, and this cannot be expressed in a key with sufficient exactness to make it probable that it can be used for identification of specimens without a series for comparison. The structure of the pygidium varies from entirely smooth to granular and through various stages of wrinkling to rugose. I cannot conclude that its differences are specific; nor are those found in the carina of the petiole."

* Paper No. 1354 of the Scientific Journal Series of the Minnesota Agricultural Experiment Station.

During the past eight or nine years I have been able to bring together several thousand specimens of this genus collected in the United States and Canada. A study of this material has shown that the species can be readily separated in the female sex and that several of the species of males previously thought to represent single species were in reality composite and represented two or more species or subspecies. A number of nomenclatorial problems have been encountered which made the study of the type material imperative. All of the type specimens have been seen with the exception of the species described by Say. The types of Fabricius, Lepeletier de Saint-Fargeau and F. Smith were examined while studying in Europe as a Fellow of the John Simon Guggenheim Memorial Foundation. It was found that the two species described by Fabricius had not been recognized as belonging to this genus and the one described by Lepeletier had been misidentified. I have also studied the types of all the species described from Mexico since the species occurring in Texas, New Mexico and Arizona undoubtedly extend their distribution to a greater or less degree into that country and duplication of descriptions of the same species might possibly exist.

The results of the study of the material mentioned above are presented herewith and include keys for the separation of species adapted for each sex; nomenclatorial changes resulting from the correlation of the two sexes and other causes; historical synonymy for each species; description of new species and subspecies; maps indicating the geographical distribution of many of the species; figures illustrating certain salient characters of the males; a bibliography of the literature pertaining to the species treated, and certain other minor notes.

The author is indebted to the following institutions for the privilege of studying type specimens: American Entomological Society, Philadelphia, Pennsylvania; United States National Museum, Washington, D. C.; British Museum of Natural History, London; Zoologisches Museum der Universität, Berlin; Muséum d'Histoire Naturelle, Paris; Museo Zoologia et Anatomia comparata della R. Università, Turin, Italy, and Museo Civico di Storia Naturale, Genoa, Italy. The amount of material studied is so great and the period of time during which it has been studied is so long that it is impossible to indicate the source of the individual specimens which have been examined. In addition to the institutions mentioned above, determined material (each specimen bearing a printed determination label) is in the collections of the following institutions and individuals: University of Minnesota, St. Paul, Minnesota; Cornell

University, Ithaca, New York; University of Kansas, Lawrence, Kansas; University of Michigan, Ann Arbor, Michigan; University of Colorado, Boulder, Colorado; University of Nebraska, Lincoln, Nebraska; Ohio State University, Columbus, Ohio; Emory University, Emory University, Georgia; University of Arizona, Tucson, Arizona; Boston Society of Natural History, Boston, Massachusetts; Entomological Branch, Canadian Department of Agriculture, Ottawa, Canada; Kansas State Agricultural College, Manhattan, Kansas; Oklahoma Agricultural College, Stillwater, Oklahoma; New Mexico Agricultural College, Las Cruces, New Mexico; Colorado Agricultural College, Fort Collins, Colorado; North Carolina Department of Agriculture, Raleigh, North Carolina; Texas Agricultural College, College Station, Texas; South Dakota Agricultural College, Brookings, South Dakota; Oregon Agricultural College, Corvallis, Oregon; Connecticut Agricultural Experiment Station, New Haven, Connecticut; Bureau of Plant Industry, Pennsylvania Department of Agriculture, Harrisburg, Pennsylvania; Clemson College, Clemson College, South Carolina; Mississippi College of Agriculture, Agricultural College, Mississippi; Tennessee Agricultural College, Knoxville, Tennessee; Montana Agricultural College, Bozeman, Montana; Utah Agricultural College, Logan, Utah; Mr. C. N. Ainslie, Sioux City, Iowa; Professor O. A. Stevens, Fargo, North Dakota; Dr. W. C. Stehr, Athens, Ohio; Dr. J. Bequaert, Cambridge, Massachusetts; Mr. Roy Latham, Long Island, New York; Mr. A. C. Burrill, Jefferson City, Missouri; Mr. B. E. Montgomery, Poseyville, Indiana; Mr. W. W. Jones, Douglas, Arizona; Dr. Harold Morrison, Washington, D. C., and Mr. H. B. Parks, San Antonio, Texas.

I am also indebted to Mr. Thomas Limborg for making the drawings of the last abdominal tergite of the males.

Genus *Timulla* Ashmead

Mutilla subgenus (*Mutilla*) (Division I) Blake, Trans. Amer. Ent. Soc., vol. 3, 1871, p. 227.

Mutilla (Division I) Blake (part), Trans. Amer. Ent. Soc., vol. 13, 1886, pp. 194, 281.

Mutilla Cresson (part), Trans. Amer. Ent. Soc., suppl. vol., 1887, p. 263.

Timulla Ashmead, Journ. New York Ent. Soc., vol. 7, 1899, p. 55.

Mutilla (group *hexagona*) Fox, Trans. Amer. Ent. Soc., vol. 25, 1899, p. 269.

Mutilla (Division I) Blake (part), Trans. Amer. Ent. Soc., vol. 42, 1916, pp. 199-214.

Genotype.—*Mutilla dubitata* Smith, only species originally included by Ashmead.

Diagnostic characters of males: Eyes large, strongly ovate, deeply emarginate within; first abdominal segment small and gradually dilated to the apex, completely sessile with the second segment, not at all transversely developed; tegulae large, conchiform; vertex rounded throughout, not elevated nor flattened, punctate throughout, not at all longitudinally striato-punctate; felt lines present on second abdominal tergite only, not present on the second sternite; distance between origin of vein M on vein R and the base of the stigmatic cell equal to or less than the length of the latter.

Diagnostic characters of females: Eyes strongly ovate; first abdominal segment small and gradually dilated to the apex, completely sessile with the second, not at all transversely developed; dorsum of thorax rectangular in outline; pygidial area present and well-defined; second abdominal tergite maculated with two spots or lines of pale glittering pubescence.

The genus *Timulla*, as defined above, not only includes all the New World species for which the genus was erected, but also those species belonging to *Trogaspidia* Ashmead which occur in Africa, Asia, Australia and the Islands of the Pacific Ocean. I have pointed out (1933) that no structural basis has been found that will serve to separate *Trogaspidia* from *Timulla*, although no intensive and critical study has been made to discover such characters. The genus *Trogaspidia* was originally erected to include certain African species in the male sex which have the scutellum gibbose rather than evenly convex, but many Asiatic species assigned to this genus have the scutellum evenly convex, while certain South American species assigned to *Timulla* have the scutellum gibbose. I am therefore retaining both names for the present as subgeneric categories of the genus *Timulla*, the subgenus *Timulla* to include the New World species, and the subgenus *Trogaspidia* to include the Old World species.

Subgenus *Timulla* Ashmead

As early as 1836 Thomas Say recognized that his species *hexagona* together with one or two others differed from other North

American Mutillidae in having emarginate eyes, but assumed that they belonged to the genus *Mutilla*, an Old World genus, and described them as such. Later, Blake (1871) proposed to separate the North American species of *Mutilla* into two subgenera, *i.e.*, *Mutilla* for those with emarginate, ovate eyes, and *Sphaeropthalma* for those with circular, non-emarginate eyes. The subgenus *Mutilla* was again subdivided into two divisions, the first including those with the first abdominal segment small, but gradually dilated to the apex and completely sessile with the second segment (the species discussed in this paper). In a second paper Blake (1886) continued the use of these same terms but elevated his subgenera to generic rank and assumed that the species he assigned to *Mutilla* were congeneric with the Old World species assigned to that genus. Ashmead (1899) proposed the new genus *Timulla* with *Mutilla dubitata* Smith as genotype. *Timulla* by definition included those species which Blake had included in his "Division I" of *Mutilla*. Fox (1899) apparently had his manuscript finished before the publication of Ashmead's paper and treated the same group of species as "group *hexagona*" of the genus *Mutilla*. André (1903) reduced *Timulla* to a synonym of *Mutilla* L. and restored all the species to that genus. Bradley (1916) used *Timulla* as a subgenus of *Mutilla* in his revision of the group.

The males of the New World species of *Timulla* (subgenus *Timulla*) not only differ from *Mutilla* L. in the form of the first abdominal segment but also differ in the form of the genitalia. The females of *Timulla* (*Timulla*) differ from those of *Mutilla* L. in the form of the first abdominal segment, and in the type of pattern of pale pubescent markings. *Timulla* is not at all closely related to *Mutilla* but has close affinities with the Old World species of *Troga-spida*. I consider the genus *Timulla* as a valid genus with cosmopolitan distribution and use the subgenus *Timulla* to include all the New World species.

The present paper deals with all the known species occurring in North America north of Mexico. A future paper will treat all the Mexican, Central American, South American and West Indian species. All of the species treated herein have the scutellum non-gibbose, slightly and evenly convex in the males. All of the females have the head entirely ferruginous. A large percentage of the Nearctic female *Timullas* have black heads and many of the Nearctic males have the scutellum gibbose.

The morphological characters of the males which are most useful

in the diagnosis of the species occurring north of Mexico are as follows: form of the last abdominal tergite; a median, elongate, glabrous area is present on this tergite which terminates in various types of carinae, in tubercles, or is sloped off to the distal margin of the tergite; the distal margin of the last tergite may be emarginate medially as in *leona* or not; the sixth, seventh, and eighth sternites, as well as the hypopygium, may be armed with tubercles or ridges, and the presence or absence of these tubercles is important; the form of the scape is modified in many species; what may be considered normal is a more or less cylindrical, arcuate scape which is bicarinate beneath; a number of species, of which *vagans* is typical have the terminal portion of the scape dilated and flattened, with a single strong carina beneath and provided beneath at the tip with a thick brush of pale, glittering hairs; some species have the mandibles simple, not excised and without a strong tooth beneath, others have the mandibles deeply excised beneath and with a strong tooth near the base beneath; the form of the median area of the clypeus is diagnostic in many cases; one group of species represented by *sayi* Blake has this area subtriangular and almost flat, others such as *vagans* have the same area transversely concave and the posterior elevated margin of the area arcuate; in many species the posterior, inner angle of the middle coxae bears an acute tooth while others have the middle coxae unarmed; additional minor characters are the color of the wings, comparative lengths of first and second segments of the flagellum, form of the first segment of flagellum, sculpture of the propodeum, presence or absence of mesosternal tubercles, color of calcaria, color and distribution of pubescence, color of integument, and finally the size of the ocelli.

It is peculiar that certain male Mutilidae and Myrmosidae which are nocturnal and are attracted to lights all have enormous ocelli, although there is apparently no morphological evidence to indicate that the function of the ocelli is related to the amount of light available. Nevertheless, the mutilids belonging to the genus *Photopsis* (sens lat.), and the myrmosids of the genera *Brachycistis* and *Chyphotes* are all nocturnal, are attracted to lights, and all have enormous ocelli. Most of the species of *Timulla* are apparently diurnal and have small ocelli, but certain species such as *sayi*, *hollensis*, *subhyalina*, *ocellaria* and *huntleyensis* have very large ocelli and many specimens of these species are before me which bear labels "taken at light." Here is a group of species in which part are diurnal as far as we know and which have small ocelli, while another group which have large ocelli have been taken at lights at

night. What is the significance of this apparent correlation between large ocelli on the one hand, and nocturnal habits and positive phototropism on the other?

The genitalia of the males discussed herein have all been examined and studied. The genitalia *in toto*, *i.e.*, removed from the abdomen but not dissected apart do not offer any characters of specific value. The genitalia of each species was therefore dissected into its various parts and mounted on slides. A study of these slides has shown that while the genitalia exhibit subtle specific differences, the latter are by no means as useful in a diagnostic way as the external morphological differences of the body. I (1934) found in a study of the Mutillidae of the Philippine Islands that those species of *Timulla* (*Trogaspidia*) having a gibbose scutellum had decidedly asymmetrical genitalia, *i.e.*, the two halves of the uncus were unlike and were modified in such a way as to present obvious specific and even subspecific differences. On the other hand those Philippine species of the same genus which have a non-gibbose scutellum had the two halves of the uncus symmetrical or only very weakly asymmetrical. These latter species invariably have the fifth, sixth and seventh sternites as well as the hypopygium simple, without tubercles or ridges. Our American species of *Timulla* (*Timulla*) discussed herein have a non-gibbose scutellum, and have the two halves of the uncus weakly asymmetrical, but have well developed tubercles on one or more of the above mentioned sternites and ridges on the hypopygium.

The morphological characters of the females most useful for diagnosing species are as follows: relative widths of the thorax anteriorly and posteriorly, in *ferrugata* the thorax is wider posteriorly than anteriorly, in others the two widths are the same, while in *navasota* the thorax is narrower posteriorly than anteriorly; the sides of the dorsum of the thorax may be parallel and not emarginate, or they may be distinctly emarginate medially; sculpture of the pygidium; presence or absence of the scutellar scale; presence or absence of a mesonotal-scutellar suture; puncturation of the second abdominal tergite, pubescent pattern of the dorsum of the abdomen; color of pubescence at the distal margin of the first tergite, and the color of the terminal abdominal segments.

For some reason which is not readily apparent the males and females of the genus *Timulla* are taken more often in copula than the two sexes of any other group of Mutillidae. This fact together with an abundance of available material has enabled me to correlate the two sexes of the majority of the species. Bradley (1916) was

able to correlate the two sexes of four species; I have been able to correlate the two sexes of fourteen species and subspecies from the material before me. Our knowledge of host relationships is very deficient; nothing whatever is known about the hosts of any of the New World species. *Timulla (Trogaspidia) minor* subsp. *minor* Ashmead has been reared from *Tiphia lucida* Ashmead in the Philippine Islands, but not a single New World *Timulla* has ever been reared from its host so far as is known.

KEY TO THE SPECIES OF TIMULLA

Males

1. Distal margin of last abdominal tergite distinctly emarginate medially 2
Distal margin of last abdominal tergite not emarginate medially 3
2. Median, impunctate area of last tergite terminating in a transverse, arcuate carina; tegulae sparsely, pale pubescent *leona* (Blake)
Median, impunctate area of last tergite terminating in an inverted U-shaped carina, the sides of the U diverging, not parallel; tegulae thickly, pale pubescent *tyro* n. sp.
3. Wings conspicuously banded, that is, fusaceous with a median, transverse, hyaline band 4
Wings subhyaline to fuliginous but not transversely banded as above 5
4. Scape with a strong, sharp carina beneath, without a brush of hairs, but with sparse, white hairs beneath; first segment of flagellum compressed but not noticeably broader than the following segments; clypeus without a median tubercle near its anterior margin *ornatipennis* (Bradley)
Scape not carinate, but with a very dense brush of long, white pubescence; first segment of flagellum very broad and flat, much broader than the following segments; clypeus with a median tubercle near its anterior margin *barbata* (Fox)
5. Last abdominal tergite with a low, median, longitudinal, impunctate ridge, not elevated posteriorly, but terminating in a pair of obscure, almost obsolete tubercles, and continued to the distal margin by a low, sharp, median carina *ferrugata* (Fabricius)
Last abdominal tergite with a high, median, angulate keel posteriorly, or with a median, impunctate, glabrous ridge terminating in the arms of a Y-shaped carina 6

6. Last abdominal tergite with a high, median, keel posteriorly, the dorsal and caudal lines of which form a right angle 7
 Last abdominal tergite with a median, impunctate, glabrous ridge terminating in the arms of a Y-shaped carina 8
7. Calcaria pale; head, pronotum and anterior half of mesonotum clothed with pale pubescence.
 navasota subsp. *navasota* (Bradley)
 Calcaria dark brown; head, pronotum and mesonotum clothed for the most part with black pubescence.
 navasota subsp. *nebulosa* n. subsp.
8. Fifth and sixth abdominal sternites each with a pair of well developed lateral tubercles, while the seventh sternite and the hypopygium have oblique, low carinae 9
 Fifth sternite without lateral tubercles, and sometimes the sixth sternite without lateral tubercles 10
9. Pronotum, mesonotum, scutellum and sometimes propodeum more or less ferruginous *dubitata* subsp. *dubitata* (Smith)
 Thorax entirely black *dubitata* subsp. *fugitiva* n. subsp.
10. Mandibles distinctly excised beneath and with a conspicuous tooth beneath near the base 14
 Mandibles not excised beneath, although sometimes shallowly emarginate, never with a conspicuous tooth beneath near the base 11
11. Mesosternal tubercles well developed and oblique in position; sternites six and seven with strong, prominent lateral tubercles; median area of clypeus transversely concave, the posterior elevated margin arcuate 12
 Mesosternal tubercles absent; sixth sternite without lateral tubercles, the seventh with only rudimentary lateral tubercles; median area of clypeus triangular, flat, scarcely at all concave 26
12. First segment of flagellum and the proximal half of the second strongly compressed and broadened, the first segment distinctly longer than the second; scape without a pubescent brush beneath; propodeum very coarsely reticulate *compressicornis* n. sp.
 First and second segment of flagellum cylindrical, not compressed or broadened, the first slightly shorter than the second; scape with a thin brush of pale pubescence beneath; propodeum moderately reticulate 13
13. Pubescence of vertex, pronotum, mesonotum, tegulae and abdominal tergites, for the most part black; integument of

second abdominal tergite entirely ferruginous except the narrow, distal margin more or less black.

barbigera subsp. *barbigera* (Fox)

Pubescence of vertex, pronotum, mesonotum and tegulae glittering ferruginous for the most part; pubescence of abdominal tergites entirely fulvous; second abdominal tergite ferruginous except the proximal fourth black.

barbigera subsp. *rohweri* n. subsp.

14. Scape more or less broadened and flattened distally, with a single well-developed carina beneath, and with a more or less dense brush of pale pubescence beneath 15
- Scape scarcely broadened and not flattened distally, with two distinct, parallel carinae beneath, and without a brush of pale pubescence beneath 20
15. Abdomen mostly ferruginous, clothed with sparse, black pubescence 16
- Abdomen mostly fulvous, clothed with glittering, fulvous pubescence 17
16. Thorax entirely black *vagans* subsp. *vagans* (Fabricius)
At least the pronotum and mesonotum ferruginous.

vagans subsp. *rufinota* n. subsp.

17. Scape strongly dilated and flattened distally, the brush of pale hairs dense, conspicuous 18
- Scape only moderately dilated distally, the brush of pale hairs sparse, inconspicuous 19
18. Ocelli large, the distance between the eye margins and the lateral ocelli equal to twice the diameter of the latter; pubescence of vertex and pronotum pale; oblique carina of hypopygium dentiform posteriorly; second abdominal sternite blackish *hunleyensi* n. sp.
Ocelli small, the distance between the eye margins and the lateral ocelli at least three times the greatest diameter of the latter; erect pubescence of vertex and pronotum black; oblique carina of hypopygium rounded, not dentiform posteriorly; second abdominal sternite entirely ferruginous.

grotei (Blake)

19. Second abdominal sternite infuscated to distinctly black; pale pubescence of pronotum sparse.

suspensa subsp. *sonora* n. subsp.

Second abdominal sternite entirely ferruginous; pale pubescence of pronotum thick.

suspensa subsp. *jonesi* n. subsp.

20. Ocelli small, the distance between the eye margins and the lateral ocelli equal to three or more times the greatest diameter of the latter 21
 Ocelli very large, conspicuous, the distance between the eye margins and the lateral ocelli slightly less than the greatest diameter of the latter 25

21. Thorax conspicuously, but not entirely, ferruginous; abdomen ferruginous, clothed with sparse, ferruginous pubescence or with black and pale pubescence 24
 Thorax entirely black; abdomen fulvous, clothed with sparse, fulvous pubescence 22

22. First abdominal segment black; wings fuliginous with a slightly darker band at the apex; intermediate coxae with a tubercle at the inner posterior margin *oajaca* (Blake)
 First abdominal segment ferruginous like the remainder of the abdomen; wings subhyaline with a darker band at the apex; intermediate coxae with a distinct tooth at the inner posterior margin 23

23. Middle and posterior tarsi ferruginous; sides of propodeum reticulate; median, glabrous area of clypeus depressed and concave medially *neobule* n. sp.
 Middle and posterior tarsi black; sides of propodeum with moderate, distinct, shallow punctures; median, glabrous area of clypeus transversely concave *nitela* n. sp.

24. Clypeus transverse, subrectangular, transversely concave; abdomen clothed with sparse, ferruginous pubescence.
 *floridensis* (Blake)
 Median area of clypeus subtriangular, almost flat, only slightly concave; anterior abdominal tergites with black, apical fringes, the distal tergites with pale, glittering pubescence.
 *kansana* n. sp.

25. Thorax entirely black *ocellaria* subsp. *ocellaria* n. subsp.
 Prothorax and mesonotum ferruginous, remainder of thorax black *ocellaria* subsp. *rufidorsa* n. subsp.

26. Ocelli small, the distance between the eye margins and the lateral ocelli at least twice the greatest diameter of the latter 27
 Ocelli large, the distance between the eye margins and the lateral ocelli distinctly less than twice the greatest diameter of the latter 28

27. Propodeum very deeply and coarsely reticulate; legs clothed with pale pubescence; distance between the eye margins

- and lateral ocelli equal to three times the diameter of the latter *rufosignata* (Bradley)
- Propodeum only moderately reticulate; legs clothed with black pubescence; distance between the eye margins and lateral ocelli equal to slightly more than twice the greatest diameter of the latter *tolerata* n. sp.
28. Wings subhyaline; thorax almost entirely ferruginous, only the mesosternum black *subhyalina* n. sp.
- Wings fuscous to fuliginous; thorax either entirely black, or only the pronotum, propleura and mesonotum ferruginous. 29
29. Distance between the eye margins and lateral ocelli equal to approximately one and one-half times the greatest diameter of the latter; tegulae very dark ferruginous or black, not concolorous with the mesonotum if the latter is ferruginous. 30
- Distance between the eye margins and lateral ocelli approximately equal to the greatest diameter of the latter; tegulae ferruginous, concolorous with the mesonotum *sayi* (Blake)
30. Pronotum, propleura and mesonotum ferruginous.
- hollensis* subsp. *hollensis* (Melander)
- Thorax entirely black *hollensis* subsp. *melanderi* n. subsp.

Females

1. Thorax very noticeably broader posteriorly than anteriorly 2
Thorax only slightly or not at all broader posteriorly than anteriorly 3
2. Pygidial area obscurely sculptured, only faintly granulate.
floridensis (Blake)
Pygidial area longitudinally striate *ferrugata* (Fabricius)
3. Second abdominal tergite with coarse, confluent punctures, especially at the sides, the punctures conspicuous through the pubescence; distal half of pygidial area granulated 4
Second abdominal tergite finely punctate throughout, without conspicuous, large punctures visible through the pubescence, or if with moderately large punctures, the latter well separated and interspersed with fine punctures; distal half of pygidial area either striate, rugose or granulate. 6
4. Scutellar scale well developed; anterior pale pubescent markings of second tergite linear *oajaca* (Blake)
Scutellar scale absent; anterior pale pubescent markings of second tergite ovate 5

5. Thorax very slightly narrowed posteriorly the sides of the dorsum subparallel; abdomen largely ferruginous to dark ferruginous; legs entirely bright ferruginous.
- navasota* subsp. *navasota* (Bradley)
- Thorax strongly narrowed posteriorly, the sides of the dorsum distinctly converging posteriorly; abdomen mostly black; at least the tibiae and tarsi black.
- navasota* subsp. *nebulosa* n. subsp.
6. Sides of dorsum of thorax not emarginate medially 7
 Sides of dorsum of thorax distinctly emarginate medially 11
7. Pygidial area finely, longitudinally striate 8
 Pygidial area irregularly rugose, or granulate 9
8. Lateral margins of posterior face of propodeum strongly denticulate; legs, especially the tibiae, dark ferruginous; abdomen dusky to black above except the pale pubescent markings *leona* (Blake)
 Lateral margins of posterior face of propodeum slightly serrate, but not strongly denticulate; legs pale ferruginous throughout; abdomen ferruginous, except pale pubescent markings, only slightly dusky above *tyro* n. sp.
9. Disk of second tergite finely punctate, only the lateral areas of the tergite with large punctures; pygidial area irregularly rugose 10
 Disk of second tergite with moderately large, separated punctures interspersed with fine punctures; pygidial area granulate *nicholi* n. sp.
10. Abdomen reddish; anterior, lateral, pale pubescent spots on second tergite indistinct or entirely absent.
- ornatipennis* (Bradley)
- Abdomen black, with pale pubescent markings, the anterior, lateral, pale pubescent spots on the second tergite distinct.
- wileyae* n. sp.
11. Last three abdominal tergites bright ferruginous, clothed with ferruginous pubescence 12
 Last three abdominal tergites dusky or black, without ferruginous pubescence 13
12. Sides of thorax deeply emarginate medially; ferruginous area of second tergite with moderate, distinct, separated punctures; second tergite with a median, obscure spot of sparse, black pubescence at the anterior margin *euterpe* (Blake)
 Sides of thorax only shallowly emarginate medially; second

- tergite with intermixed small and fine punctures throughout; anterior margin of second tergite without a median, obscure, black pubescent spot *euphrosyne* n. sp.
13. Posterior margin of first abdominal tergite with a pale pubescent band 14
 Posterior margin of first abdominal tergite with a black pubescent band *dubitatiformis* n. sp.
14. Scutellar scale entirely absent 15
 Scutellar scale present and distinct 16
15. Sides of thorax weakly emarginate; front, vertex and dorsum of thorax with moderate, contiguous punctures; legs entirely black *contigua* n. sp.
 Sides of thorax strongly, deeply emarginate; front, vertex and dorsum of thorax with coarse, confluent punctures; coxae, trochanters and femora ferruginous.
barbigera subsp. *barbigera* (Bradley)
16. Second abdominal tergite with lateral, narrow, subparallel, pale pubescent bands connecting the posterior marginal, pubescent bands of the first and second tergites 17
 Second abdominal tergite without complete, longitudinal pubescent bands, at the most with lateral, elongate, pale pubescent spots on the anterior half 18
17. Legs entirely black *suspensa* subsp. *suspensa* (Gerstaecker)
 Legs, at least the coxae, trochanters and femora, ferruginous.
suspensa subsp. *sonora* n. subsp.
18. Mesonotal-scutellar suture distinct just anterior to the scutellar scale, the latter broad and distinct 19
 Mesonotal-scutellar suture not evident; scutellar scale narrow, not prominent; pygidial area longitudinally rugose.
dubitata subsp. *dubitata* (Smith)
19. Second abdominal tergite velvety black, without anterior, pale pubescent spots, with only a posterior marginal, pale pubescent band; fifth tergite with the pale pubescent spots distinctly separated *grotei* (Blake)
 Second abdominal tergite ferruginous to blackish, with a pair of more or less distinct, pale pubescent spots on the anterior half; fifth tergite with a pale pubescent band, narrowed medially but not interrupted 20
20. United States and Canada east of the Rocky Mountains except Florida *vagans* subsp. *vagans* (Fabricius)
 Florida *vagans* subsp. *rufinota* n. subsp.

- Timulla (Timulla) ferrugata* (Fabricius). (New combination)
1804. *Mutilla ferrugata* Fabricius, Syst. Piez., p. 438, no. 47, female.
1811. *Mutilla ferrugata* Olivier, Encycl. méthod. Insect., viii, p. 60, no. 34, female.
1845. *Mutilla ferrugata* Lepeletier, Hist. nat. Insect. Hymén., iii, p. 608, female.
1845. *Mutilla rufa* Lepeletier, Hist. nat. Insect. Hymén., iii, p. 631, male. (New synonymy.)
1871. *Mutilla Promethea* Blake, Trans. Amer. Ent. Soc., iii, p. 229, male. (New synonymy.)
1886. *Mutilla Promethea* Blake, Trans. Amer. Ent. Soc., xiii, p. 198, male.
1897. *Mutilla ferrugata* Dalla Torre, Cat. Hymen., viii, p. 40, female.
1897. *Mutilla Promethea* Dalla Torre, Cat. Hymen., viii, p. 74, male.
1897. *Mutilla rufa* Dalla Torre, Cat. Hymen., viii, p. 79, male.
1899. *Mutilla promethea* Fox, Trans. Amer. Ent. Soc., xxv, p. 271, male.
1903. *Mutilla promethea* André, Gen. Ins., i, fasc. 11, p. 42, male.
1903. *Mutilla rufa* André, Gen. Ins., i, fasc. 11, p. 42, male.
1903. *Ephuta ferrugata* André, Gen. Ins., i, fasc. 11, p. 60, female.
1903. *Mutilla promethea* Melander, Trans. Amer. Ent. Soc., xxix, p. 323, male.
1916. *Mutilla (Timulla) promethea* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 209, male and female.
1928. *Timulla ferrugata* Mickel, Bull. 143, U. S. Nat. Mus., p. 135, female.

Type.—Female, Carolina, in collection of University of Kiel. Holotype of *rufa* Lepeletier is in Spinola collection, University of Turin, Turin, Italy. Holotype of *promethea* Blake is in American Entomological Society collection, Philadelphia.

Specimens examined.

NEW JERSEY: male, Weymouth, July 23, 1923.

MARYLAND: female.

VIRGINIA: male, Norfolk, July 8, 1910 (F. A. Johnston); male, Norfolk, September 21 (E. G. Smyth).

NORTH CAROLINA: male, Wilmington, January 21, 1919 (Max Kisliuk); male, Raleigh, October, 1917 (J. E. Eckert); male, Southern Pines, September 24, 1907 (A. H. Manee); male, Lumberton, July 3, 1903 (F. Sherman).

SOUTH CAROLINA: female, Columbia, September 10, 1908; male, Myrtle Beach, July 5, 1927 (H. C. Coker).

GEORGIA: female, Savannah; male, Clyde, September 11-12, 1931 (Bradley and Knorr); female, Fort Valley, September 6, 1902 (Bridwell); male, Tifton, June 13, 1906; male, Tifton; female, Albany, May 16, 1916 (W. D. Pierce); male, Swainsboro, May 31, 1931 (P. W. Fattig); male, St. Simon's Island, June 4, 1911; female, St. Simon's Island, July 14, 1931 (C. A. Frost); three males, Billy's Island, Okefenokee Swamp, June, 1912; four females, Spring Creek, Decatur Co., May 18-21, 1916 (J. C. Bradley); female, Spring Creek, Decatur Co., June 7-23, 1911 (J. C. Bradley); eleven females, male, Spring Creek, Decatur Co., July 16, 29, 1912 (J. C. Bradley); female, Spring Creek, Decatur county, August 9-12, 1931 (Bradley and Knorr); male, Bainbridge, May 30-June 1, 1911 (J. C. Bradley); female, Bainbridge, July 30, 1912; male, Bainbridge; female, Thomasville, May 21, 1915 (C. S. Spooner); two males, four females.

FLORIDA: female, LaBelle, April 18 (J. N. Knull); female, Jacksonville, July 21; female, Jacksonville; female, Lakeland (G. G. Ainslie); female, Sanford, April, 1932 (C. O. Bare); female, Sanford, May 21, 1931 (C. O. Bare); male, Orlando, May 28, 1925 (O. C. McBride); male, Orlando, June 2, 1925 (O. C. McBride); male, Gainesville, Alachua county, April 23, 1922; two males Gainesville, Alachua county, May 4, 1928 (Alexander-Walker); female, Gainesville, Alachua county, May 11, 1911; female, Gainesville, August 17, 1931 (Bradley and Knorr); female, Alachua county, March 18, 1930 (C. J. Guard); female, Palatka, May 3-4, 1916 (J. C. Bradley); male, Lake County, April 20, 1922 (T. P. Winter); two males, Kissimmee Prairie, August 25, 1931 (Bradley and Knorr); female, Homestead, March 5 (A. Mosier); male, Homestead, April 18, 1924 (T. R. Robinson); female, Indian River (H. G. Hubbard); female, Ft. Mead, August 13, 1930 (R. H. Beamer); female, Wildwood, August 2, 1930 (J. Nottingham); female, Enterprise, April 18; female, Bell Glade, July, 1926 (M. D. Leonard); three males.

MISSISSIPPI: female, Agricultural College, April 16, 1916 (W. H. Carpenter); female, Agricultural College, November 1, 1917 (N. A. Moore); female, Agricultural College, June 15, 1915 (C. C. Greer); male, Agricultural College, June 27, 1914 (C. C. Greer); male, Agricultural College, July 3, 1914 (C. C. Greer); male, Agricultural Col-

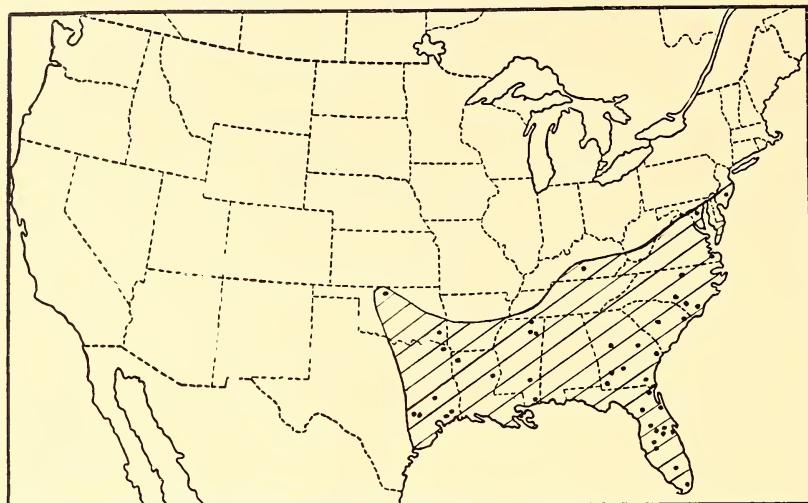
lege, July 6, 1914 (C. C. Greer); male and female, Agricultural College, July 10, 1914 (C. C. Greer); two males, Agricultural College, July 14, 1914 (C. C. Greer); female, Agricultural College, May 8, 1921 (P. D. Sanders); male, Agricultural College, June 25, 1913 (J. G. Hester); two females, Agricultural College, July 1, 1913 (J. G. Hester); male, Agricultural College, July 14, 1913 (J. G. Hester); male, Agricultural College, July 19, 1913 (J. G. Hester); female, Agricultural College, fall, 1921 (G. A. Thompson); two females, Agricultural College, July 10, 1913 (T. F. McGehee); female, Agricultural College, July 29, 1913 (T. F. McGehee); female, Agricultural College, May, 1922 (C. T. Wallace); female, Agricultural College, May 14, 1921 (S. W. Box); female, Agricultural College, October 14, 1914 (S. M. Thomas); female, Agricultural College, October 20, 1914 (A. M. Rogers); female, Agricultural College, May 1, 1922 (W. C. Avens); female, Agricultural College, May 16, 1921 (C. E. Loeb); female, Agricultural College, April 15, 1922 (H. C. Ashcraft); female, Agricultural College, June 13, 1921 (J. W. Lumpkin); male, Agricultural College, July 12, 1921 (J. W. Lumpkin); female, Agricultural College, April 24, 1921 (R. D. Morrow); female, Agricultural College, March 30 (J. C. Garrett); female, Agricultural College, November 5, 1921 (C. E. Ross); male, Agricultural College, October, 1919 (W. M. Porter); male, Agricultural College, August 6, 1913 (C. F. Stiles); male, Agricultural College, May, 1922 (J. H. Heckman); male, Agricultural College (P. D. Houston); female, Agricultural College, July 25, 1917; female, Starkville, May 14, 1922 (O. E. Earnest); male, Blue Mountain, July 11, 1914 (H. H. Carter); male, Laurel, August, 1916 (M. G. Dyess); two males, Ocean Springs, June 5, 1915 (F. F. Bibby); two males, Ocean Springs, June 8, 1915 (F. F. Bibby); male, Ocean Springs, June, 1915 (F. F. Bibby).

KENTUCKY: male.

LOUISIANA: male and female (in copula) Tallulah, October 16, 1910 (R. A. Cushman); female, Tallulah, April 10 (R. A. Cushman); male, Tallulah, June, 1916 (C. S. Whittington); female, Shreveport, May 29, 1905; male, New Orleans; female, Lake Bruins, August 3, 1925 (B. E. Montgomery); eight males, two females.

TEXAS: female, Wharton, June 24, 1917; female, Willis, May 14, 1903 (Bridwell); female, Columbus (Wickham); two females, Colorado county, August 5, 1922 (Grace O. Wiley); female, Liberty, October 12, 1933; female, Madison county, August 20, 1931 (F. F. Bibby); male, Nome, June 21, 1918 (E. L. Diven); male, New Boston, October 26, 1906 (F. C. Bishopp); male.

OKLAHOMA: female, Latimer county, June 16, 1931 (R. D. Bird); female, Isabel, June 8, 1931 (C. C. Deonier); male and female (in copula), Alfalfa county, August 6, 1932 (Pritchard and Deonier).



Distribution of *Timulla (Timulla) ferrugata* (Fabricius)

I have previously (1928) suggested that *ferrugata* Fabricius belonged to the genus *Timulla*. Through the courtesy of Dr. Olaw Schroeder, of the Zoological Institut, University of Kiel, and Dr. H. Bischoff, of the Zoological Museum of the University of Berlin, I was able to reexamine a specimen in the Kiel collection bearing a label “*ferrugata*” in Fabricius’ handwriting. This specimen agrees exactly with the original description. The latter particularly describes the distal margin of the first abdominal segment as black, and the remaining margins cinereus. The Kiel specimen has the distal margin of the first segment black and the margins of the remaining segments cinereus, but the first segment has obviously been rubbed and was originally clothed with pale pubescence. Other diagnostic characters of the Kiel specimen are the thorax broader behind than in front, and the legs black except ferruginous femora. Females which Bradley (1916) assigned to *promethea* Blake agree in every respect with the Kiel specimen, including the black distal margin of the first tergite although the black area of Bradley’s specimens is clothed with pale pubescence.

The original description of *ferrugata* mentions the specimens as belonging to the Bosc collection. This collection is now in the

Muséum Nationale d'Histoire Naturelle, Paris. I have investigated the possibility of the type's presence there. There is only one specimen in the Bosc material at Paris that can possibly have any claim as the type specimen of this species. It is labeled "*M. antiquensis* Fabricius. H. in Carolina." It is a specimen of *Dasymutilla lepeletieri* Fox. It cannot be the type for the following reasons: (1) The description states "parva"; this specimen is large, 14 mm. long; (2) Description states "reliquis margine cinereo"; this specimen has the distal margin of the second tergite black with a median, pale pubescent spot; (3) Description states "femoribus ferrugineis"; the specimen has the femora blackish like the other parts of the leg.

Further confirmatory evidence that the Kiel specimen is the one Fabricius described as *ferrugata* is to be found in the fact that specimens in the Spinola collection at Turin, Italy, which originally came from the Olivier collection and the Latreille collection are labeled "*ferrugata* Fabr." and are conspecific with the Kiel specimen.

I have examined the female recorded by Bradley (1916) as the allotype of *promethea* Blake and find it to be the same as the Kiel specimen. A second pair taken in copula is recorded above from Louisiana and a third pair from Oklahoma. The male in both cases is the same as *rufa* Lepeletier and *promethea* Blake. I have examined the holotype of both *rufa* and *promethea* and find them to be identical. The female in both of the above cases is the same as the Kiel specimen.

Timulla (Timulla) ornatipennis (Bradley). (New combination)

1916. *Mutilla (Timulla) ornatipennis* Bradley. Trans. Amer. Ent. Soc., xlvi, pp. 205-206, 318, male and female.

Holotype male and allotype female.—Southern Pines, North Carolina, August 12, 1907 (A. H. Manee), nos. 111.1 and 111.2 in Cornell University collection, Ithaca, New York.

Diagnostic characters of the female not mentioned in the original description are: scape and pedicel ferruginous, the flagellum blackish; antennal scrobes distinctly carinate above; sides of dorsum of thorax parallel, not noticeably emarginate at the mesonotal region; length of thorax about one and two-thirds times the width; dorsum of thorax with large, confluent punctures, almost longitudinally rugoso-punctate; mesonotal-scutellar suture obsolete; scutellar scale present and distinct; lateral margins of posterior face of propodeum denticulate; second tergite finely punctate on the disk, the punctures becoming

ing moderate in size towards the sides; anterior pale pubescent spots of second tergite obsolete; pygidial area irregularly rugose; median carina of first sternite elevated anteriorly into a prominent tooth.

The holotype and allotype have been examined and specimens compared with them.

Specimens examined.—

NEW JERSEY: two females, Iona, May 16, 1909 (G. M. Greene).

VIRGINIA: two males, Falls Church, September 4, 1915 (C. T. Greene); female, Falls Church, September 14, 1915 (G. M. Greene); female, Colonial Beach, July, 1897; female, Clifton, July 15, 1923 (J. C. Bridwell); two females, Clifton, July, 1933 (J. C. Bridwell); two females, Clifton, August 20, 1933 (J. C. Bridwell).

NORTH CAROLINA: male and female (in copula), Southern Pines, July 9, 1907 (A. H. Manee); female, Raleigh, April 16, 1904 (C. S. Brimley); female, Raleigh, early August (C. L. Metcalf); female, Kittrell, September, 1917 (J. E. Eckert); male, Wilson, September 1, 1914; female (Forel).

SOUTH CAROLINA: female, Clemson College (J. O. Pepper).

GEORGIA: female, Atlanta, April 23, 1933 (P. W. Fattig); female, Atlanta, August 11, 1934 (P. W. Fattig); female, Atlanta, August 30, 1934 (P. W. Fattig); female, Atlanta, September 5, 1932 (P. W. Fattig); male and female (in copula), Stone Mt., August 11, 1932 (P. W. Fattig); female, Chickamauga, July 10, 1898; male, Tifton; female, Billy's Island, Okefenokee Swamp, September 1-5, 1913.

FLORIDA: female, Tampa, March 27; male, Capron, April 25; female, Ft. Meyers, May 7, 1916 (J. C. Bradley); female.

ALABAMA: female, Greenville, August 3, 1915.

TENNESSEE: female, Knoxville, May 1, 1890; male.

MISSISSIPPI: female, Agricultural College, April 14, 1918 (C. M. Brickell); female, Agricultural College, April 6, 1919 (W. T. Covington); female, Lucedale, March 3, 1932 (H. Dietrich); female, Fulton, July 14, 1930 (P. W. Oman).

The characters used in the keys will separate both sexes of this species from related forms without difficulty. The female has been confused with *dubitata* Smith but that species has the thorax distinctly emarginate medially at the sides.

Timulla (Timulla) barbata (Fox). (New combination)

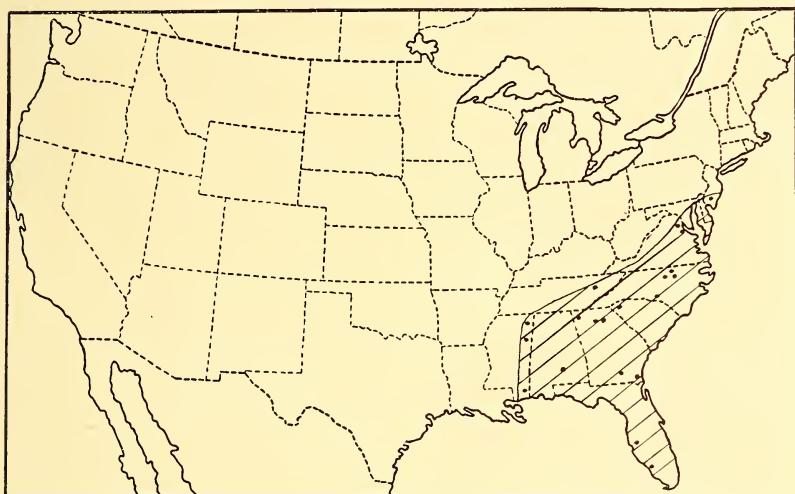
1899. *Mutilla barbata* Fox, Trans. Amer. Ent. Soc., xxv. p. 272,
male.

1903. *Mutilla barbata* André, Gen. Ins., i, fasc. 11, p. 41, male.

1916. *Mutilla (Timulla) barbata* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 205, male.

Type.—Male, Ripley County, Missouri (P. J. Smith), in collection of American Entomological Society, Philadelphia.

A second specimen is in the collection of the University of Kansas; male, Caddo County, Louisiana, August 19 (R. H. Beamer).



Distribution of *Timulla (Timulla) ornatipennis* (Bradley)

The thick, long fringe of white hairs on the yellowish scape beneath; the broad, flat, first flagellar segment; and the banded wings separate this at once from all other species in the genus.

Timulla (Timulla) leona (Blake). (New combination)

1871. *Mutilla leona* Blake, Trans. Amer. Ent. Soc., iii, p. 230, female.

1886. *Mutilla leona* Blake, Trans. Amer. Ent. Soc., xiii, p. 200, female.

1894. *Mutilla leona* Cameron, Biol. Centr.-Amer., ii, p. 269, female.

1897. *Mutilla leona* Dalla Torre, Cat. Hymen., viii, p. 53, female.

1900. *Mutilla leona* Fox, Ent. News, xi, p. 401, female.

1903. *Mutilla leona* André, Gen. Ins., i, fasc. 11, p. 42, female.

?1903. *Mutilla nestor* Melander, Trans. Amer. Ent. Soc., xix, p. 323, male.

Type.—Female, Mexico (F. Sumichrast), in collection of American Entomological Society, Philadelphia.

The description of the male is as follows: Head, thorax and legs, black; first abdominal segment blackish, the posterior margin ferruginous; remainder of abdomen ferruginous; inferior margin of mandibles strongly emarginate and with a prominent tooth near the base; distal margin of last abdominal tergite distinctly emarginate medially. Length, 15 mm.

Head entirely black, clothed throughout with pale, glittering pubescence, thickest on the front; clypeus transversely concave, the concave area glabrous, and the elevated posterior margin of the glabrous area evenly arcuate; scape distinctly bicarinate beneath; first and second flagellar segments approximately equal in length; ocelli small, the distance between the lateral ones and the inner eye margins more than three times the greatest diameter of the former.

Thorax entirely black; pronotum clothed with erect and appressed, pale, glittering pubescence; mesonotum clothed with black pubescence, except the anterior fourth with pale, glittering pubescence; anterior half of scutellum with erect, black hairs, the posterior half with erect, pale hairs; propodeum clothed with sparse, appressed, pale pubescence; pleural areas clothed with sparse, pale pubescence; scutellum strongly, evenly convex, densely punctured; enclosed area of propodeum not elevated posteriorly into a tubercle; tegulae large, glabrous, finely punctate throughout, clothed throughout with sparse, pale, glittering pubescence; mesosternal tubercles transverse.

Abdomen ferruginous, except the first segment largely black, only the distal margin ferruginous, clothed throughout with erect and appressed, fulvous pubescence, except the erect pubescence of the first tergite pale; distal margin of last tergite distinctly emarginate medially; last tergite with a median, elongate, glabrous, impunctate area terminating before the distal margin in a transverse, strongly elevated carina, the latter viewed posteriorly distinctly arcuate; sixth sternite unarmed; seventh sternite with small lateral tubercles; hypopygium with a pair of widely separated, longitudinal ridges on the anterior half.

Legs entirely black, sparsely clothed with pale, glittering pubescence; middle coxae with a weak tooth at the inner, posterior margin; callearia pale.

Wings dark fuscous.

Allotype.—Male, Tallulah, Louisiana, July 17, 1925, in collection of University of Minnesota.

Specimens examined.—

GEORGIA: two males, Bainbridge.

ALABAMA: male, Thomasville, June 10, 1917; three males, Jackson, Tombigbee River, June 10, 1917.

MISSISSIPPI: female, Agricultural College, June 24, 1914 (C. C. Greer).

ARKANSAS: male, Pine Bluff, September, 1890.

LOUISIANA: two females, New Orleans; male, Cameron, June 29, 1905; male, Tallulah, July 24, 1925; two males.

TEXAS: female, Brownsville, May 1, 1904 (H. S. Barber); three males, Galveston, May (F. H. Snow); male, Galveston, June 16, 1924 (Trotter); male, Galveston, July 24, 1924 (Trotter); three females, Richmond, May 29, 1918 (J. C. Bradley); two females, Richmond, Brazos River, June 22, 1917; eight females, five males, Wharton, June 24, 1917; male, Austin, May 21, 1921 (R. H. Painter); three females, Columbus (Wickham); female, Bastrop County; male, College Station, June 15, 1932; male, College Station, June 26, 1932 (H. J. Reinhard); male, College Station, August 17, 1932 (S. W. Bromley); two males, McLennan County, July 10, 1934 (F. F. Bibby); male and female, McLennan County, July 16, 1933 (F. F. Bibby); two females, Aransas County, August 6, 1928 (R. H. Beamer and A. M. James).

OKLAHOMA: male, Alfalfa County, August 6, 1932 (C. C. Deonier).

KANSAS: male, Douglas County, July 25, 1919 (Wm. E. Hoffmann); male, Riley County, June 30; male, Riley County, July 17 (Popenoe); female, Riley County, July 26 (G. A. Dean); female, Riley County, July 21 (Popenoe); female, Riley County, July 22 (G. A. Dean); female, Riley County, August 8 (J. B. Norton); female, Clay County, August, 1901 (Bridwell); male.

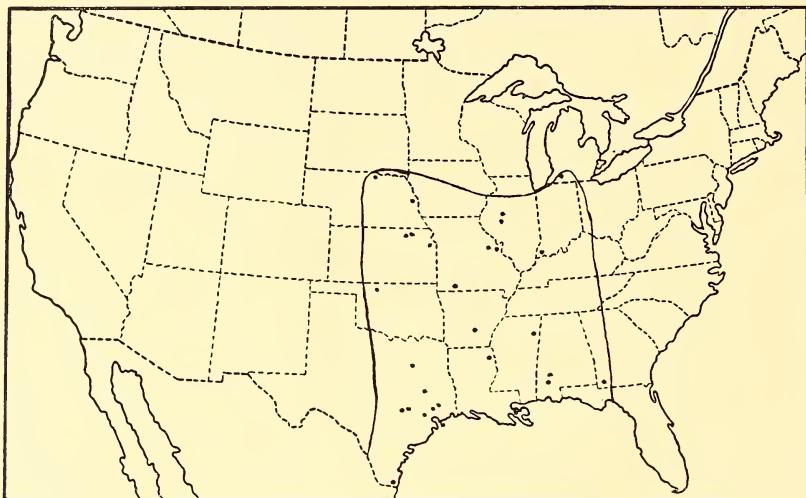
NEBRASKA: male, Omaha, July 7, 1914 (L. T. Williams); two males, Omaha, August 3, 1914 (L. T. Williams); male and female, Omaha, August 12, 1913 (L. T. Williams); female, Omaha, August 13, 1914 (L. T. Williams); male, Omaha, August 14, 1913 (L. T. Williams); male, Omaha, August 19, 1913 (L. T. Williams); female, Omaha, September 9, 1913 (L. T. Williams); male, Carns, July 22, 1902 (M. H. Swenk).

MISSOURI: male and female, Callaway County, October, 1898; male, St. Louis, August 16, 1922 (P. Rau); two females, St. Louis (P. Rau); male, Hollister, August 12, 1912 (H. H. Knight).

ILLINOIS: two females, Meredosia, August 22, 1898 (F. M. McE.) ; two females, Havana, October 6.

INDIANA: male and female, Posey County, August 10, 1927 (B. E. Montgomery).

MICHIGAN: male.



Distribution of *Timulla (Timulla) leona* (Blake)

The female of *leona* is closely related to *prominens* Cameron. The latter has the same form of thorax, the same sculpture of the pygidium and the same pubescent markings of the abdomen, but has an entirely black head. André (1898, Ann. soc. ent. France, lxxvii, p. 38) identified a male mutillid from Mexico as *ardens* Gerstaecker and described the female taken with it as the female of *ardens*. I have examined these two specimens in the Muséum Nationale d'Histoire Naturelle, Paris, and find that the male is not *ardens*, but an undescribed species, while the female is *prominens* Cameron. The male taken with this female must then be the male of *prominens*. This male has the distal margin of the last abdominal tergite emarginate medially, and has the median, impunctate, glabrous area of the same tergite terminating in a transverse carina before the distal margin of the tergite. The carina is slightly arcuate and extends transversely through the median three-fifths of the tergite. Since the female of *leona* is closely related to the female of *prominens*, it follows that the male of *leona* is probably related to the male of *prominens*. The male described above is not only closely related to

the male of *prominens* but it has practically the same geographical distribution as the females of *leona*. It differs from *prominens* in having sparser pale pubescence on the dorsum of the propodeum and on the tegulae, and the carina of the last abdominal tergite extends transversely through only the median two-fifths of the tergite, and is strongly arcuate. To further support this conclusion, the material before me includes five instances where this male and female have been collected at the same time and place, *i.e.*, McLennan County, Texas, July 16, 1933 (F. F. Bibby); Wharton, Texas, June 24, 1917; Callaway County, Missouri, October, 1898; Omaha, Nebraska, August 12, 1913 (L. T. Williams), and Posey County, Indiana, August 10, 1927 (B. E. Montgomery). The female has been confused in collections with *vagans* subsp. *vagans*, although the longitudinally striate pygidium separates it at once from that species. The male has been confused with *oajaca* which it resembles in color, but differs in the emarginate distal margin of the last abdominal tergite.

Timulla (Timulla) tyro n. sp.

Male.—Head and thorax black, clothed with pale pubescence, except the posterior three-fourths of the mesonotum with black pubescence; abdomen ferruginous, clothed with fulvous pubescence; legs black except the tibiae dark ferruginous and the tarsi distinctly ferruginous; tegulae with thick, pale pubescence; distal margin of last abdominal tergite emarginate; median, impunctate area of last tergite terminating in an inverted U-shaped carina. Length, 11 mm.

Head entirely black, clothed throughout with rather thick, erect and appressed, pale pubescence; mandibles strongly emarginate beneath and with a prominent tooth near the base beneath; clypeus transversely concave, the concave area glabrous, impunctate, the elevated, posterior margin evenly arcuate; scape distinctly bicarinate beneath; first and second segments of flagellum approximately equal in length; ocelli small, the distance between the eye margins and lateral ocelli equal to four times the diameter of the latter.

Thorax entirely black, clothed with pale pubescence, except the posterior three-fourths of mesonotum with black pubescence; pale pubescence thick on pronotum, scutellum and mesopleurae, elsewhere sparse; scutellum evenly convex, densely punctured; enclosed area of propodeum not elevated posteriorly into a tubercle; dorsum and posterior face of propodeum dis-

tinctly, shallowly reticulate; tegulae large, clothed with thick, pale pubescence; mesosternal tubercles transverse.

Abdomen entirely ferruginous, clothed with fulvous pubescence throughout; distal margin of last tergite distinctly, roundly emarginate medially; last tergite with a narrow, elongate, median, impunctate area terminating in an inverted U-shaped carina, the sides of the U diverging posteriorly, not parallel; sixth sternite with a pair of distinct tubercles, one at each postero-lateral angle; seventh tergite with a pair of similar but slightly stronger tubercles; hypopygium with a pair of widely separated, longitudinal ridges anteriorly, the ridges elevated posteriorly forming a sharp tooth projecting backwards.

Legs black, except the tibiae dark ferruginous, and the tarsi distinctly ferruginous, clothed with sparse, pale pubescence; calcaria pale.

Wings fuscous.

Female.—Pale ferruginous throughout, including the legs; head and dorsum of thorax coarsely punctured, almost longitudinally rugoso-punctate; sides of dorsum of thorax parallel, not noticeably emarginate; scutellar scale broad and well developed; a distinct mesonotal-scutellar suture anterior to the scutellar scale; lateral margins of posterior face of propodeum slightly serrate, not strongly denticulate as in *leona*; abdomen finely punctured, slightly dusky above due to sparse, short, black pubescence; abdomen with pale markings above as in *leona*; pygidial area distinctly, longitudinally striate.

Holotype.—Male, Cat. No. 50954 U. S. National Museum, Imperial County, California, May, 1911 (J. C. Bridwell).

Allotype.—Female, Arizona, in collection of United States National Museum.

Paratype.—Female, Needles, California (Wickham), in University of Minnesota collection.

Closely related to *leona* Blake. The male differs from the latter as expressed in the key, in the ferruginous color of the tibiae and tarsi, the distinct tubercles on the sixth sternite and the thicker, pale pubescence on the head and pronotum. The female differs in the serrate, rather than strongly denticulate, lateral margins of the propodeum, and the much paler ferruginous color of the body and legs. Although the two sexes have not been taken in copulation there can be no doubt that the specimens placed here represent the two sexes of a single species. The female is so closely related to *leona* Blake that it is separated from specimens of that species with difficulty,

and while the male is distinct from the male of *leona* as noted above and in the key, it is very closely related. The geographical ranges of the two are widely separated in the United States, *leona* having been taken only as far west as central Texas while *tyro* is known from Arizona and southeastern California. *Tyro* will undoubtedly be found in the state of Sonora, Mexico, and possibly in lower California.

Timulla (Timulla) navasota subsp. *navasota* (Bradley). (New combination)

1916. *Mutilla (Timulla) navasota* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 213, male.

Holotype.—Male, Brazos County, Texas, in Museum of Comparative Zoology, Cambridge, Massachusetts.

The description of the female, which was heretofore unknown, is as follows: Female.—Head, thorax and legs ferruginous, except tips of mandibles and flagellum beyond the first segment blackish; abdomen ferruginous; second abdominal tergite with a pair of anterior, ovate, pale pubescent spots; lateral margins of thorax not emarginate medially; thorax slightly narrower posteriorly than anteriorly; scutellar scale absent; second tergite with large, close, confluent punctures throughout; pygidial area mostly granulate. Length, 9 mm.

Head entirely ferruginous, except the tips of the mandibles and the flagellum beyond the second segment blackish; mandibles edentate at the tip and with a small tooth within near the tip; clypeus elevated posteriorly, the elevated margin arcuate, and with a large, transverse, median tubercle immediately posterior to the elevated margin; scape obscurely punctate above; first segment of flagellum slightly shorter than the second and third segments united; antennal serobes distinctly carinate above; front, vertex and genae with large, dense, confluent punctures throughout and clothed with sparse, erect pubescence, ferruginous on the front and vertex, pale on the genae; relative widths of head and thorax, 3.5:3.3.

Thorax entirely ferruginous, the dorsum clothed with sparse, erect, ferruginous pubescence, the posterior face of propodeum with sparse, erect, pale pubescence and the pleural areas with sparse, pale micropubescece; lateral margins of dorsum of thorax almost parallel, not emarginate medially, the thorax slightly but distinctly narrower posteriorly than anteriorly; relative widths of thorax at humeral angles and propodeum, 3.3:3.1; humeral angles rounded; dorsum of thorax

with large, dense, deep, confluent punctures, becoming shallower posteriorly and finally reticulate and slightly asperate on the posterior face of propodeum; scutellar scale entirely absent; lateral margins of posterior face of propodeum dentate; propleura densely punctuate anteriorly, the sides of propodeum with scattered, moderate punctures anteriorly and dense, large punctures posteriorly, and the pleural areas entirely micro-punctate.

Abdomen ferruginous, dusky posteriorly; first tergite with moderately large, separated punctures and sparse, erect, pale pubescence, except the distal margin with a band of dense, appressed, pale pubescence; second tergite with large, close, more or less confluent punctures interspersed with fine punctures, clothed with sparse, erect and appressed, fuscous pubescence, except at the sides with sparse, erect, pale pubescence, and a pair of anterior, ovate spots and a broad, distal band of dense, appressed, pale pubescence, the anterior margin of the distal pubescent band slightly and angularly dilated medially; tergites three to five with moderate punctures anteriorly replaced by fine punctures posteriorly, clothed with sparse, erect and appressed black pubescence, except sparse, pale, erect pubescence at the lateral margins and each with a pair of subquadrate spots of dense, appressed, pale pubescence, the spots converging towards the tip of the abdomen, those on tergite five distinctly separated; pygidial tergite with pale and fuscous pubescence, the pygidial area granulate; first sternite with a median, longitudinal carina on the anterior two-thirds, the elevated margin of the carina distinctly emarginate anteriorly; second sternite with large, close punctures throughout, clothed with sparse, erect, pale pubescence and with a thin, distal fringe of pale hairs; tergites three to five with small, dense punctures towards the distal margin and each with a thin, distal fringe of pale hairs.

Legs entirely ferruginous, sparsely clothed with pale pubescence; calcaria pale.

Allotype.—Female, without locality data, taken in copula with a male, in collection of the United States National Museum.

Specimens examined.—

TEXAS: male, Lee County, September 7, 1905; male and female, Dallas (Boll); male, McLennan County, August 7, 1933 (H. B. Mills); male, Laredo, July 1, 1930 (H. M. Smith); male, Plano, July (E. S. Tucker); male, Plano, August (E. S. Tucker); two males,

Brownsville, June 5, 1904 (H. S. Barber); two males, Brownsville, June 6, 1904 (H. S. Barber); three males, Brownsville, June; male and female.

The female resembles the female of *oajaca* in having the second abdominal tergite strongly punctured, but differs from *oajaca* in having the thorax slightly narrower posteriorly than anteriorly, in the absence of the scutellar scale, in having the anterior, pale pubescent markings of the second tergite ovate instead of linear, and in the much more densely and deeply punctured anterior portion of the dorsum of the thorax. The allotype specimen has the abdomen rubbed so that the pale markings are practically obliterated; the description of the pale markings of the abdomen has been taken from one of the paratypes. The two females other than the allotype have the abdomen very dark ferruginous.

The male is closely related to *amulae* Cameron from Mexico, but the latter has much smaller ocelli and denser pale pubescence on the pronotum. This subspecies is replaced in western Texas, New Mexico and Arizona, as well as northwestern Mexico, by the following subspecies. Specimens vary in length from 13 to 22 mm.

Timulla (*Timulla*) *navasota* subsp. *nebulosa* n. subsp.

Male.—Exactly like subsp. *navasota* except the calcaria are very dark brown, and the pubescence of the head, pronotum and anterior half of mesonotum is predominantly black with a few pale hairs intermixed; mandibles not emarginate, not toothed beneath; ocelli large, the distance between the inner eye margins and the lateral ocelli equal to the greatest diameter of the latter. Length, 17 mm.

Female.—Head, thorax, coxae, trochanters and femora except the tips, ferruginous; flagellum, abdomen, tips of femora, tibiae and tarsi, black; lateral margins of thorax converging posteriorly, not emarginate medially, the thorax distinctly narrower posteriorly than anteriorly; narrow distal margin of first tergite, broad distal margin of second tergite, a pair of anterior spots on the second tergite, and a pair of large, quadrate, lateral spots on tergites three to five, all of dense, appressed, pale, glittering pubescence; second tergite coarsely punctate; pygidial area finely ridged in a pattern resembling a finger print. Length, 11 mm.

Head, scape, pedicel and proximal third of first flagellar segment, ferruginous, the remainder of the flagellum black; front and vertex clothed with sparse, glittering, very pale fer-

ruginous pubescence, the genae with sparse, pale, glittering pubescence; mandibles slender, edentate at the apex, not emarginate nor toothed beneath; clypeus elevated posteriorly into a prominent arcuate ridge, the latter with prominent lateral angles; first segment of flagellum slightly shorter than segments two and three united; antennal scrobes distinctly carinate above; front, vertex and genae strongly, confluent punctuate, somewhat longitudinally rugoso-punctate; posterior margin of genae obscurely carinate; relative widths of head and thorax, 4.7 : 5.0.

Thorax entirely ferruginous, the dorsum clothed with sparse, erect and recumbent, glittering, very pale ferruginous pubescence; dorsum strongly, confluent, longitudinally rugoso-punctate; humeral angles moderately angulate; relative widths of thorax anteriorly and posteriorly, 5.0 : 4.2; scutellar scale entirely absent; posterior half of lateral margins of posterior face of propodeum dentate; lateral margins of dorsum of propodeum straight, not crenulate, gradually converging posteriorly from the pronotal tubercles; anterior margin of propleura defined by a carina; propleura with large, close punctures anteriorly and micropunctate throughout; mesopleura with moderate, close punctures at the posterior margin and on the postero-ventral area, as well as micropunctate throughout; metapleura with scattered, moderate punctures ventrally and micropunctate throughout; sides of propodeum with scattered, moderate punctures anteriorly and large, close punctures posteriorly, as well as micropunctate throughout.

Abdomen entirely black, clothed with sparse, erect and appressed, black pubescence except narrow, distal margin of first tergite, a pair of large, subovate spots on anterior half of second tergite reaching the anterior margin of tergite and merging into lateral pale areas, broad, distal margin of second tergite, lateral fifths of second tergite, a pair of large, transverse spots on tergites three to five, those on three widely separated, those on five distinctly separated but close, lateral areas of pygidial tergite, sparse pubescence on sternite two, and distal fringes of sternites two to five, all pale and glittering, the pubescence of the margins of tergites one and two, and spots on tergites two to five all dense and appressed; second tergite with large, close, dense, confluent punctures interspersed with very small punctures; pygidial area as described above; first sternite with a prominent thin keel elevated anteriorly and posteriorly; second

sternite with large punctures, dense and confluent laterally, close and only slightly confluent medially; sternites three to five with moderate, dense, confluent punctures distally.

Coxae, trochanters, femora except the tips, and front tibiae, ferruginous; tips of femora, intermediate and posterior tibiae, and all the tarsi, black; calcaria ferruginous.

Holotype.—Male, Douglas, Arizona, September, 1930 (W. W. Jones), in University of Minnesota collection.

Allotype.—Female, Santa Rita Mts., Arizona, August 12, 1932 (D. K. Duncan), in University of Minnesota collection.

Paratypes.—Male, Douglas, Arizona, September, 1930 (W. W. Jones); three males, Douglas, Arizona, August (F. H. Snow); male, Tucson, Arizona (F. H. Snow); two females, Tucson, Arizona (F. H. Snow); female, Palmerlee, Arizona, July 18 (H. A. Kaeber); male, Vegas José, New Mexico, August 4; male, Steins, New Mexico, July 14, 1917; three males, Phantom Lake, Fort Davis Quad, Davis Mts., Texas, June 14, June 19 and July 12, 1916 (F. M. Gaige); two females, Phantom Lake, Ft. Davis Quad, Davis Mts., Texas, May 24 and June 14, 1916 (F. M. Gaige); male, State of Coahuila, Mexico (C. A. Purpus).

The male paratype from Tucson, Arizona, has the calcaria brown, but the pubescence on the vertex, pronotum and anterior half of mesonotum is mostly pale. While the male and female have not been taken in copula, the relationships of the two sexes to the respective sexes of subsp. *navasota* make certain they are the two sexes of a single subspecies. The female of subsp. *nebulosa* is like that of subsp. *navasota* in the form of the thorax, absence of scutellar scale, sculpture of pygidium, puncturation of second abdominal tergite and pale markings of the abdomen. *Nebulosa* differs from *navasota* in having the thorax more strongly narrowed posteriorly and in the much darker color of the abdomen, tibiae and tarsi.

Timulla (Timulla) dubitata subsp. *dubitata* (Smith). (New combination)

1855. *Mutilla dubitata* Smith, Cat. Hymen. Brit. Mus. iii, p. 60, female.
1871. *Mutilla dubitata* Blake, Trans. Amer. Ent. Soc., iii, p. 256, female (in part).
1886. *Mutilla dubitata* Blake, Trans. Amer. Ent. Soc., xiii, p. 201, female (in part).
1897. *Mutilla dubitata* Dalla Torre, Cat. Hymen., viii, p. 33, female.

1899. *Mutilla dubitata* Fox, Trans. Amer. Ent. Soc., xxv, p. 270, female (in part).
1899. *Timulla hexagona* Ashmead, John B. Smith's Insects of New Jersey, p. 535, female (in part).
1903. *Mutilla dubitata* André, Gen. Ins., i, fasc. 11, p. 42, female.
1903. *Mutilla dubitata* Melander, Trans. Amer. Ent. Soc., xxix, p. 323, female (in part).
1909. *Mutilla (Timulla) dubitata* Viereck, John B. Smith's Insects of New Jersey, p. 665, female (in part).
1916. *Mutilla (Timulla) rufa* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 209, male and female (in part).
1916. *Mutilla (Timulla) hexagona* Bradley, Trans. Amer. Ent. Soc., xlvi, pp. 213-214, female (not male).

I have examined and redescribed as follows Smith's type of this species in the British Museum of Natural History:

Female.—Entirely ferruginous; thorax noticeably contracted at the mesonotal area; scutellar scale present and distinct; lateral margins of posterior face of propodeum dentate; basal, lateral, pubescent spots of second tergite obscure; pygidial area longitudinally rugose, the rugae not reaching the distal margin. Length, 8.5 mm.

Head entirely ferruginous, clothed with sparse, recumbent, pale fulvous hairs, and sparse, erect, pale hairs; mandibles edentate at the tips, with a small tooth within, the tips only, black; clypeus elevated posteriorly, the elevated margin arcuate, seen from above slightly sinuate, and somewhat dentate at the sides; flagellum of antennae dusky, the first segment one and one-half times as long as the second; antennal scrobes carinate above; front and vertex with moderate, dense, confluent punctures, the genae with moderate, close punctures; relative widths of head and thorax, 3.4:2.9.

Thorax entirely ferruginous, not at all broader posteriorly than anteriorly; dorsum distinctly contracted at the mesonotal area, the lateral margins slightly crenulate, with large, dense, confluent punctures becoming deeply reticulate on the propodeum, clothed with sparse, recumbent, pale fulvous hairs, and sparse, erect, pale hairs; humeral angles rounded; mesonotal-scutellar suture indistinct; scutellar scale present; lateral margins of posterior face of propodeum dentate; propleura indistinctly punctate, meso-, and metapleura impunctate, sides of

propodeum with moderate, close punctures, and all clothed with sparse, inconspicuous, pale pubescence.

Abdomen ferruginous, the apical portions of the tergites and the pygidium somewhat dusky, but not black; first tergite with sparse, moderate punctures, sparse, pale, erect hairs, and an apical band of appressed, pale pubescence; second tergite with small, shallow punctures, clothed with sparse, recumbent, dark pubescence on the disk, scattered, pale pubescence at the sides, except a pair of obscure, basal, lateral, elongate spots, and a distinct apical band, suddenly, angulately dilated medially at the anterior margin, of appressed, pale pubescence; tergites three to five finely, closely punctate, each with an apical band of appressed, pale pubescence broadly interrupted medially with dark pubescence, that on the third tergite more broadly interrupted than that on the fifth; pygidium longitudinally rugose, the rugae not extending to the apical margin; first sternite with a median, longitudinal carina on the basal half, elevated posteriorly into a blunt tooth; second sternite with moderate, distinct punctures throughout, finely punctate at the apical margin, sparsely clothed with erect, pale hairs, and with an apical fringe of pale hairs; sternites three to five with small, close punctures apically, and each with a thin, apical fringe of pale hairs; last sternite with small, close punctures and erect, pale hairs.

Legs entirely ferruginous, sparsely clothed with pale hairs; calcaria pale.

Male.—Ferruginous, except proximal half of mandibles, clypeus, antennae, front between antennal tubercles, ventral half of mesopleura, propodeum except sides and antero-lateral areas of dorsum, mesosternum, and legs, all black, clothed with sparse, fuscous to black pubescence, except the front anterior to the median ocellus, antennal scrobes, genae, lateral and posterior areas of clypeus and proximal half of mandibles externally, all with sparse, pale, glittering pubescence; mandibles slightly emarginate beneath, but without a strong tooth near the base; mesosternal tubercles somewhat oblique; intermediate coxae with a glabrous ridge on the external lateral margin, and also on the posterior margin, the latter terminating inwardly in a low tubercle; fifth and sixth abdominal sternites with prominent lateral tubercles, the seventh sternite and the hypopygium with conspicuous, lateral, oblique carinae; wings fuliginous. Length, 16 mm.

Head ferruginous, except proximal half of mandibles, clypeus, antennae and front between the antennal tubercles, all black, clothed with pubescence as described above; mandibles slightly but distinctly emarginate beneath and angulate but not toothed near the base beneath; median, glabrous area of clypeus strongly, transversely concave; scape distinctly but delicately bicarinate beneath; first and second segments of flagellum approximately equal in length; antennal scrobes distinctly carinate above; front, vertex and genae with moderately large, dense, confluent punctures, the latter somewhat less dense on the genae than on the front and vertex; ocelli small, the distance between the eye margins and a lateral ocellus approximately four times the greatest diameter of the latter.

Thorax ferruginous, the ventral half of mesopleura, mesosternum, and propodeum except sides and antero-lateral areas of dorsum, black, clothed throughout with sparse, erect, fuscous to black pubescence; pronotum, mesonotum, scutellum and mesopleura for the most part, with moderately large, dense, confluent punctures; parapsidal furrows present and complete from the anterior to posterior margins of mesonotum; enclosed space of dorsum of propodeum well developed, elongate, subrectangular; remainder of propodeum including the sides with large, close, more or less confluent punctures, approaching reticulate; propleura longitudinally rugose, the broad posterior margin glabrous and finely punctate; metapleura micropunctate and micropubescent except the ventral third closely, confluently punctate; tegulae large, glabrous and impunctate except the broad anterior and inner margins closely punctate and black pubescent.

Abdomen ferruginous, clothed throughout with sparse, erect, fuscous to black pubescence, the latter thickest at the posterior margins of the segments, except the sternites with sparse, pale pubescence; first tergite with moderate punctures, close laterally and posteriorly, becoming smaller at the distal margin; tergites three to six with moderate, close punctures, becoming dense and confluent distally; last tergites with moderate, dense, confluent punctures, except a median, narrow, elongate, glabrous, impunctate area terminating in the arms of a Y-shaped carina, the stem of the Y extending to the distal margin and slightly shorter than the arms; first sternite with a distinct, median, longitudinal carina; second sternite with moderately large, close, distinct punctures becoming sparse

medially, and moderate and sparse distally; sternites three to six with moderate, close punctures distally; sternites five and six with prominent, lateral tubercles; sternite seven and the hypopygium with conspicuous, oblique, lateral carinae.

Wings fuliginous; cell 2nd $R_1 + R_2$ long and subtruncate at the apex; cell R_4 present and receiving vein M_2 three-fifths the distance from base to apex; cell R_5 receiving vein M_{3+4} two-thirds the distance from base to apex.

Legs entirely black, sparsely clothed with fuscous to black pubescence; calcaria pale.

Type.—Female, St. John's Bluff, E. Florida (E. Doubleday), in British Museum of Natural History, London.

Allotype.—Male, Orlando, Florida, June 3, 1907, in collection of United States National Museum.

Specimens examined.—

NEW YORK: female, Yaphank, Long Island, September 22, 1911; female, Yaphank, Long Island, September 24, 1911; three females, Cold Spring Harbor, Long Island, June 17, 1923 (E. G. Anderson); male, Cold Spring Harbor, Long Island, July 10, 1921 (S. H. Emerson); male, Cold Spring Harbor, Long Island, July 11, 1921 (E. G. Anderson); male, Cold Spring Harbor, Long Island, September 13, 1922 (E. G. Anderson).

NEW JERSEY: male, Helmetta, September 21, 1909; male, between Stafford's Forge and E. Plains, Ocean Co., August 14, 1929 (Rehn and Hebard); male, Ocean County; male, Clementon, September 10; female, Lakehurst, July 12, 1911 (Wm. T. Davis); female, Jamesburg, July 22, 1912 (Wm. T. Davis); female, Menantico, May 14, 1923 (J. C. Bradley); female, Speedwell, Burlington County, June 20, 1901 (J. A. G. Rehn); female, Camden County, June 20, 1891; two females, Brown's Mills Jc., April 21, 1908 (C. T. Greene); female, Clementon, August 7, 1892; female, Weymouth, July 1, 1926 (H. E. Guerlac); female, Atlantic County, May 29, 1890; three females.

MARYLAND: female, Baltimore; female, Odenton, July 17, 1918 (H. Dietrich); female, Beltsville, May 17 (Frederick Knab); female, Plummer's Island, May 10, 1914 (J. C. Crawford); female, Plummer's Island, August 10, 1902 (Barber and Schwarz); female, Marshall Hall, June, 1898; female, Plum Point, July 4, 1912 (Wm. Palmer); female, Breton Bay, July 12, 1924 (H. S. Barber); female, Bryantown, August 21, 1932 (H. G. Barber).

VIRGINIA: female, Great Falls, April 20; female, Great Falls, May 19; six females, Clifton, July 1-9, 1933 (J. C. Bridwell); two

females, Clifton, July 15–23, 1933 (J. C. Bridwell) ; two females, Clifton, July, 1933 (J. C. Bridwell) ; two females, East Falls Church, July 2, 1912 ; female, Falls Church, August 4 ; female, Falls Church, August 13, 1914 (G. M. Greene) ; male, female, Falls Church, August 20, 1913 (C. T. Greene) ; female, Falls Church, September 1, 1915 (C. T. Greene) ; female, Falls Church, September 4, 1915 (C. T. Greene) ; two females, Falls Church, September 11, 1915 (G. M. Greene) ; female, Nelson County, July 1, 1925 (W. Robinson).

NORTH CAROLINA : female, Black Mountains, August (Beutenmüller) ; female.

SOUTH CAROLINA : female, Clemson College, August 1, 1927 (B. B. Pepper) ; female.

TENNESSEE : female, Nashville ; female, Monteagle, August 21, 1931 (A. G. Richards) ; four females.

GEORGIA : female, Stone Mountain, August 16, 1913 ; female, Talmulah Falls, June 19–25, 1909 (J. C. Bradley) ; male, Clyde, Georgia, September 1–12, 1931 (Bradley and Knorr) ; male, St. Simon's Island, June 1, 1911 ; male, St. Simon's Island, June 5, 1929 (P. W. Fattig) ; male, St. Simon's Island, June 7, 1911 ; male, Spring Creek, Decatur County, May 18–21, 1916 (J. C. Bradley) ; male, Spring Creek, Decatur County, June 7–23, 1917 (J. C. Bradley) ; two females, Spring Creek, Decatur County, July 16–29, 1912 (J. C. Bradley) ; male, Spring Creek, Decatur County, August 9–12, 1931 (Bradley and Knorr) ; male, Spring Creek, Decatur County ; two females.

FLORIDA : female, Lake Worth ; female, Gainesville, Alachua County, April 4, 1913 ; male, Gainesville, Alachua County, May 10, 1922 (T. P. Winter) ; male, Agricultural Experiment Station, Gainesville (J. R. W.) ; female, Palatka, May 3–4, 1916 (J. C. Bradley) ; female.

MISSISSIPPI : female, Agricultural College, April 12, 1916 (C. D. Coleman) ; female, Agricultural College, April 28, 1919 (L. V. Colvin) ; female, Agricultural College, May 8, 1921 (W. S. Anderson) ; female, Agricultural College, May 15, 1915 (J. C. Powell) ; female, Agricultural College, June 4, 1919 (B. H. Virden) ; female, Agricultural College, 1921 (L. W. Jones) ; female, Columbia, July (B. Morris).

LOUISIANA : female, Orange, September 30, 1906 (F. C. Bishopp).

TEXAS : female, Bexar county, August 10, 1933 (H. B. Parks) ; three females, Bexar County, August 30, 1933 (H. B. Parks) ; female, Bexar County, October 2, 1931 (H. B. Parks) ; female, Bexar

County, October 4, 1933 (H. B. Parks); female, Bexar County, October 20, 1931 (H. B. Parks); male, Colorado County, June 27, 1922 (Grace O. Wiley); male, Beaumont, November 13, 1918 (H. S. Barber); female, Lee County, June 9, 1906; female, Lee County, June, 1908; female, Fedor, September 5, 1897 (Birkman); female, Dallas; male, Paris, October 26, 1904 (C. R. Jones); female.

ARKANSAS: female, Marion County, 1897; female, Marion County, July (Bridwell).

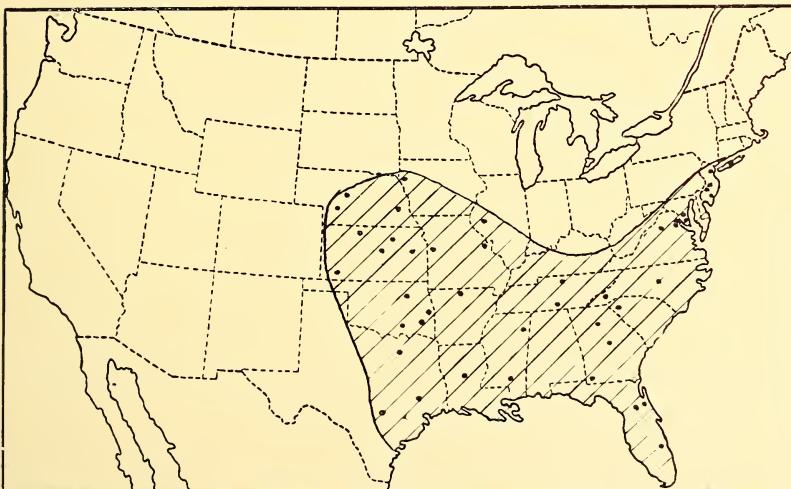
OKLAHOMA: female, Payne County, May 9, 1926 (W. J. Brown); female, Payne County, June 3, 1925 (W. J. Brown); male, female, Payne County, June 24, 1925 (W. J. Brown); female, Latimer County, June 20, 1931 (R. D. Bird); female, Wiley, July 3; female, Stillwater, April 20, 1933 (Reynold Dahms).

ILLINOIS: female, Illinois River, August.

IOWA: female, Sioux City, July 28, 1928 (C. N. Ainslie).

MISSOURI: female, St. Louis (Rau); female, Kansas City, August 17 (F. Rogers).

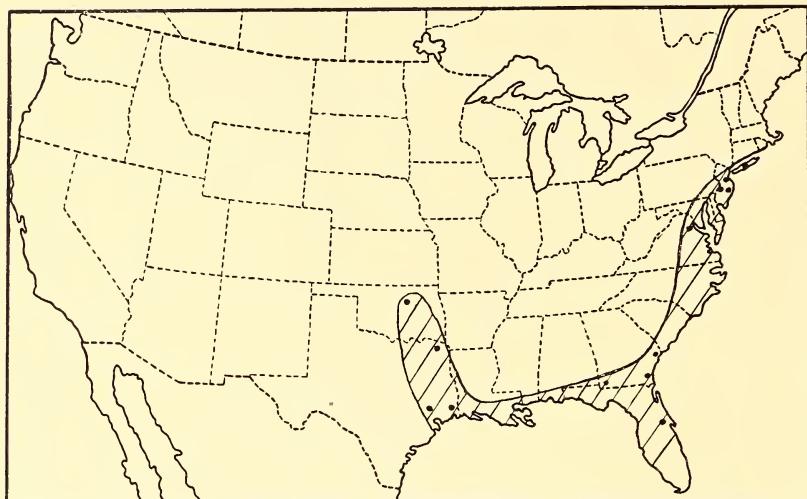
KANSAS: female, Manhattan, May 15, 1920 (H. M. Smith); female, Manhattan, September 19, 1932 (C. W. Sabrosky); female, Riley County, July 3 (Popenoe); female, Riley County, July 21 (Popenoe); two females, Riley County, August 9 (Popenoe); female, Riley County, August 23 (J. B. Norton); female, Lyons County, June 4, 1923 (C. O. Bare); female, Medora, June 9, 1933;



Distribution of *Timulla (Timulla) dubitata* subsp. *dubitata* (Smith). Females

female, Philipps County, August 30, 1912 (F. X. Williams); female, Seward County, July 21; female (Popenoe).

NEBRASKA: two females, Halsey, August 13, 1925 (R. W. Dawson); female, Halsey, August 14, 1925 (R. W. Dawson); female, Halsey, September 3, 1924 (R. W. Dawson); female, Wallace, July 7, 1931.



Distribution of *Timulla (Timulla) dubitata* subsp. *dubitata* (Smith). Males

The female has been confused in collections with the female of *vagans*, and even with the female of *ferrugata*; it has also been identified by Bradley (1916) as the female of *hexagona*. I have examined Bradley's allotype of *hexagona* and find it to be the same as Smith's *dubitata*. Bradley's allotype was not taken in copula with a male but was correlated with *hexagona* on other evidence which has since proven to be incorrect. The male was identified by Bradley (1916) as Lepeletier's *rufa*. An examination of the type of the latter has shown it to be the male of *ferrugata*. This female and male, and the following subspecies of male were first associated by Bradley (1916) on the basis of specimens collected together but not in copula by Nathan Banks, and on the basis of geographical distribution. The study of the material before me has confirmed that conclusion. The female may be recognized by the elongate thorax, the sides of which are distinctly but not strongly emarginate medially, by the absence of the mesonotal-scutellar suture just anterior to the scutellar scale, the distinct scutellar scale, and the

longitudinally rugose pygidium. The male may be readily recognized by the presence of well-developed tubercles on the fifth sternite, the bicarinate scape without a pubescent brush beneath, and the more or less ferruginous head and thorax. The males vary with respect to the emargination of the mandibles; some are only slightly emarginate with an inconspicuous angular prominence beneath near the base; intergrades occur between that condition and the mandibles broadly, distinctly emarginate beneath with the angular prominence conspicuous and almost forming a tooth. The subspecies in the male sex described below has the head and thorax black and has a more extensive but different geographical distribution. I have attempted to find some morphological character in the females which would separate them into groups having the same geographical distribution as the two subspecies of male, but have been unsuccessful. The females appear to me to be uniform throughout the entire geographic range.

Timulla (Timulla) dubitata subsp. *fugitiva* n. subsp.

1899. *Mutilla hexagona* Fox, Trans. Amer. Ent. Soc., xxv, p. 270, male (in part).

1899. *Timulla hexagona* Ashmead, John B. Smith's Insects of New Jersey, p. 535, male (in part).

1916. *Mutilla (Timulla) rufa* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 209, male (in part).

Male.—Exactly like the subsp. *dubitata* except the head and thorax entirely black; emargination of mandibles, form of clypeus, elongate, glabrous area and Y-shaped carina of last tergite, tubercles of fifth and sixth sternites, and carinae of seventh sternite and hypopygium, all the same as in subsp. *dubitata*. Length, 17 mm.

Holotype.—Male, Halsey, Nebraska, August 13, 1925 (R. W. Dawson), in University of Minnesota collection.

Paratypes.—The following specimens.—

NEW JERSEY: male, Gloucester County, August 16, 1891.

PENNSYLVANIA: male, Rockville, August 4, 1912; male, Rockville, August 18, 1912 (Champlain); male, Rockville, August 21, 1910 (H. B. Kirk).

MARYLAND: male, Baltimore, 1870 (Uhler); male, Chestertown, August 12, 1901 (E. G. Vanatta); male, Blythedale, September 18; male, College Park, August 23, 1925 (C. T. Greene).

DISTRICT OF COLUMBIA: male, Rock Creek, October 14, 1904 (C. E. Burden); male, Washington, July 23, 1902 (Bridwell).

VIRGINIA: male, Clifton, July 15–23, 1933 (J. C. Bridwell) ; male, Barcroft, September 3, 1928 (J. C. Bridwell) ; male, Falls Church, August 23 ; male, Falls Church, August 26, 1916 (G. M. Greene) ; male, Falls Church, August 28 ; male, Falls Church, August 30 ; two males, Falls Church, September 1, 1915 (C. T. Greene) ; two males, Falls Church, September 4, 1915 (C. T. Greene) ; male, Kerney, August 15, 1913 (Wm. Middleton) ; two males, Nelson County, July 12, 1928 (W. Robinson) ; male, Nelson County, August 6, 1925 (W. Robinson).

TENNESSEE: two males, Allardt, Fentress County, August 20, 1922 (T. H. Hubbell) ; male.

GEORGIA: male, Austell, August 27, 1910.

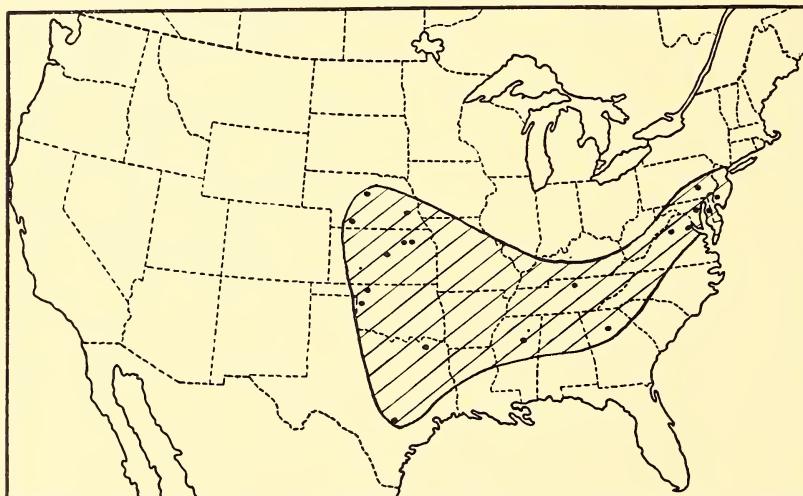
MISSISSIPPI: male.

TEXAS: male, Bexar County, June 12, 1933 (H. B. Parks) ; male, Paris, June 25, 1933 ; male, Paris, September 23, 1904 (W. R. Hooker).

OKLAHOMA: male, Woods County, July 5, 1930 (R. D. Bird) ; male, Shattuck, August 12, 1933 (Reynolds Dahms).

KANSAS: male, Onaga, July 13, 1925 (R. H. Beamer) ; two males, St. George, July 21 ; male, Riley County, August 6 (J. B. Norton) ; male, Riley County, August 19 (Popenoe) ; two males, Riley County, August 22 (Popenoe) ; male, Russell County, August 26, 1912 (F. X. Williams).

NEBRASKA: male, Weeping Water, July 20 (H. S. Smith) ; male,



Distribution of *Timulla (Timulla) dubitata* subsp. *fugitiva* n. subsp. Males

Halsey, August 12, 1925 (R. W. Dawson); male, Halsey, August 14, 1920 (C. B. Philip); male, Halsey, August 20, 1920 (C. B. Philip); male, McCook, September 3, 1892 (Barber).

The emargination of the mandibles varies as in subsp. *dubitata*, some specimens having the emargination shallow, others more deeply emarginate with a conspicuous angle beneath near the base. As stated above the attempt to find subspecific differences in the females from the same region in which this male subspecies occurs was unsuccessful. Females of *dubitata* from Florida, for example, cannot be separated from females collected in Nebraska, Tennessee or other areas where the species occurs. The males vary in length from 17 mm. to 20 mm.

Timulla (Timulla) wileyae n. sp.

Female.—Head, thorax, legs and abdomen beneath in part, ferruginous; tips of mandibles, flagellum beyond the first segment, abdomen above, and abdomen beneath beyond the second sternite, all black; lateral margins of dorsum of thorax not emarginate medially; scutellar scale present; disk of second tergite finely punctate, and with a pair of anterior, obscure, subcircular, pale pubescent spots, the tergite also with a broad, distal band of dense, appressed, pale pubescence, the anterior margin of the band angularly dilated medially; tergites three to five each with a distal band of pale pubescence attenuated and interrupted medially with black; pygidial area irregularly rugose. Length, 9 mm.

Head entirely ferruginous, except the tips of the mandibles and the flagellum beyond the first segment, blackish, clothed with sparse, erect, ferruginous pubescence, that on the genae paler than that on the front and vertex; mandibles edentate at the apex and with a small tooth within near the apex; clypeus elevated posteriorly, the elevated margin evenly arcuate; scape finely punctate above; first segment of flagellum approximately equal in length to the second and third segments united; antennal scrobes distinctly carinate above; front, vertex and genae with moderate punctures, dense and confluent on the front and vertex, separated and interspersed with fine punctures on the genae; relative widths of head and thorax, 3.3 : 2.8.

Thorax entirely ferruginous, the dorsum clothed with sparse, erect, ferruginous pubescence, the posterior face of propodeum with sparse, erect, pale pubescence, and the pleural areas with pale micropubescece; humeral angles rounded; dorsum with

moderately large punctures, very dense and confluent anteriorly, less dense medially and posteriorly and becoming reticulate on the posterior face of propodeum; lateral margins of dorsum of propodeum not emarginate medially, the sides parallel; width of thorax at the humeral angles and dorsum of propodeum equal; scutellar scale present and well developed; pleural areas throughout micropunctate, the propleura also with moderate, obscure punctures and the sides of propodeum with moderate punctures separated anteriorly, close posteriorly.

Abdomen black, except the first segment anteriorly above and entirely beneath, and the second sternite entirely, ferruginous; first tergite finely punctate and with scattered small punctures, clothed with sparse, erect, pale pubescence and also with a distal band of dense, appressed, pale pubescence; second tergite finely, closely punctate except the lateral fourths also with moderate, separated punctures, clothed with sparse, appressed, black pubescence except the lateral fourths with the pubescence pale, and also with a pair of anterior, obscurely subcircular spots and a broad, distal band with its anterior margin angularly dilated medially, of dense, appressed, pale pubescence; tergites three to five finely, closely punctate, clothed with sparse, appressed, black pubescence and each with a distal, interrupted band of dense, appressed, pale pubescence, the band on each attenuated and interrupted medially, broadly so on the third and scarcely on the fifth; pygidial segment with sparse, pale pubescence, the pygidial area irregularly rugose; first sternite with a median, longitudinal carina on the anterior two-thirds, the carina distinctly elevated anteriorly into a slight tooth; second sternite with moderately large, close punctures, becoming small and close at the distal margin, clothed with sparse, pale pubescence, and with a thin, distal fringe of pale pubescence; sternites three to five with small, close punctures towards the distal margin and each with a thin, distal fringe of pale pubescence.

Legs entirely ferruginous, sparsely clothed with pale pubescence; calcaria pale.

Holotype.—Female, Rock Island, Texas, June 27, 1922 (Grace O. Wiley), in University of Minnesota collection.

Paratypes.—Texas: female, Willis, May 14, 1903 (Bridwell); female, Willis, May 15, 1903 (Bridwell); female, Willis, May, 1903 (Bridwell); female, Lee County, April 10; female, Mineola, July 19 (C. R. Jones); female, Rosser, June 28, 1905 (C. R. Jones); two females, Dallas (Boll).

LOUISIANA: female, Orange, March 22.

ARKANSAS: female, Hope, June (Louise Knobel).

OKLAHOMA: female, Ardmore, May 18, 1906 (F. C. Bishopp); female, Cherokee, August 8, 1932 (A. E. Pritchard).

Similar to *dubitata* but differs in having the lateral margins of the dorsum of the thorax parallel and not emarginate medially, in the smaller anterior, pale pubescent spots of the second tergite, and the irregularly rugose pygidium. I am pleased to name this species for Mrs. Grace O. Wiley, formerly Curator of Reptiles at the Brookfield Zoological Gardens, Chicago, who collected the holotype specimen.

Timulla (Timulla) nitela n. sp.

Male.—Head, thorax and legs entirely black; abdomen entirely fulvous, sparsely clothed with fulvous pubescence; median area of clypeus transversely concave; mandibles emarginate beneath and with a conspicuous tooth near the base beneath; ocelli small, the distance between the eye margins and the lateral ocelli equal to about four times the greatest diameter of the latter; last tergite with the median, elongate, glabrous area terminating in the arms of a Y-shaped carina, the arms of the Y about equal in length to the stem; hypopygium with a pair of prominent, oblique carina, the seventh sternite with a pair of lateral, cariniform tubercles, the sixth sternite with a pair of small, lateral tubercles; intermediate coxae with a distinct tooth at the inner, posterior margin; wings subhyaline with a slightly darker band apically. Length, 13 mm.

Head entirely black, sparsely clothed with short, appressed and long, erect, pale, glittering pubescence; mandibles and clypeus as above; first segment of flagellum slightly shorter than the second; scape distinctly bicarinate beneath; front and vertex with moderate, dense, slightly confluent punctures, the genae with slightly smaller, contiguous but scarcely confluent punctures; ocelli as above; antennal serobes carinate above; relative widths of head and thorax at the tegulae, 4.7: 5.7.

Thorax entirely black, sparsely clothed with pale, glittering pubescence, except the posterior two-thirds of mesonotum and anterior middle of scutellum with sparse, black pubescence; pronotum, mesonotum and scutellum with moderately, large, dense, slightly confluent punctures; parapsidal furrows present and distinct, shallow anteriorly, deep posteriorly; enclosed space of dorsum of propodeum elongate, triangular; remainder of dorsum of propodeum and posterior face of propodeum

reticulate; propleura glabrous, micropunctate and faintly transversely rugose; mesopleura micropunctate throughout and with moderate, close, shallow punctures, except at the anterior margin; metapleura micropunctate except for moderate, close punctures ventrally; sides of propodeum with moderate, shallow punctures except the anterior margin only micropunctate; mesosternal tubercles well developed, transverse; tegulae large, convex, glabrous, impunctate, except the anterior and inner margins punctate and with sparse, pale pubescence.

Abdomen entirely fulvous, sparsely clothed with fulvous pubescence; first tergite with moderately large, distinct punctures; second tergite with similar punctures but becoming small and close towards the posterior margin; tergites three to six with moderately small, distinct punctures; last tergite with a Y-shaped carina as above, the posterior margin emarginate each side of the stem of the Y; first sternite with a distinct, longitudinal, median carina; second sternite with moderately large, close, somewhat confluent punctures; sternites three to six with small, close punctures posteriorly; sternites six and seven, and the hypopygium armed as described above.

Wings subhyaline with a distal, marginal darker band; cell 2nd $R_1 + R_2$ subtruncate at the apex; cell R_5 receiving vein M_{3+4} two-thirds the distance from base to apex; cell R_4 present and receiving vein M_2 almost two-thirds the distance from base to apex.

Legs entirely black, sparsely clothed with pale pubescence; intermediate coxae with a low carina at the posterior margin terminating at the inner margin in a distinct tooth; calcaria pale.

Holotype.—Male, Douglas, Arizona, August 7, 1933 (W. W. Jones), in University of Minnesota collection.

Paratypes.—Two males, Douglas, Arizona, August 7, 1933 (W. W. Jones).

Very similar in appearance to *neobule*, the following species, but has the wings slightly darker, the clypeus transversely concave, the head and thorax more sparsely pubescent, the tarsi entirely black, and the sides of propodeum with shallow punctures.

Timulla (Timulla) neobule n. sp.

Male.—Head and thorax black, abdomen fulvous, legs black except the intermediate and posterior tarsi ferruginous; median, impunctate area of last tergite terminating in the flaring arms of a Y-shaped carina, the arms of the Y about equal in

length to the stem; sixth sternite with a pair of small, lateral tubercles; seventh sternite with the lateral tubercles large; hypopygium with a pair of lateral, oblique, polished ridges terminating posteriorly in distinct tubercles. Length 12 mm.

Head black; front below the ocelli, posterior part of vertex, and genae with appressed, pale pubescence, as well as sparse, erect, pale hairs, the appressed pubescence densest on the front; anterior part of vertex with sparse, erect, pale hairs; mandibles edentate at the tip and with a small tooth within near the tip, emarginate beneath and with a prominent tooth near the base beneath; median area of clypeus depressed medially, thus concave, the posterior and lateral margins higher than the center and evenly arcuate; scape bicarinate beneath, the two carinae about equally developed; first and second segments of flagellum approximately equal in length; antennal scrobes weakly carinate above; front, vertex and genae with moderate, close punctures; ocelli moderate in size, the distance between the eye margins and the lateral ocelli two and two-thirds times the greatest diameter of the latter; relative widths of head and thorax at the tegulae, 4.4 : 5.5.

Thorax black; pronotum densely, confluent punctate, clothed throughout with appressed, pale pubescence, and sparse, erect, pale hairs; humeral angles rounded; mesonotum densely, confluent punctate, clothed with sparse, erect, black hairs, except the anterior third with appressed, pale pubescence and sparse, erect, pale hairs; parapsidal furrows distinct; scutellum evenly convex, not gibbose, densely, confluent punctate throughout, clothed with sparse, erect, black hairs at the base medially, elsewhere with sparse, erect, pale hairs; proximal portion of propodeum with appressed, pale pubescence, elsewhere with sparse, erect, pale hairs; enclosed area of propodeum distinct, the sides parallel, not elevated posteriorly into a tubercle; lateral margins of dorsum of propodeum not defined by a raised, polished line; dorsum and posterior face of propodeum distinctly reticulate; anterior margin of propleura defined by a weak carina; propleura shallowly punctate anteriorly, weakly, transversely rugose posteriorly; mesopleura elevated, the elevated portions with shallow, dense, confluent punctures, and sparse, erect and appressed pale pubescence; metapleura impunctate dorsally, distinctly, shallowly punctate ventrally; sides of propodeum moderately, shallowly reticulate except the anterior margin; tegulae smooth, polished, the basal and inner margins with pale pubescence.

Abdomen fulvous; first tergite with sparse, moderate punctures, sparse, erect, pale hairs and a thin, apical fringe of fulvous hairs; second tergite impunctate on the median line, with moderate, distinct punctures elsewhere, clothed with sparse, erect, fulvous hairs, except the distal fourth slightly depressed and clothed with sparse, fulvous pubescence, the distal margin with a fringe of fulvous hairs; tergites three to six with moderate, close punctures, sparse, erect, fulvous hairs, and each with a distal fringe of fulvous hairs; last tergite densely punctate at the sides, with sparse, erect, fulvous hairs; median, impunctate area terminating in the flaring arms of a Y-shaped carina, the stem of the latter extending to the distal margin, the latter somewhat produced medially; arms of the Y-shaped carina about equal in length to the stem; first sternite with a median, longitudinal carina on the proximal two-thirds; second sternite with large punctures, sparse medially, close at the sides; sternites two to seven closely punctate at the distal margin and each with a thin, distal fringe of pale hairs; lateral tubercles of sixth sternite small but distinct, those of the seventh sternite moderate and elongate, the last sternite with a pair of anterior, oblique, lateral polished ridges terminating in distinct tubercles posteriorly.

Wings subhyaline, cell 2nd $R_1 + R_2$ indistinctly truncate at the apex; cell R_5 receiving vein M_{3+4} slightly beyond the middle; cell R_4 present but less distinct than R_5 and receiving vein M_2 slightly beyond the middle.

Legs black, except the intermediate and posterior tarsi distinctly ferruginous, sparsely clothed with pale hairs; calcaria pale. Intermediate coxae with a distinct, inner, distal tooth.

Holotype.—Male, Cat. no. 50949, U. S. National Museum, Los Mochis, Sinaloa, Mexico, July 15, 1922 (C. T. Dodds).

Paratypes.—Three males, Tucson, Arizona (F. H. Snow); male, Pima County, Arizona, September 30, 1925 (Neva Schultz); eleven males, Mesa, Arizona, October 11, 1925 (A. A. Nichol); male, Mesa, Arizona, October 28, 1925 (A. A. Nichol).

Similar in appearance to *oajaca* and other species having the head and thorax black with the abdomen mostly fulvous; differs from all but *nitela* in having the first abdominal segment also fulvous, and in the ferruginous middle and hind tarsi; very close to *nitela* but differs in having the median area of clypeus concave only at the middle and not transversely concave, in the ferruginous tarsi, and in the reticulate sides of the propodeum.

Timulla (Timulla) nicholi n. sp.

Female.—Entirely ferruginous, except the flagellum beyond the first segment, the tips of the mandibles, and the disk of all the abdominal tergites, blackish; lateral margins of dorsum of thorax not emarginate medially; scutellar scale present; second tergite with moderately large, separated punctures interspersed with fine punctures; first and second tergites with a distal band of dense, pale pubescence, the second also with a pair of linear marks of pale pubescence on the anterior half; tergites three to five each with a pair of subquadrate spots of pale pubescence; pygidial area granulate. Length, 9 mm.

Head entirely ferruginous, except the tips of the mandibles and flagellum beyond the first segment blackish, clothed with sparse, erect, ferruginous pubescence, the genae also with inconspicuous, pale, appressed pubescence; mandibles edentate at the tip and with a small tooth within near the tip; clypeus elevated posteriorly, the elevated margin arcuate; scape obscurely punctured; first segment of flagellum approximately equal in length to the second and third segments united; antennal scrobes carinate above; front, vertex and genae with large, dense, confluent punctures, those on the genae slightly smaller than those on the front; relative widths of head and thorax, 3.5 : 3.2.

Thorax entirely ferruginous, the dorsum clothed with sparse, erect, ferruginous pubescence, the posterior face of propodeum with sparse, erect, pale pubescence, and the pleural areas with sparse, pale micropubescent; humeral angles rounded; lateral margins of dorsum of thorax irregularly crenulate; dorsum of thorax with large, coarse, dense, confluent punctures, approaching longitudinally rugoso-punctate, and becoming reticulate and asperated on the posterior face of propodeum; scutellar scale present; lateral margins of posterior face of propodeum dentate; pleural areas throughout micropunctate, the propleura with obscure, moderate punctures anteriorly, and the sides of propodeum with moderate, separated punctures posteriorly.

Abdomen ferruginous, the disk of the tergites blackish to black; first tergite with moderate, separated punctures and sparse, erect, pale pubescence, except the distal margin finely punctate and with a band of dense, appressed, pale pubescence; second tergite with moderately large, separated punctures interspersed with fine punctures, the larger punctures becoming more closely spaced and the fine punctures eliminated towards the lateral margins; second tergite with sparse, erect and appressed,

black pubescence on the disk, sparse, erect, pale pubescence on the lateral thirds, and with a pair of broad lines on the anterior half together with a broad, distal band of dense, appressed, pale pubescence, the anterior margin of the distal band only slightly sinuate; tergites three to five finely punctate and with scattered, moderate punctures intermixed, clothed with sparse, erect and appressed, black pubescence medially, sparse, erect, fuscous pubescence at the sides with a few pale hairs at the lateral margins and each with a pair of large, subquadrate spots of dense, appressed, pale pubescence, the spots converging towards the tip of the abdomen but those on tergite five widely separated; pygidial segment with sparse, erect, pale fuscous pubescence, the pygidial area granulate throughout; first sternite with a median, longitudinal carina slightly elevated medially; second sternite with moderate, sparse punctures, the distal margin with moderately small, close punctures and a thin fringe of pale pubescence; sternites three to five with moderately small, close punctures towards the distal margin and each with a thin distal fringe of pale pubescence.

Legs entirely ferruginous, sparsely clothed with pale pubescence; calcaria pale.

Holotype.—Female, Mesa, Arizona, October 11, 1925 (A. A. Nichol), in University of Minnesota collection.

Paratypes.—Female, Phoenix, Arizona, June 11, 1927 (A. A. Nichol); female, Douglas, Arizona, San Bernardino ranch, August (F. H. Snow).

Somewhat similar to *oajaca* Blake but much less coarsely punctured on the second tergite than that species, the anterior margin of the pale distal pubescent band of the second tergite almost straight and not strongly sinuate as in *oajaca*, the pale pubescent spots on tergites three to five larger and more distinctly quadrate than in *oajaca*, and the legs paler ferruginous. The two paratypes have the first abdominal tergite ferruginous. It gives me great pleasure to name this species for my friend Mr. A. A. Nichol who collected the holotype and one paratype.

This is probably the female of *neobule*. Mr. Nichol has collected both species at the same time and place, and the evidence gained by the process of elimination indicates that *nicholi* and *neobule* are probably the two sexes of the same species.

Timulla (Timulla) oajaca (Blake). (New combination)

1871. *Mutilla oajaca* Blake, Trans. Amer. Ent. Soc., iii, p. 228,
male (nec female).

1886. *Mutilla oajaca* Blake, Trans. Amer. Ent. Soc., xiii, p. 196, male (nec female).
1894. *Mutilla oajaca* Cameron, Biol. Centr.-Amer., Hymen., ii, p. 274, male (nec female).
1897. *Mutilla oajaca* Dalla Torre, Cat. Hymen., viii, p. 67, male (nec female).
1899. *Mutilla nestor* Fox, Trans. Amer. Ent. Soc., xxv, p. 271, male. (New synonymy).
1903. *Mutilla nestor* André, Gen. Ins., i, fasc. 11, p. 42, male.
1903. *Mutilla oajaca* André, Gen. Ins., i, fasc. 11, p. 42, male (nec female).
1903. *Mutilla nestor* Melander, Trans. Amer. Ent. Soc., xxix, p. 323, male.
1904. *Mutilla ornata* Howard, The Insect Book, Pl. viii, fig. 21, female. (New synonymy).
1916. *Mutilla (Timulla) nestor* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 211, male.
1916. *Mutilla (Timulla) oajaca* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 212, male.

Type.—Male, Mexico (F. Sumichrast), in collection of American Entomological Society, Philadelphia. The type of *nestor* is also at Philadelphia.

Female.—Entirely ferruginous; head with moderate, dense punctures; antennal scrobes carinate above; lateral margins of dorsum of thorax very feebly, almost not at all emarginate medially; thorax not broader posteriorly than anteriorly, the lateral margins parallel; dorsum of thorax with large, dense, confluent punctures; scutellar scale present and distinct; dorsum and posterior face of propodeum coarsely reticulate, the lateral margins of the posterior face of propodeum denticulate; pleural areas glabrous, micropunctate, except the sides of propodeum with sparse, moderate punctures becoming close and confluent at the posterior margin; second abdominal tergite with moderate, dense, somewhat confluent punctures; distal margin of first tergite with a narrow band, distal margin of second tergite with a broad band sinuate anteriorly, and tergites three to five each with a pair of longitudinal, rectangular spots widely separate on three and somewhat approximate on five, all of dense, appressed, pale pubescence; pygidial area irregularly rugose on the anterior half, distinctly granulate on the posterior half; second tergite with moderately large, somewhat confluent punctures. Legs ferruginous, sparsely clothed with pale hairs.

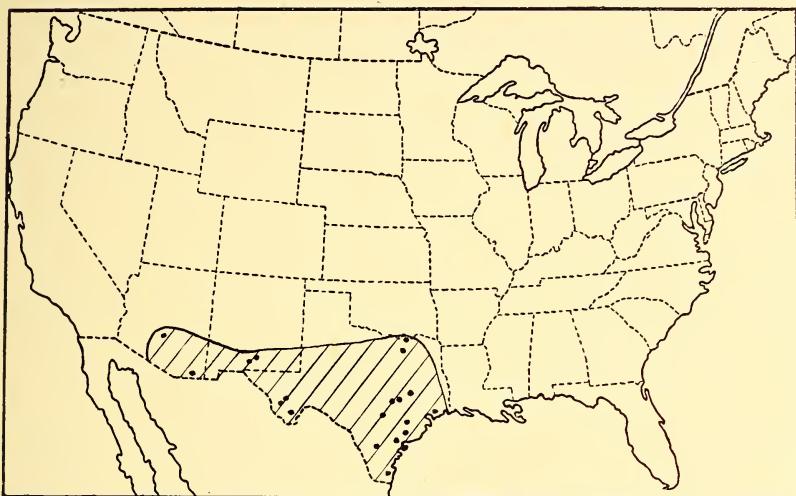
Allotype.—Female, in copula with male, Cotulla, Texas, May 11, 1906 (J. C. Crawford), in collection of U. S. National Museum.

Specimens examined.—

TEXAS: female, Riviera, July 17, 1921 (F. M. Hull); female, Calhoun County, March and April, 1902 (J. D. Mitchell); male, Calhoun County (J. D. Mitchell); female, Victoria, June 19, 1913 (J. D. Mitchell); two males, Victoria, April 17, 1907 (W. E. Hinds); male, Victoria, August 28, 1915 (A. McLaughlin); female, Smith Point, August 19, 1918 (E. L. Diven); female, Columbus; female, Colorado County, April 21, 1922 (Grace O. Wiley); male, Colorado County, August 18, 1922 (Grace O. Wiley); female, Colorado County, September 5, 1922 (Grace O. Wiley); female, Bexar County, June 11, 1933 (H. B. Parks); two females, Bexar County, August 30, 1933 (H. B. Parks); male, San Antonio, September 11 (J. C. Crawford); female, Elmendorf, June 1 (A. W. Morrill); female, Anhalt, Comal County, June 29, 1917; female, Bryan, July 7, 1906 (J. C. Crawford); male, College Station, May 29, 1920 (H. J. Reinhard); male, College Station, June 10, 1919 (H. J. Reinhard); male and female (in copula), College Station, July 10, 1931 (H. J. Reinhard); female Bastrop, May 9, 1921 (R. H. Painter); male, Lee County, August 7, 1905; male, Lee County, September 1; male, Lee County, September 7; two males, Lee County, September 7, 1905; male, Lee County, September 16, 1905; female, Fedor, April 13, 1898 (Birkman); two males, Fedor, September 7, 1905; male, Fedor, September, 1900; male, Fedor, September; male and female, Fedor; female, Dallas, September 19, 1918 (T. H. Hubbell); female, Dallas, October 7, 1906 (F. C. Bishopp); male, Dallas, October 9, 1905 (F. C. Bishopp); female, Dallas (Boll); female, Bonham, June 20, 1933; female, Sherman, September 30, 1908 (E. S. Tucker); female, Cypress Mill; female, McKinney, September 8, 1920 (R. H. Painter); two females, Chisos Mts., Brewster County, June 10–12, 1908 (Mitchell and Cushman); male, Limpia Canyon, Davis Mts., July 7, 1917; male, Musquiz Canyon, Ft. Davis, July 6, 1917; male and female, Cherry Canyon, Fort Davis Quad, Davis Mts., June 27, 1916 (F. M. Gaige); female, Cherry Canyon, Fort Davis Quad, Davis Mts., June 28, 1916 (F. M. Gaige); three females, Cherry Canyon, Fort Davis Quad, Davis Mts., June 29, 1916 (F. M. Gaige); male, Ft. Davis, Jeff Davis County, Davis Mts., July–August, 1927–28 (Mrs. O. C. Poling); male, Valentine, July 3, 1933 (S. E. Jones); male and female (taken together), and female, Valentine, July 8, 1917; three males, six females.

NEW MEXICO: two females, Mesilla Park, August 12 (Cockerell); female, Mesilla Park, September 24; female, Organ Mts., August 30.

ARIZONA: male, Douglas, August 7, 1933 (W. W. Jones); male, Douglas, August (F. H. Snow); female, Phoenix, September 24, 1928; female, Phoenix, October 20, 1928 (O. L. Barnes).



Distribution of *Timulla (Timulla) oajaca* (Blake)

The types of *oajaca* and *nestor* have been compared with each other and studied in comparison with additional specimens from the United States and Mexico. The type of *nestor* is a small specimen of *oajaca*. Occasionally small specimens of *oajaca* are taken in Texas which seem to have relatively small ocelli, but otherwise there are no structural differences between these small specimens and larger ones taken at or near the same locality.

The female described by Blake as *oajaca* is certainly not the opposite sex of this male. The sexes have been collected twice while mating as noted above and there can be no question that the female described above is the true one for this male *oajaca*. I have also seen a specimen of this same female taken at the same time and place as a male of *oajaca* at Santiago Iscuintla, Jalisco, Mexico. The specimen figured by Howard, Pl. viii, Fig. 21, The Insect Book, is before me and proves to be this same female.

The males can be recognized at once by the exceedingly short arms of the Y-shaped carina on the last tergite and the tuberculate intermediate coxae; the form of the clypeus is also characteristic, the posterior, elevated margin of the polished area being angulate and produced or reflexed laterally. The female may be recognized

by the coarse puncturation of the second abdominal tergite, the rugose pygidium, and the carina of the first sternite entire.

Timulla (Timulla) floridensis (Blake). (New combination)

- 1879. *Mutilla floridensis* Blake, Trans. Amer. Ent. Soc., vii, p. 249, male.
- 1886. *Mutilla floridensis* Blake, Trans. Amer. Ent. Soc., xiii, p. 199, male.
- 1897. *Mutilla floridensis* Dalle Torre, Cat. Hymen., viii, p. 41, male.
- 1899. *Mutilla floridensis* Fox, Trans. Amer. Ent. Soc., xxv, p. 271, male.
- 1903. *Mutilla floridensis* André, Gen. Ins., i, fasc. 11, p. 42, male.
- 1916. *Mutilla (Timulla) floridensis* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 209, male.

Female.—Entirely ferruginous; thorax distinctly wider posteriorly than anteriorly, the relative widths at humeral angles and dorsum of propodeum, 3.1:3.4; lateral margins of thorax shallowly emarginate medially, distinctly crenulate; scutellar scale present; head with moderate, dense, confluent punctures; dorsum and posterior faces of propodeum coarsely rugoso-reticulate, their lateral margins denticulate; pleural areas glabrous, micropunctate, the sides of propodeum with small, scattered punctures and becoming rugose at the posterior margin; second tergite with moderate, distinct, deep punctures throughout interspersed with fine punctures; band at distal margin of first tergite, a pair of longitudinal lines on the second tergite extending from the anterior margin to slightly beyond the middle, a broad band at distal margin of second tergite angularly produced at the anterior middle, and a pair of longitudinal rectangular spots on tergites three to five arranged in the form of a V, with those on tergite five only slightly separated, all of dense, appressed, pale, glittering pubescence; pale spots on tergites three to five obscurely connected to lateral margins of those tergites by obscure, pale pubescence; sternites two to five with thin, distal fringes of pale hairs; pygidial area faintly granulate; first sternite with a median, longitudinal carina on the anterior two-thirds, the elevated margin straight; second sternite with large, close punctures, becoming smaller, dense and confluent at the distal margin; legs entirely ferruginous. Length, 7 mm.

Type.—Male, Florida, in collection of American Entomological Society, Philadelphia.

Allotype.—Female, in copula with male, Crescent City, Florida, July 8 (H. G. Hubbard), in U. S. National Museum.

Specimens examined.—

CAROLINA: male and female.

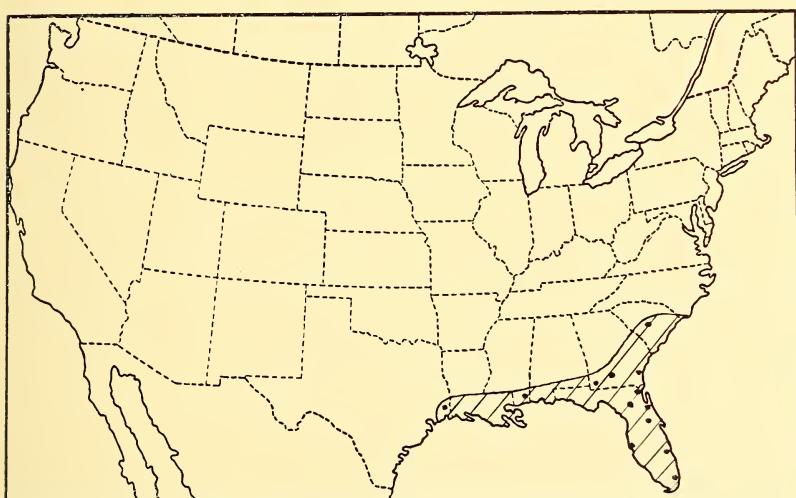
SOUTH CAROLINA: female, Swansea, August 4, 1911 (Frederick Knab).

GEORGIA: male, Tifton; male, St. Simon's Island, June 9, 1911; female, Spring Creek, Decatur County, July 16–29, 1912; male.

FLORIDA: male, Jacksonville; male, Biscayne Bay; male, Gainesville, Alachua County, May 3, 1922 (T. P. Winter); male and female, St. Leo, October 22, 1907 (Russell); male, St. John's County, March, 1891; female, Capron, September 18; male and female, Dunedin, September 30, 1914 (W. S. Blatchley); female, Enterprise, May 14; male, Martin County, March 15, 1930 (B. F. Mizell); female.

MISSISSIPPI: female, Lucedale, March 29, 1932 (H. Dietrich).

TEXAS: female, Silsbee, June 25, 1918 (E. L. Diven).



Distribution of *Timulla (Timulla) floridensis* (Blake)

The males may be recognized by the bicarinate scape, ferruginous thorax, excised mandibles, vertically placed ocelli and Y-shaped carina of last tergite with the arms of the Y much shorter than the stem; the latter is very similar to the structure of the last tergite in *oajaca* Blake. The females may be recognized by the slightly emarginate lateral margins of dorsum of thorax, the thorax distinctly

broader behind, the coarsely punctate second tergite and the faintly granulate, almost glabrous pygidium. The females vary in length from 5.5 to 10 mm.

Timulla (Timulla) barbigera subsp. *barbigera* (Bradley). (New combination)

1916. *Mutilla (Timulla) barbigera* Bradley, Trans. Amer. Ent. Soc., xlvi, pp. 206-207, male.

Female.—Head and thorax ferruginous; abdomen more or less black; legs ferruginous except tips of femora, tibiae and tarsi blackish; first tergite with a broad, distal band, second tergite with a pair of anterior, narrow, elongate spots on the anterior half and a broad band at the distal margin, the anterior margin of the band sinuate and strongly, acutely produced anteriorly at the middle, and tergites three to five with a broad band at the distal margin, that on three attenuated and broadly interrupted medially, that on four attenuated and narrowly interrupted medially, that on five attenuated and very narrow medially but not interrupted, all of dense, appressed, pale, glittering pubescence; dorsum of thorax very convex, the lateral margins strongly emarginate; scutellar scale obsolete; pygidial area longitudinally rugose; carina of first sternite produced anteriorly into a very prominent tooth. Length, 15 mm.

Head entirely ferruginous except the tips of the mandibles and flagellum distad of segment one, black; mandibles slender, edentate at the apex, with a distinct tooth within remote from the apex, not emarginate nor toothed beneath; clypeus elevated posteriorly into a transverse, strongly arcuate, slightly crenulate ridge; scape with small, close punctures above; first segment of flagellum slightly shorter than segments two and three united; antennal scrobes distinctly carinate above; front, vertex and genae with moderately large, dense, confluent punctures, clothed with sparse, short, suberect, and very scattered, long, erect, dark ferruginous pubescence, except that on the genae pale and glittering; relative widths of head and thorax, 5.3 : 5.3.

Thorax entirely ferruginous, the lateral margins strongly emarginate medially, and the dorsum slightly wider posteriorly than anteriorly; relative widths of thorax at humeral angles, anterior spiracles, just posterior to anterior spiracles, narrowest part of mesonotal area, and dorsum of propodeum, 4.5, 5.0, 4.6, 4.0, 5.3; humeral angles strongly rounded, not prominent; mesonotal-scutellar suture present but not conspicuous; scutel-

lar scale obsolete; dorsum of propodeum strongly convex, with large, dense, confluent punctures, tending to longitudinally rugoso-punctate, the punctures becoming coarser and deeper on the dorsum of propodeum and anterior half of posterior face of propodeum, the latter with distinct asperities; dorsum of thorax clothed with sparse, short, suberect, ferruginous pubescence; lateral margins of dorsum and posterior face of propodeum serrate; anterior margin of propleura not defined by a carina; propleura with moderate, close, confluent punctures anteriorly, micropunctate posteriorly; mesopleura and metapleura micropunctate throughout; sides of propodeum with moderate, close, confluent punctures posteriorly, the punctures becoming sparser and shallower anteriorly, the anterior area micropunctate; all the pleural areas pale mieropubescent.

Abdomen black, the anterior two-thirds of first tergite, large, ovate, lateral spots on second tergite, first sternite and second sternite, all ferruginous; pubescent pattern of tergites as described above; first tergite with moderate punctures, close laterally and posteriorly, sparse medially and interspersed with fine punctures; second tergite with moderate, close punctures interspersed with very small, dense punctures; tergites three to five with moderately small, separated punctures interspersed with small, dense punctures; pygidial area longitudinally rugose; first sternite with the median, longitudinal carina produced anteriorly into a strong, prominent tooth; second sternite with moderately large, close, confluent punctures becoming dense anteriorly and laterally, the coarsely punctate area terminating distally at a narrow, transverse, submarginal, irregular, glabrous area, the broad, distal margin slightly depressed, with moderate separated punctures, interspersed with fine, dense punctures and clothed with thick, appressed, pale pubescence; sternites three to five with moderate, close punctures distally, and each with an apical fringe of pale pubescence; hypopygium ferruginous and with moderate, dense punctures.

Legs ferruginous, except the tips of the femora, tibiae and tarsi, blackish; posterior femora darker ferruginous than the anterior and intermediate ones; legs clothed with sparse, pale, glittering pubescence; calcaria ferruginous.

Holotype.—Male, Dallas, Texas, in collection of American Entomological Society, Philadelphia.

Allotype.—Female, Colorado County, Texas, August 21 (Grace O. Wiley), in collection of University of Minnesota.

Specimens examined.—

VIRGINIA: females, Seven Pines, August 8, 1916 (Wm. T. Davis).

NORTH CAROLINA: female, Raleigh, mid-July (C. S. Brimley); male, Raleigh, early September (C. S. Brimley).

SOUTH CAROLINA: male, Clemson College, October 26, 1926 (D. Dunavan).

FLORIDA: male and female (in copula), Miami, June 2, 1928.

MISSISSIPPI: female, Agricultural College, April 15, 1925 (G. R. Fulton); female, Agricultural College, April 13, 1921 (C. A. Rose); female, Agricultural College, July 26, 1915 (G. F. Arnold); male, Agricultural College, September, 1919 (W. W. Porter); two males, Agricultural College, October 5, 1919 (R. J. Smith); male, Agricultural College, October 7, 1920 (J. W. Hollandsworth); female, Agricultural College, November 16, 1917 (J. H. Williams); female, Jones County, July 20, 1910 (J. C. Reddoch).

LOUISIANA: female, Tallulah, July 31, 1925 (B. E. Montgomery); male, Johnson's Bayou, August 24, 1906 (J. D. Mitchell).

TEXAS: male and female, Devers, June 21, 1917; male and female (in copula), Willis, June 18, 1903 (Bridwell); female, Bexar County, August 4, 1933 (H. B. Parks); two females, College Station, August 18, 1932 (S. Bromley); male, Paris, September 5, 1904 (F. C. Bishopp); male, Colorado County, June 3, 1922 (Grace O. Wiley); male, Colorado County, August 18, 1922 (Grace O. Wiley); male, Madison County, August 11, 1930 (Bibby and Tate); male and female, Dallas (Boll); female, Texas (Belfrage); four males.

OKLAHOMA: male, Payne County, July 5, 1925 (W. J. Brown); female, Boise City, July 10, 1933 (R. Dahms).

KANSAS: female, Chautauqua County (R. H. Beamer); female, Cherrivale (H. B. Hungerford); female, McPherson; two females, Hamilton County (F. H. Snow); female, Hamilton County (S. J. Hunter); female, Sherman County, August 1, 1925 (R. H. Beamer); two females, western Kansas (Popenoe); female (Snow).

SOUTH DAKOTA: female, Capa, September 11, 1917 (H. C. Severin).

(*To be Continued on Page 57*)

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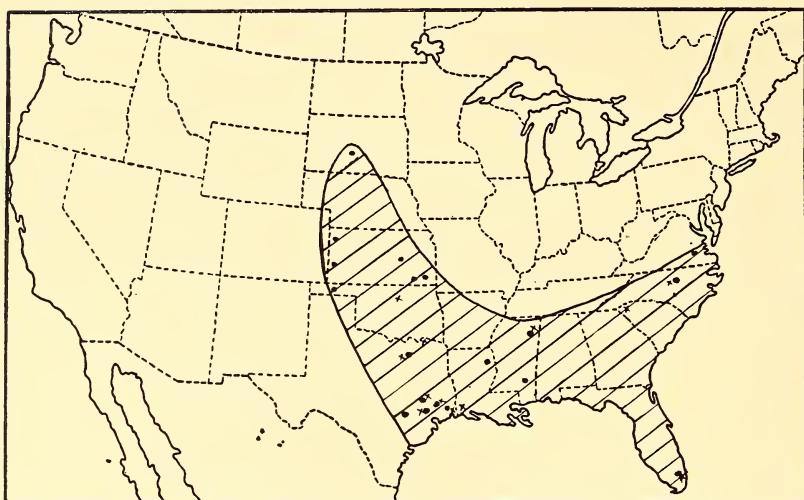
APRIL, 1937

No. 2

THE MUTILLID WASPS OF THE GENUS TIMULLA WHICH OCCUR IN NORTH AMERICA NORTH OF MEXICO

BY CLARENCE E. MICKEI
UNIVERSITY OF MINNESOTA
(Continued from Page 56)

The female averages larger in size than any of this genus occurring in North America north of Mexico, the length varying from 10 to 17 mm. The thorax of the larger specimens is slightly wider posteriorly than anteriorly, as in the allotype, but in the smaller ones the width anteriorly and posteriorly is the same. The color of the abdomen varies from the black described for the allotype to extensive ferruginous; in the most ferruginous ones the second tergite except the distal margin, and all the sternites are entirely ferruginous. This female is very similar in appearance to the female of *dubitata* Smith but lacks the scutellar scale which is well developed in the latter, has the lateral margins of the thorax more strongly emarginate, and has the second tergite more strongly punctate. An attempt has been made to find some basis for separating the Kansas female specimens of *barbigera* from the others, as the male subspecies *rohweri* is known only from Kansas, but no differences could be found between the Kansas specimens and the ones from other states. Specimens from the series of males have been compared with the holotype and found to be the same. The pubescent brush of the scape, the Y-shaped carina of the last tergite in which the stem of the Y is shorter than the arms, and the absence of distinct tubercles on the fifth sternite are characters which will serve in distinguishing *barbigera* from species which superficially resemble it.



Distribution of *Timulla (Timulla) barbigera* subsp. *barbigera* (Bradley)
x = males. • = females.

Timulla (Timulla) barbigera subsp. *rohweli* n. subsp.

1871. *Mutilla rufa* Blake, Trans. Amer. Ent. Soc., iii, p. 257, male.
 1886. *Mutilla rufa* Blake, Trans. Amer. Ent. Soc., xiii, pp. 201–202, male.
 1897. *Mutilla rufa* Fox, Trans. Amer. Ent. Soc., xxv, p. 271, male.

Male.—Exactly like typical *barbigera* in the form of the scape and its pubescent brush, clypeus, tegulae, glabrous area and Y-shaped carina of last tergite, the tubercles of the sixth and seventh sternites, and the carinae of the hypopygium; differs in having the anterior fourth to third of the second abdominal tergite black, the second sternite almost entirely black, and the front, vertex, pronotum, mesonotum, scutellum, tegulae and the abdomen above and beneath (except the first tergite, first sternite and second sternite with sparse, erect, pale pubescence) all with erect and appressed, fulvous pubescence.

Holotype.—Male, Cat. No. 50947 U. S. National Museum, Kansas (Snow).

Paratypes.—Male, Russell County, Kansas, August 26, 1912 (F. X. Williams); male, Grant County, Kansas, July 23, 1911 (F. X. Williams); male, Grant County, Kansas, July 27, 1911 (F. X. Williams); male, Stanton County, Kansas, July 30, 1911 (F. X. Wil-

liams) ; four males, Morton County, Kansas, August 5, 1911 (F. X. Williams) ; male, Wallace County, Kansas (F. H. Snow) ; four males, Kansas (Snow) ; male, Kenton, Oklahoma, June 26, 1933 (Edward Ivy) ; male, Boise City, Oklahoma, July 10, 1933 (A. E. Pritchard) ; two males, without locality data.

The above synonymy is based on a single specimen without locality label in the American Entomological Society collection and labeled by Blake as *Mutilla rufa* Lep. This specimen is mentioned by Fox (1897) and tentatively accepted by him as *rufa*. I have examined this specimen and compared it with the specimens listed above and there is no doubt but that the two are the same. Specimens of this subspecies are known only from western Kansas and extreme western Oklahoma. The one specimen of *barbigera* which I have seen from central Oklahoma is without question the subsp. *barbigera*. The two are easily separated by the color of the pubescence as mentioned above. I am happy to dedicate this subspecies to my friend Mr. S. A. Rohwer who first recognized this form as distinct.

Timulla (Timulla) compressicornis n. sp.

Male.—Head above the insertion of antennae, prothorax, mesonotum, most of scutellum and abdomen beyond the first segment except the distal margin of the second, third and fourth segments, all ferruginous; head anterior to insertion of antennae, thorax except as above, first abdominal segment, distal margin of first and second tergite, and legs, all black; mandibles not emarginate nor toothed beneath; clypeus transversely concave, the elevated posterior margin arcuate; first segment of flagellum conspicuously longer than the second, the whole of the first segment and proximal half of the second, strongly compressed; median, glabrous area of last tergite terminating in the arms of a strongly elevated Y-shaped carina; sixth sternite with a pair of distinct, lateral tubercles; seventh sternite with a pair of prominent, cariniform, lateral tubercles; hypopygium with a pair of distinct, oblique carinae on the proximal half; wings fuliginous. Length, 14 mm.

Head ferruginous, except anterior to the antennal tubercles, the caudal aspect of the head medially, and proximal half and extreme tips of mandibles, all black; head clothed with long, erect, sparse, black hairs and very short, sparse, inconspicuous, pale pubescence; mandibles edentate at the apex and with a distinct tooth within near the apex, the dorsal aspect with a high,

sharp, prominent, longitudinal carina, not at all emarginate nor toothed beneath; median, glabrous area of clypeus slightly but distinctly, transversely concave, the elevated posterior margin evenly arcuate; scape clothed with sparse, black hairs, not conspicuously broadened distally, nor with a brush of pubescence beneath, bicarinate beneath but the two carinae approximate and not distinct; first segment of flagellum as well as the proximal half of the second strongly compressed and broadened, the flattened surface beneath with very short, thick, silky, pale pubescence; first segment of flagellum distinctly longer than the second; antennal scrobes distinctly carinate above; front, vertex and genae with moderate, dense, more or less confluent punctures throughout; ocelli small, the distance between the eye margins and the lateral ocelli equal to approximately three times the greatest diameter of the latter; relative widths of head and thorax at the tegulae, 5.0 : 6.8.

Thorax black, except the pronotum and most of propleura, an obscure spot at the median, anterior margin of the mesopleura, the mesonotum entirely, and the scutellum except the posterior margin, all ferruginous; thorax clothed with sparse, erect, long, blackish hairs, the dorsal areas also with short, sparse, obscure ferruginous pubescence; pronotum, mesonotum and scutellum with moderately large, dense, confluent punctures throughout; parapsidal furrows distinct, deeper posteriorly than anteriorly; scutellum strongly convex; enclosed area of dorsum of propodeum deep, narrow, elongate, subtriangular, the sides more or less sinuate, the apex slightly but distinctly elevated into a tubercle; dorsum and posterior face of propodeum otherwise strongly, deeply reticulate; propleura obscurely, confluent punctate, the broad posterior margin glabrous, micropunctate; ventral and dorsal areas of mesopleura separated by a deep, transverse furrow, with large, dense, confluent punctures; mesosternal tubercles well developed, oblique; metapleura glabrous, micropunctate, except for large, close punctures ventrally; sides of propodeum reticulate posteriorly, becoming shallowly reticulate medially and glabrous, micropunctate anteriorly; tegulae dark ferruginous, large, convex, glabrous, impunctate, except the anterior and inner margins punctate and black pubescent.

Abdomen ferruginous, except the first segment entirely, and broad, distal margins of the second, third and fourth both above and below, black; first sternite with sparse, long, pale hairs;

second sternite except distal margin with long, sparse, pale ferruginous hairs; second tergite except narrow anterior margin and broad posterior margin with sparse, long, erect, and sparse, short, subappressed, pale ferruginous pubescence; remainder of abdomen with sparse, erect, black pubescence, thicker at the distal margins of the second, third and fourth tergites; first tergite with large, distinct punctures becoming smaller and closer posteriorly; second tergite with moderate, distinct punctures becoming close and adjacent laterally, small and close at the posterior margin; tergites three to six with moderately small, distinct punctures; median, glabrous area of last tergite with a median, elongate, depressed area posteriorly and terminating in the arms of a very strongly elevated Y-shaped carina, the arms of the Y much more strongly elevated than the stem and almost as long as the stem; first sternite with a median, longitudinal carina on the anterior three-fourths; second sternite with moderately large, distinct punctures; sternites three to six with moderately small, distinct punctures towards the distal margin; fifth sternite without lateral tubercles; sixth sternite with a pair of distinct lateral tubercles; seventh sternite with a pair of prominent, cariniform, lateral tubercles; hypopygium with a pair of distinct, oblique carinae on the proximal half.

Wings fuliginous throughout; cell 2nd $R_1 + R_2$ obscurely truncate at the apex; cell R_5 receiving vein M_{3+4} slightly beyond the middle; cell R_4 present but somewhat less distinct than R_5 and receiving vein M_2 at almost four-fifths the distance from the base to apex.

Legs entirely black, sparsely clothed with fuscous to black pubescence; intermediate coxae with a distinct tubercle at the inner, posterior margin; calcaria pale.

Holotype.—Male, Cat. No. 50951, U. S. National Museum, Johnson's Bayou, Louisiana, August 24, 1906 (J. D. Mitchell).

Paratypes.—

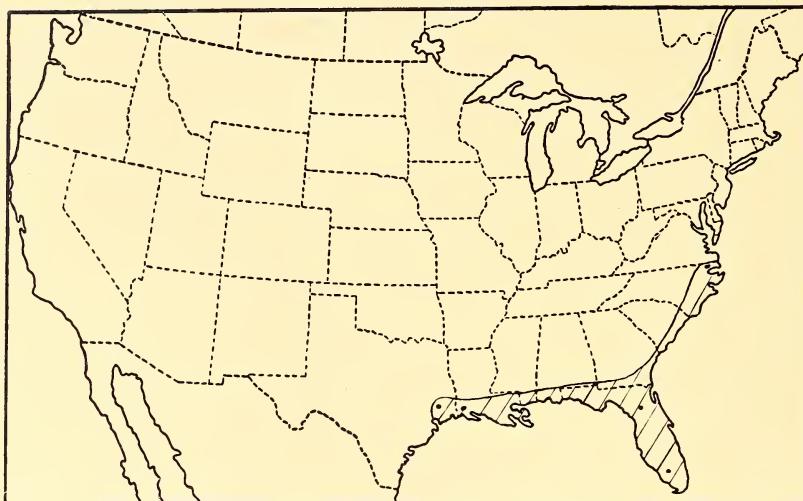
NORTH CAROLINA: male, South Mills, September 16, 1931 (Bradley and Knorr).

FLORIDA: male, Gainesville, July 13, 1918 (P. W. Fattig); two males, 10–40 miles east of Everglades, August 30, 1931 (Bradley and Knorr); male.

TEXAS: male.

Without data: male.

Related to *barbigera* subsp. *barbigera* Bradley which it closely

Distribution of *Timulla (Timulla) compressicornis* n. sp.

resembles. It differs from Bradley's species in the strongly compressed first and second flagellar segments, less concave median area of clypeus, absence of pubescent brush on scape beneath, more coarsely reticulate propodeum, and the more highly elevated Y-shaped carina of the last abdominal tergite. The paratype from Texas has the head and pronotum heavily infuscated so that they appear blackish, only the vertex and large humeral areas of the pronotum appearing distinctly ferruginous. The paratypes vary in length from 12 to 19 mm. This may be the male sex of *euterpe* Blake.

Timulla (Timulla) euterpe (Blake). (New combination)

- 1879. *Mutilla Euterpe* Blake, Trans. Amer. Ent. Soc., vii, p. 249, female.
- 1886. *Mutilla euterpe* Blake, Trans. Amer. Ent. Soc., xiii, p. 201, female.
- 1897. *Mutilla euterpe*, Dalla Torre, Cat. Hymen., viii, p. 38, female.
- 1899. *Mutilla euterpe* Fox, Trans. Amer. Ent. Soc., xxv, p. 272, female.
- 1903. *Mutilla euterpe* André, Gen. Ins., i, fasc. 11, p. 42, female.
- 1916. *Mutilla (Timulla) euterpe* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 210, female.

1923. *Timulla euterpe* Mickel, 19th Rept. State Ent. Minnesota,
p. 111, female.

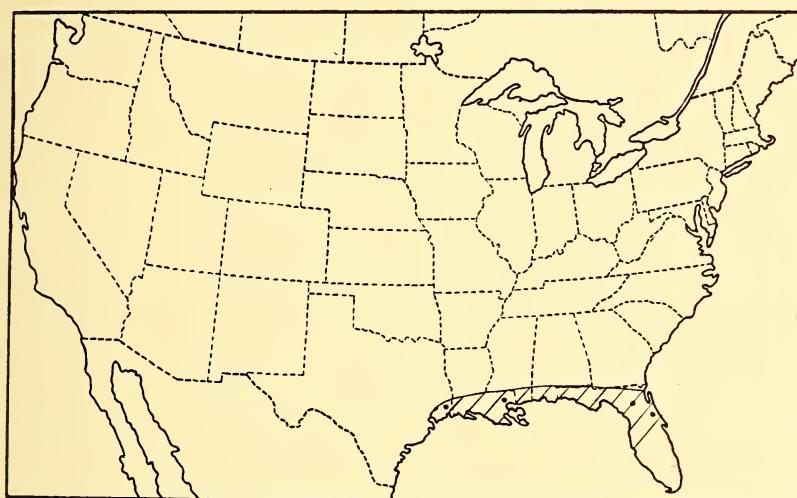
Type.—Female, Enterprise, Florida, May, in collection of
American Entomological Society, Philadelphia.

Specimens examined.—

FLORIDA: female, Gainesville, May 16, 1926 (M. D. Leonard);
female, Bell Glade, July, 1926 (M. D. Leonard).

LOUISIANA: three females, New Orleans.

TEXAS: female, Beaumont, July 1–5, 1918 (E. L. Diven).



Distribution of *Timulla (Timulla) euterpe* (Blake)

I have previously (1923) recorded a specimen of this species from Hennepin County, Minnesota, although expressing doubt as to the correctness of the locality label. I have now examined seven other specimens in addition to the holotype, all of which are from the Gulf Coast. I believe now that the alleged Minnesota specimen bears an incorrect locality label and that it should not be considered as a Minnesota species. *Euterpe* appears to be allied to *barbigera* subsp. *barbigera* although this is not obvious on account of the color pattern of the abdomen. The thoraces of the two species are very similar, both being strongly constricted medially and both lacking a scutellar scale. Both species also have the median, longitudinal carina of the first sternite strongly elevated anteriorly. If these two species are related, as seems probable, then the male of *euterpe*

may be *compressicornis* which has a similar geographic distribution to *euterpe*.

Timulla (Timulla) euphrosyne n. sp.

Female.—Ferruginous, except the antennae, first abdominal segment, posterior third of second tergite, broad distal margin of second sternite, third abdominal segment entirely, and legs, all black, the fourth abdominal sternite dusky; lateral margins of thorax shallowly but distinctly emarginate medially; scutellar scale entirely absent; abdomen without pale pubescent markings except the second tergite with a narrow, distal band of thick, pale pubescence narrowly, conspicuously, angularly dilated anteriorly at the middle; pygidial area faintly granulate throughout and faintly longitudinally rugose anteriorly. Length, 9 mm.

Head ferruginous, except the antennae and tips of mandibles black, clothed throughout with sparse, erect and recumbent, ferruginous pubescence; mandibles edentate at the apex and with a small tooth within near the tip; clypeus elevated posteriorly the elevated margin arcuate and with four evenly spaced, low, blunt teeth; scape with close, fine punctures above; first segment of flagellum approximately equal in length to the second and third segments united; antennal scrobes distinctly carinate above; front and vertex with moderate, dense, confluent punctures, the latter denser anteriorly on the front than posteriorly on the vertex; genae with moderate, shallow, separated punctures interspersed with fine punctures; relative widths of head and thorax, 3.5 : 3.2.

Thorax entirely ferruginous, the dorsum clothed with sparse, erect, ferruginous pubescence, the pleural areas with pale micropubescence; humeral angles not prominent; lateral margins of dorsum of thorax distinctly emarginate medially; relative widths of thorax at humeral angles, immediately posterior to anterior spiracles, at propodeal spiracles, and greatest width of propodeum, 3.2, 2.8, 2.9, 3.1, respectively; dorsum of thorax with moderately large, dense, confluent punctures becoming reticulate and asperated on the posterior face of propodeum; scutellar scale absent; propleura with moderate, obscure punctures; sides of propodeum with moderate punctures posteriorly; remainder of pleural areas micropunctate and micropubescent.

Abdomen ferruginous, except the first segment entirely, distal third of second tergite, broad distal margin of second sternite

and third abdominal segment entirely, all black; first tergite with fine, close, shallow punctures throughout, clothed with sparse, erect, pale pubescence, except the distal fringe black; second tergite with fine and very small punctures intermixed throughout, clothed with sparse, ferruginous pubescence, except medially with sparse, black pubescence, the black distal third with black pubescence, and the distal margin with a narrow band of pale pubescence angularly dilated at the anterior middle; third tergite with very small, close punctures, clothed with sparse, fuscous to black pubescence except laterally with some pale pubescence; tergites four and five with fine, close punctures and sparse, ferruginous pubescence; pygidial tergite clothed with ferruginous pubescence, the pygidial area faintly granulate throughout and faintly, longitudinally rugose anteriorly; first sternite with a median, longitudinal carina somewhat elevated anteriorly; second sternite with scattered moderate punctures, except the posterior margin with very small, close punctures, clothed with sparse, pale pubescence and a thin distal fringe of pale pubescence; sternites three to five with fine and moderately small punctures intermixed at their distal margins and each with a thin, distal fringe of pale pubescence.

Legs entirely black, sparsely clothed with pale pubescence, the spines of the tibiae dark ferruginous; calcaria pale ferruginous.

Holotype.—Female, Cat. No. 50953 U. S. National Museum, High Island, Texas, May 29, 1918 (E. L. Diven).

Paratypes.—Female, Galveston, Texas, May (F. H. Snow); female, Dunedin, Florida, March 24, 1914 (W. S. Blatchley).

Very similar in appearance to *euterpe* Blake on account of the three ferruginous terminal, abdominal segments, the black third abdominal segment and the similarity of the markings on the second segment. It also resembles *euterpe* in lacking a scutellar scale. This species can be easily separated from *euterpe* by the less deeply emarginate latero-dorsal margins of the thorax and the much finer, closer punctuation of the second tergite.

Timulla (Timulla) vagans subsp. *vagans* (Fabricius). (New combination)

1798. *Mutilla vagans* Fabricius, Suppl. Entom. Syst., p. 282, female.

1804. *Mutilla vagans* Fabricius, Syst. Piezatorum, p. 439, female.

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- 1811. *Mutilla vagans* Olivier, Encycl. méthod. Insect. p. 66, female.
- 1836. *Mutilla hexagona* Say, Bost. Journ. Nat. Hist., i. p. 295, male. (New synonymy.)
- 1859. *Mutilla hexagona* Leconte, Writ. of Th. Say, Entom., ii, p. 738, male.
- 1865. *Mutilla hexagona* Cresson, Proc. Entom. Soc. Phila., iv, p. 430, male.
- 1865. *Mutilla ornativentris* Cresson, Proc. Ent. Soc. Phila., iv, p. 438, female. (New synonymy.)
- 1871. *Mutilla Briaxus* Blake, Trans. Amer. Ent. Soc., iii, p. 277, male. (New synonymy.)
- 1871. *Mutilla hexagona* Blake, Trans. Amer. Ent. Soc., iii, p. 228, male (in part).
- 1871. *Mutilla ornativentris* Blake, Trans. Amer. Ent. Soc. iii, p. 230, female.
- 1871. *Mutilla vagans* Blake, Trans. Amer. Ent. Soc., iii, p. 257, female.
- 1885. *Mutilla Briaxus* Radoskowski, Horae soc. ent. Rossicae, xix, p. 14, T. 2, f. 10, male.
- 1886. *Mutilla hexagona* Blake, Trans. Amer. Ent. Soc., xiii, p. 195, male (in part).
- 1886. *Mutilla hexagona* var. *briaxus* Blake, Trans. Amer. Ent. Soc., xiii, p. 195, male.
- 1886. *Mutilla ornativentris* Blake, Trans. Amer. Ent. Soc., xiii, pp. 196-197, female.
- 1886. *Mutilla vagans* Blake, Trans. Amer. Ent. Soc., xiii, p. 280, female.
- 1887. *Mutilla canadensis* Provancher, Add. et Corrections au vol. 2 de la Faune Entom. du Canada, Trait des hymén, p. 250, male. (New synonymy.)
- 1897. *Mutilla hexagona* var. *briaxus* Dalla Torre, Cat. Hymen., viii, p. 47, male.
- 1897. *Mutilla ornativentris* Dalla Torre, Cat. Hymen., vii, p. 69, female.
- 1897. *Mutilla secunda* Dalla Torre, Cat. Hymen., viii, p. 84, male. (New synonymy.)
- 1897. *Mutilla vagans* Dalla Torre, Cat. Hymen., viii, p. 95, female.
- 1899. *Mutilla hexagona* Fox, Trans. Amer. Ent. Soc., xxv, p. 270, male (in part).

1899. *Mutilla dubitata* Fox, Trans. Amer. Ent. Soc., xxv, pp. 270-271, female (in part).
1900. *Mutilla hexagona* Ashmead, in John B. Smith's Catalogue of the Insects of New Jersey, p. 535, male (in part).
1900. *Mutilla ornativentris* Ashmead, in John B. Smith's Catalogue of the Insects of New Jersey, p. 535, female (in part).
1903. *Mutilla hexagona* var. *briaxus* André, Gen. Ins., i, fasc. 11, p. 42, male.
1903. *Mutilla secunda* André, Gen. Ins., i, fasc. 11, p. 74, male.
1903. *Mutilla vagans* André, Gen. Ins., i, fasc. 11, p. 74, female.
1903. *Mutilla hexagona* Melander, Trans. Amer. Ent. Soc., xxix, p. 323, male (in part).
1903. *Mutilla dubitata* Melander, Trans. Amer. Ent. Soc., xxix, p. 323, female (in part).
1909. *Mutilla (Timulla) briaxus* Rohwer, Trans. Amer. Ent. Soc., xxxv, p. 132-133, male (not female).
1910. *Timulla hexagona* Viereck, in John B. Smith's, The Insects of New Jersey, p. 665, male (in part).
1910. *Timulla ornativentris* Viereck, in John B. Smith's, The Insects of New Jersey, p. 665, female (in part).
1916. *Mutilla (Timulla) briaxus* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 207-208, male and female.
1923. *Timulla briaxus* Mickel, 19th Report of State Entomologist of Minnesota, 1922, p. 111, male and female.
1928. *Mutilla (Timulla) briaxus* Bradley, in Leonard's, A List of the Insects of New York, Mem. 101, Cornell Uni. Agri. Exp. Sta., p. 994, male and female.

Type.—Female, Boreal America, in Zoologisk Museum, Copenhagen, Denmark. Types of *ornativentris* Cresson and *briaxus* Blake in collection of American Entomological Society, Philadelphia. Type of *canadensis* Provancher, yellow label, 1409, in Provancher collection, Public Museum, Quebec, Canada.

All of the above type specimens have been examined with the result that *vagans* and *ornativentris* were found to be identical; and *briaxus* and *canadensis* were found to be the same as had been suggested by Bradley (1916). Ten instances (*i.e.*, the specimens) are before me of males and females taken in copula; in all cases the fe-

male is the same as *vagans* Fabricius and the male is the same as *briaxus* Blake. Fabricius' name of course has priority. The female assigned to *briaxus* by Rohwer (1909) is a different species (*cf. dubitatiformis* n. sp.) and not the same as the females which are invariably taken in copula with the male of *vagans*. Say's type of *hexagona* is apparently lost but there can be little doubt that it is the same as the male of *vagans*; the latter is the only male *Timulla* occurring in Indiana and Missouri that agrees with Say's description.

Specimens examined.—

CANADA: Ontario: two males, Toronto, July 12, 1891; three males, Toronto, July 17, 1891; two females, Toronto, August 1, 1893; male, Toronto, August 2, 1891; male, Toronto, August 5, 1888; female, Grimsby, July 31, 1894; male, July 21-31 (C. H. Kennedy).

CANADA: four males, two females.

VERMONT: female, Fairlee (C. M. Weed); female, Winooski, August 20, 1901.

MASSACHUSETTS: two males, Woods Hole, August, 1922 (E. G. Anderson); male and female (in copula), Woods Hole, July 11, 1919 (W. T. M. Forbes); female, Southampton, August 1, 1896; female, Nantucket, August 18, 1926 (C. W. Johnson); female, Nantucket, September 18, 1933 (J. M. Valentine); female, Springfield (Geo. Dimmock); female, West Springfield, September 10, 1915 (H. E. Smith).

CONNECTICUT: male, Lyme, July 4, 1911 (Kirk and Champlain); male, Lyme, July 22, 1918 (W. S. Fisher); two males, Lyme, July 23, 1918 (W. S. Fisher); female, Lyme, August 26, 1909 (A. Champlain); two males, Waterbury, August 10, 1932; two males, Black Point, July 28, 1896; two males, Hartford, July 30, 1893; female, Hartford, August 7, 1892; male, Hartford, August 16, 1893; female, Hartford, September 4, 1899; female, Hartford, September 15, 1896; female, East Hartford, August 29, 1904 (H. L. Viereck); female, New Canaan, September 10, 1908 (H. B. Walden); female, Yalesville, September 24, 1912 (H. B. Kirk); female, New Haven, July 26, 1904 (H. L. Viereck); female, New Haven, July 28, 1932; male, East Haven, July 25, 1923 (J. L. Rogers).

NEW YORK: female, Cold Spring Harbor, Long Island, June 24, 1921 (E. G. Anderson); two females, Cold Spring Harbor, Long Island, June 27, 1921 (S. H. Emerson); male and female, Cold Spring Harbor, Long Island, July 8, 1921 (E. G. Anderson); two females, Cold Spring Harbor, Long Island, July 9, 1921 (E. G.

Anderson) ; female, Cold Spring Harbor, Long Island, July 28, 1921 (John Rowman) ; male, Cold Spring Harbor, Long Island, July 29, 1921 (S. H. Emerson) ; female, Cold Spring Harbor, Long Island, August 4, 1921 (John Rowman) ; female, Cold Spring Harbor, Long Island, August 9, 1921 (E. G. Anderson) ; female, Riverhead, Long Island, May 30, 1933 (Roy Latham) ; female, Riverhead, Long Island, July 1, 1933 (Roy Latham) ; two females, Calverton, Long Island, June 19, 1932 (Roy Latham) ; female, Jessup Creek, Long Island, September 8, 1932 (Roy Latham) ; female, Sag Harbor, Long Island, May 6, 1932 (Roy Latham) ; female, Mattituck, Long Island, August 1, 1926 (Roy Latham) ; female, Greenport, Long Island, September 3, 1933 (J. M. Valentine) ; female, Long Island ; female, Crown Point, August ; male, Ithaca, August, 1917 (E. G. Anderson) ; female, Ithaca, July 18, 1918 (E. G. Anderson) ; female, Ithaca, July 20, 1919 ; male, Ithaca, July 20, 1934 ; male, Ithaca, July 30, 1902 ; female, Ithaca, August 12, 1929 (H. Rahn) ; male, Taughannock Falls, August 3, 1931 (P. P. Babiy) ; male, Rochester Jc., July 14, 1911 (M. D. Leonard) ; female, Olcott, July 18, 1921 (H. Dietrich) ; female, Olcott, August 1, 1921 (H. Dietrich) ; female, Olcott, August 5, 1921 (H. Dietrich) ; female, Olcott, August 20, 1921 (H. Dietrich) ; female, Lockport, August 22, 1934 (L. L. Pechuman) ; male and female.

PENNSYLVANIA : male, Pike County, July, 1910 ; female, Philadelphia, August 16 (Carl Ilg) ; two males, Chestertown, August 4, 1902 ; male, Chambersburg, July 12, 1922 (Craighead and Stear) ; female and male, Chambersburg, July 18, 1922 (Craighead and Stear) ; male, Columbia, July 14, 1908 (P. R. Myers) ; female, Harrisburg, August 8, 1909 (P. R. Myers) ; female, Rockville, August 15, 1915 ; female, Kennett Square, July 2, 1918 ; female, Leigh Gap, July 23, 1903 (J. C. Bradley) ; female, Inglenook, July 20, 1911 (W. S. Fisher) ; male, two females.

DELAWARE : male and female.

NEW JERSEY : female and male, Fords, July 20, 1909 (W. T. Davis) ; female, Whitesville, July 13, 1911 (W. T. Davis) ; two females, Westville, August 30 ; female, Brownstown, August 21, 1909 (W. T. Davis) ; male, Camden County, July 26, 1891 ; female, Camden County, July 27, 1890 ; four females, Camden County ; three males, Gloucester County, July 15 ; male, Gloucester County, July 5, 1891 ; male, Malaga, August 4, 1907 (G. M. Greene) ; male, Merchantville, July 15 ; male, Riverton, July 5, 1901 ; female, Riverton, September 11 ; male, Moorestown, August 6, 1927 ; male, Monmouth County, July 6, 1891 ; female, Weymouth, July 25, 1923 ; female,

Cape May County, August, 1910 (W. T. Davis) ; female, August 31, 1890; two females.

MARYLAND : females, Chestertown, August 2, 1901 ; male, Chestertown, August 12, 1901 ; male, Poolesville, July, 1898 ; female, Baltimore, August, 1839 ; male, Beltsville, July 30, 1916 (Harold Morrison) ; two males, Riverdale, August 2, 1902 ; male, Camp Meade, May, 1919 (R. C. Shannon) ; male, Chautauqua (Chittenden).

DISTRICT OF COLUMBIA : female, Washington, July 20, 1929 ; two females, Washington, September, 1906 ; female, August, 1878 ; male, Washington, July 23, 1902 ; female, two males.

VIRGINIA : female, Great Falls, August 6, 1923 ; female, Rosslyn ; male, nine females, Clifton, July 1-9, 1933 (J. C. Bridwell) ; male, two females, Clifton, July 15-23, 1933 (J. C. Bridwell) ; male, three females, Clifton, July, 1933 (J. C. Bridwell) ; female, Clifton, August 6, 1932 (J. C. Bridwell) ; male, two females, Clifton, August 20, 1933 (J. C. Bridwell) ; female, Barcroft, September 17, 1933 (J. C. Bridwell) ; male, Barcroft, September, 1926 (J. C. Bridwell) ; female, Falls Church, July 21, 1922 (R. A. Cushman) ; female, Falls Church, August 4, 1913 (H. B. Kirk) ; female, Falls Church, August 26, 1916 (G. M. Greene) ; female, Falls Church, September 4, 1915 (C. T. Greene) ; female, Glencarlyn, July 26 (N. Banks) ; female, Accotink, August 26 (H. S. Barber) ; female, Nelson County, June 26, 1914 (W. Robinson) ; female, Nelson County, July 10, 1925 (W. Robinson) ; female, Wingina (Wm. T. Davis) ; female, August 4, 1880 ; female, August 9, 1888 ; female, July 19 ; male.

NORTH CAROLINA : two females, Durham, August, 1902 (F. Sherman) ; male, Kittrell, July 2, 1906 (R. S. Woglum) ; male, Asheville, August 12, 1903 (S. W. Foster) ; male, Homestead, August 19, 1903 (S. W. Foster) ; female, Southern Pines, August 12, 1904 (G. M. Bentley).

SOUTH CAROLINA : male, Clemson College, June 28, 1927 (D. Dunavan) ; female (Zimmerman).

GEORGIA : male, female, Monticello (E. G. Titus) ; female, Prattsburg, July 25, 1930 (R. H. Beamer) ; female, Atlanta, July 20, 1934 (P. W. Fattig) ; female, Atlanta, August 11, 1934 (P. W. Fattig) ; female, Atlanta, August 19, 1934 (P. W. Fattig) ; female, Atlanta, August 25, 1933 (P. W. Fattig) ; two females, Atlanta, August 26, 1932 (P. W. Fattig) ; female, Atlanta, September 23, 1934 (P. W. Fattig) ; female, Stone Mountain, August 3, 1913 ; female, Yonah Mt., July 28, 1934 (P. W. Fattig) ; three females, Griffin, September, 1902 ; female.

TENNESSEE: male, Chattanooga, July 4, 1922 (T. H. Hubbell); three males, Cumberland County, July 8, 1922 (T. H. Hubbell); male, Cumberland County, July 15, 1922 (T. H. Hubbell); female, Fentress County, August 15, 1922 (T. H. Hubbell); male, Fentress County, August 20, 1922 (T. H. Hubbell); female, Fentress County, August 23, 1922 (T. H. Hubbell); male, Knoxville, July 14, 1920; male, Knoxville, July 19, 1923 (Geo. G. Ainslie); female, Knoxville; two females, Knox County (Geo. G. Ainslie); two females, Nashville, August 3, 1915 (Geo. G. Ainslie); female, Townshend, July 14, 1909; female, 1922 (Gill).

KENTUCKY: male, female.

WEST VIRGINIA: female, Harper's Ferry, September 2, 1922 (H. S. Barber).

OHIO: four males, Hocking County, August (C. H. Kennedy); two males, Put-in-Bay, July 8, 1922; male, Highland County, August 9, 1926 (C. H. Kennedy); male, Lawrence County, August 23, 1926 (C. H. Kennedy); male, Cedar Point, July 8, 1918 (O. Gossard); female, Wauseon, August 5, 1896; female, Sandusky, August 8, 1924; female, Sandusky, August 10, 1924; female, Amherst, July, 1934 (H. J. Reinhard); male, Carbondale, July 27, 1932 (W. C. Stehr); male, Jug Run, Smithfield, August 4, 1927 (C. H. Kennedy); male, Amherst, July, 1933 (H. J. Reinhard); female, Athens, July 17, 1932 (W. C. Stehr); two females, Athens, July 23, 1932 (W. C. Stehr); female, Athens, July 29, 1932 (W. C. Stehr); female, Athens, July 31, 1932 (W. C. Stehr).

MICHIGAN: two females, Jackson, July 22, 1925 (W. M. McComb and C. E. Matson); female, Jackson, July 24, 1925 (C. E. Matson); female, Jackson, July 27, 1925 (C. E. Matson); female, Jackson, July 28, 1925 (C. E. Matson); female, Jackson, August 5, 1925 (E. G. Anderson); two females, Jackson, August 12, 1925 (C. E. Matson); five females, Ann Arbor, July 16, 1925 (E. G. Anderson); female, Ann Arbor, August 14, 1925 (E. G. Anderson); three females, Ann Arbor, September 21, 1925 (E. G. Anderson); female, Dexter, July 3, 1923 (E. G. Anderson); fourteen males, Dexter, July 18, 1923 (E. G. Anderson); twenty-five males, Dexter, July 19, 1923 (E. G. Anderson); female, Dexter, July 27, 1924 (E. G. Anderson); fourteen females, Dexter, September 14, 1924 (E. G. Anderson); eleven females, Dexter, September 16, 1924 (E. G. Anderson); four females, Dexter, September 18, 1924 (E. G. Anderson); sixteen females, Dexter, September 19, 1924 (E. G. Anderson); three females, Dexter, September 23, 1924 (E. G. Anderson); female, Eloise, Wayne County, August 18, 1912 (F. E. McCain);

female, South Haven, September 15, 1914; male and female, Breesville (Nettie Fuller); female, Agricultural College, August 17, 1920 (L. J. Botimer); female, Agricultural College, August 11, 1887; three males, four females.

INDIANA: male, Bloomington, July 8, 1923 (E. G. Anderson); male and female, Bloomington, July 9, 1923 (E. G. Anderson); four males, Borden, July 16-18, 1913 (Harold Morrison); five males, Corydon, July 20, 1913 (Harold Morrison); three males, Brown County, Indiana, August 2, 1913 (Harold Morrison); male, Wawasee, July 18, 1912 (Harold Morrison); female, Hebron, July 17, 1925 (E. G. Anderson); male and female, Harrison County, July 21, 1911; two males, female, Posey County, July 22-30, 1927; male, Posey County, July 31, 1927; male, Noblesville, July 4, 1913 (Harold Morrison); male, Noblesville, July 4, 1914 (Harold Morrison); male, Noblesville, July 25, 1915; female, Marion County, June 30, 1910 (Harold Morrison); female, Mineral Springs, July 29, 1923 (Owen Bryant); female, Elkton City, July, 1895; female, Vincennes, August 16, 1924.

ILLINOIS: male, Urbana, July 15, 1915; female, Farina, August, 1917 (H. Andrews).

MISSOURI: male, St. Louis, July 26, 1922 (P. Rau); female, St. Louis, August, 1877; female, St. Louis, August 8, 1922 (P. Rau); female, St. Louis (P. Rau); female, Jefferson City, September 16, 1925 (A. C. Burrill); female, Kansas City, July 10 (F. Rogers).

MISSISSIPPI: male, Ocean Springs, June, 1910 (F. F. Bibby); male, Agricultural College, August 2, 1913 (J. G. Hester); male, Lakeview, July 16, 1914 (J. C. Bradley).

LOUISIANA: female, Tallulah, July 15, 1925; two males, female, July 18, 1925; female, Tallulah, July 21, 1925; female, Tallulah, July 24, 1925; female, Tallulah; female, Tallulah, June 8, 1922 (R. C. Daney); male.

ARKANSAS: female, Ridgeway, August 13, 1884; female, Imboden, July 9, 1925 (Byron C. Marshall); female, Imboden (Byron C. Marshall).

WISCONSIN: female.

IOWA: two females, Iowa City, August 4, 1896; two females, Iowa City (Wickham); male and female (in copula), Ames, July 26, 1931 (H. A. Scullen); female, Sargent's Bluff, July 7, 1931 (C. N. Ainslie); three males, three females, Sargent's Bluff, July 8, 1933 (C. N. Ainslie); female, Sargent's Bluff, July 9, 1931 (C. N. Ainslie); four males, five females, Sargent's Bluff, July 25, 1933 (C. N. Ainslie); female, Sargent's Bluff, July 28, 1930 (C. N. Ains-

lie); four females, two males, Sargent's Bluff, August 3, 1933 (C. N. Ainslie); male, Sioux City, July 7, 1931 (C. N. Ainslie); male and female (in copula), Sioux City, July 10, 1917 (C. N. Ainslie); female, Sioux City, July 11, 1931 (C. N. Ainslie); female, Sioux City, July 12, 1933 (C. N. Ainslie); female, Sioux City, July 13, 1929 (C. N. Ainslie); female, Sioux City, July 13, 1931 (C. N. Ainslie); two males, Sioux City, July 17, 1931 (C. N. Ainslie); female, Sioux City, July 20, 1928 (C. N. Ainslie); female, Sioux City, July 20, 1933 (C. N. Ainslie); female, Sioux City, July 22, 1932 (C. N. Ainslie); female, two males, Sioux City, July 24, 1931 (C. N. Ainslie); female, Sioux City, July 24, 1933 (C. N. Ainslie); female, Sioux City, July 25, 1931 (C. N. Ainslie); female, Sioux City, July 26, 1928 (C. N. Ainslie); female, Sioux City, July 28, 1931 (C. N. Ainslie); male, Sioux City, August 4, 1923 (C. N. Ainslie); female, Sioux City, August 19, 1932 (C. E. Mickel); female, Sioux City, August 25, 1928 (C. N. Ainslie); female, Sioux City, September 1, 1923 (C. N. Ainslie); female, Sioux City, October 1, 1932 (C. N. Ainslie); female.

MINNESOTA: female and male (in copula), Lake City, August 14, 1918; male, Lake City, July 7, 1921 (A. A. Nichol); female, Newport, July 18, 1922 (A. A. Nichol); female, Newport, July 18, 1922 (C. E. Mickel); male, Minneapolis, June 27, 1921 (A. A. Nichol).

NORTH DAKOTA: male, Marmarth, July 4, 1918 (O. A. Stevens); twelve females, thirteen males, Medora, August 3, 1923 (O. A. Stevens).

SOUTH DAKOTA: fourteen males, Buffalo, July 31, 1924; two females, Buffalo, September 9, 1927 (H. C. Severin); female, Buffalo, August 17, 1926 (H. C. Severin); two males, Camp Crook, August 1, 1924; male, Hot Springs, July 7, 1924; female, Hot Springs, September 12, 1927 (H. C. Severin); male, Whitewood, July 23, 1924; male, Rapid City; female, Elk Point, August 15 (C. N. Ainslie); female, Smithville.

NEBRASKA: male, South Sioux City, July 26, 1912 (L. T. Williams); male, Omaha, July 11, 1914 (L. T. Williams); female, Omaha, July 14, 1914 (L. T. Williams); two males, Omaha, July 30, 1914 (L. T. Williams); female, Omaha, August 2, 1913 (L. T. Williams); male, Omaha, August 13, 1914 (L. T. Williams); two females, Platts-mouth, September 3, 1923 (C. B. Philip); female, Lincoln, July 28, 1920 (R. W. Dawson); female, Lincoln, August 24, 1916 (M. H. Swenk); female, Lincoln, September; female, West Point, June 24; male, West Point, June 26; male, West Point, June, 1887; male,

West Point, July, 1887; male, two females, Meadow Grove, July 18, 1929 (C. N. Ainslie); male, Holt County, July 19, 1920 (F. C. Pelleter); male, Culbertson, July 3, 1911 (J. T. Zimmer); female, Benkelman, July, 1899 (L. Bruner); male, Imperial, July 1, 1911 (J. T. Zimmer); male, female, Wallace, July 2, 1933 (R. Roberts); five males, two females, Wallace, July 3, 1933 (R. Roberts); three males, female, Ogallala, June 24, 1913 (R. W. Dawson); female, Sutherland, June 20, 1932 (M. J. Oosthuizen); three males, Lodgepole, August 6, 1934 (H. A. Scullen); male, Bridgeport, July 11, 1917 (C. E. Mickel); female, Scottsbluffs, August 5, 1923 (Leonard Worley); female, Mitchell, July 11, 1916 (C. E. Mickel); male Mitchell, July 20, 1916 (C. E. Mickel); female, Mitchell, July 22, 1913 (L. M. Gates); female, Mitchell, July 25, 1916 (C. E. Mickel); female, Mitchell, August 16, 1915 (E. M. Partridge); male, two females, Harrison, August 9, 1908 (R. W. Dawson); male, Glen, August 16, 1900; male, Monroe Canyon, August 6, 1908 (R. W. Dawson); female, Monroe Canyon, August 27, 1912 (E. J. Taylor); female, Hat Creek, August 14, 1911 (F. H. Shoemaker); female, Hat Creek, August; female.

KANSAS: two females, Doniphan County, August 26, 1921 (W. J. Brown and Robt. Guentert); female, Lawrence, August (E. S. Tucker); female, Lawrence, July 22, 1922 (C. H. Curran); female, Baldwin, June 27, 1906 (J. C. Bridwell); male, Baldwin, July 14, 1906 (J. C. Bridwell); male, Baldwin, July 24, 1906 (J. C. Bridwell); male, female, Baldwin, August 26, 1906 (J. C. Bridwell); two males, Baldwin, July (J. C. Bridwell); female, Douglas County, July 16, 1919 (Wm. E. Hoffmann); female, Douglas County, July 20, 1920 (Wm. E. Hoffmann); male, Douglas County, July 20, 1922 (W. J. Brown); female, Douglas County, July 29, 1919 (Wm. E. Hoffmann); female, Douglas County, September 5, 1911 (F. X. Williams); female, Douglas County, September 24, 1923 (R. H. Beamer); male, Cherokee County (R. H. Beamer); two females, Ottawa, August 6, 1923; female, Wabaunsee County (Forrest Anderson); female, Manhattan, August 19, 1930 (F. H. Walker); female, Riley County, June 26 (G. A. Dean); male, Riley County, July 4 (Popenoe); male, Riley County, July 16 (Popenoe); female, Riley County, July 18 (G. A. Dean); female, Riley County, July 22 (C. W. Pape); female, Riley County, July 24 (G. A. Dean); two females, Riley County, July (Marlatt); female, Riley County, July (Popenoe); male, Riley County, August 7 (Marlatt); female, Riley County, August 7 (Popenoe); female, Riley County, August 8 (J. B. Norton); female, Riley County, August 20 (P. J. Parrott); male,

Riley County, August (Popenoe); female, Riley County, August (Marlatt); female, Riley County, September 6 (Popenoe); female, Riley County, September 12 (Popenoe); female, Riley County (Popenoe); female, Riley County (J. B. Norton); male, Riley County; three males, four females, Clay County, August, 1901 (J. C. Bridwell); male, female, Dickinson County (J. C. Bridwell); female, Republic County (R. H. Beamer); female, Wellington; female, Medora, August 28, 1925 (W. J. Brown); female, Haven, July (Searle); three females, central Kansas, August, 1898 (J. B. Norton); male, Ellsworth County, July 12, 1923 (L. C. Woodruff); male, Rice County, July 3, 1923 (R. H. Beamer); female, Onaga, July 13, 1925 (R. H. Beamer); male and female (in copula), Onaga, July 13, 1925 (R. H. Beamer); male and female (in copula), Onaga, July 12, 1920 (Crevecoeur); male, Onaga, July 15, 1920 (Crevecoeur); female, Onaga, July 15, 1927 (Crevecoeur); female, Onaga, July 16, 1929 (Crevecoeur); male, Onaga, July 18, 1925 (Crevecoeur); male and female (in copula), Onaga, July 26, 1924 (Crevecoeur); male, Onaga, August 5, 1922 (Crevecoeur); female, Onaga, August 13, 1923 (Crevecoeur); female, Onaga, September 17, 1926 (Crevecoeur); two females, Onaga, September 15, 1926 (Crevecoeur); female, Onaga, September 23, 1926 (Crevecoeur); male, Osborne County; male, Pratt County, June 27, 1911 (F. X. Williams); male, Kiowa County, July 6, 1911 (F. X. Williams); female, Kiowa County, July 14, 1923 (R. H. Beamer); female, Wellsville, July 23, 1901; two males, Norton County, July 5, 1925 (R. H. Beamer); female, Norton County, August 24, 1912 (F. X. Williams); female, Graham County, August 16, 1912 (F. X. Williams); male, Trego County, July 12, 1912 (F. X. Williams); female, Philipps County, August 30, 1912 (F. X. Williams); female, Ness County, July 5, 1912 (F. X. Williams); male, Dodge City, June 14 (Lantz); two males, four females, Meade County, July 10, 1911 (F. X. Williams); two females, Gray County, July 9-15, 1917; male, Gove County, July 1, 1885; male, Gove County (F. H. Snow); six males, female, Sheridan County (F. X. Williams); male and female (in copula), Sheridan County (F. X. Williams); six males, Decatur County (F. X. Williams); male, Rawlins County, July 4, 1925 (R. H. Beamer); male, Rawlins County (F. X. Williams); male, Thomas County (F. X. Williams); three females, Cheyenne County, July 5, 1925 (R. H. Beamer); male, Cheyenne County (F. X. Williams); female, Grainfield, September 23 (Lantz); fifteen females, Sherman County, August 1, 1925 (R. H. Beamer); male, female, Sherman County (F. X. Wil-

liams); male, Logan County (F. X. Williams); female, Wallace county, July 8; six males, Wallace County, July, 1885; two females, male, Wallace County (F. X. Williams); twenty-four males, Wallace County (F. H. Snow); male, female, Wichita County (F. X. Williams); six males, Scott County, June 17, 1925 (R. H. Beamer); male, Scott County, June 19, 1925 (Howard Deay); male, Scott County, June 22, 1925 (R. H. Beamer); male, Scott County, July 25, 1925 (R. H. Beamer); female, Hamilton County, August 27; female, Stanton County (S. J. Hunter); male, female, Grant County, July 23, 1911 (F. X. Williams); male, two females, Morton County, July 20, 1924 (C. O. Bare); female, Morton County, August 2, 1924 (C. O. Bare); female, Morton County, August 3, 1924 (C. O. Bare); four females, Morton County, August 5, 1911 (F. X. Williams); two males, Morton County (F. H. Snow); male and female (in copula), Kanorado, July 26, 1933 (Rodeck and James); five males, three females, western Kansas (Popenoe); two males, western Kansas (Williston); five males, two females.

OKLAHOMA: two males, female, Payne County, July 5, 1925 (W. J. Brown); female, Latimer County, June 20, 1931 (R. D. Bird); female, Latimer County, July 19, 1931 (W. Fisher); female, Latimer County, July 20, 1931 (W. Fisher); female, Latimer County, July 23, 1931 (W. Fisher); male, Pawnee County, July 20, 1932 (C. C. Deonier); male, Sequoyah County, July 27, 1931 (Costner and Davis); male, Sequoyah County, July 29, 1931 (Costner and Davis); male, Kenton, June 25, 1933 (A. E. Pritchard); male, Kenton, June 30, 1933 (W. Chiles); male, Hugo, June 20, 1934 (J. Stankovich); female, Okmulgee, July 25, 1931 (C. C. Deonier); female, Boise City, July 10, 1933 (W. Chiles); female, Boise City, July 9, 1933 (E. E. Ivy).

TEXAS: female, Willis, April, 1903 (J. C. Bridwell); male, two females, Willis, May, 1903 (J. C. Bridwell); female, Athens, June 4, 1906 (F. C. Bishopp); two females.

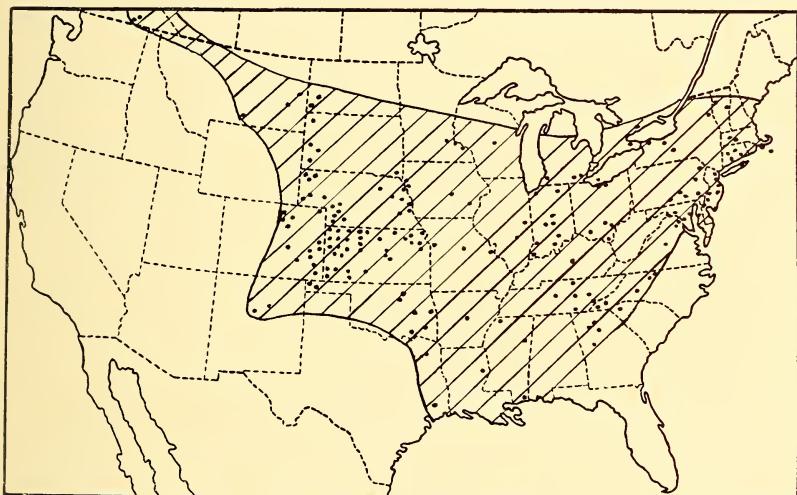
NEW MEXICO: male, Las Vegas, August 11 (Barber and Schwarz); five males, two females, Albuquerque; male, Albuquerque, June 27, 1931 (H. A. Scullen).

COLORADO: male, Julesburg, August 4, 1899; male, Lamar, July 6, 1932 (C. R. Jones); three males, Burlington, July 27, 1933 (Rodeck and James); male and female (in copula), Cheyenne Wells, August 9, 1929 (Klots); female, Sugar City, September 16, 1930 (H. Rodeck); male, Eads, July 29, 1933 (Rodeck and James); four females, Two Buttes, August 2, 1933 (Rodeck and James); male, Kit Carson, July 9, 1932 (C. R. Jones); female, Roggen, July 8,

1933 (M. and H. James); female, Colorado Springs, June 16, 1893; female, Denver, July 22, 1900; male and female, Boulder, July 24 (Cockerell); female, Boulder, July 15 (Cockerell); male, Boulder, July 10 (Cockerell); male, Boulder, July 25, 1932 (M. T. James); female, White Rocks, Boulder County, October 4, 1924 (Bethel Blake); thirteen males, Fountain Valley School, Colorado Springs, July 12-19, 1932; three females, two males, Fort Collins, July 12, 1900; male, Fort Collins, July 16, 1903; female, Fort Collins, September 27, 1931; thirteen males, six females.

MONTANA: male, Huntley, July 19, 1917; male, Huntley, July 23, 1917; ten males, Huntley, August 23, 1915; male, Miles City, August 27, 1915; female, Glendive, September, 1928 (C. N. Ainslie); eight males, female.

CANADA: British Columbia: male, female, Okanagan, August; two males, Osoyoos.



Distribution of *Timulla (Timulla) vagans* subsp. *vagans* (Fabricius)

This is the most widely distributed and abundant species of the genus *Timulla* in North America north of Mexico. The female has been confused with *dubitata* Smith in collections. The female may be recognized at once by the following combination of characters: sides of thorax distinctly emarginate medially, second tergite with a pair of anterior, more or less distinct, pale pubescent spots, and a distinct mesonotal-scutellar suture or groove just anterior to the scutellar scale. The male can be distinguished by the brush of white

hairs on the scape beneath, the dark fuscous wings, and the sparse, black pubescence of the abdominal tergites. The females as well as the males vary a great deal in size; length of females varies from 6 to 14 mm.; the males from 9 to 19 mm.

Timulla (Timulla) vagans subsp. *rufinota* n. subsp.

Male.—Exactly like *vagans* except the pronotum and mesonotum entirely and the propodeum more or less, ferruginous. Length, 17 mm.

Female.—Indistinguishable from *vagans*. Length, 9 mm.

Holotype and allotype.—Male and female taken in copula, Cat. No. 51097 U. S. National Museum, Centreville, Florida, July 20.

Paratypes.—Female, Gainesville, Florida, March 7, 1922; male, Gainesville, Florida, May 4, 1928; male, Gainesville, Florida, May 16, 1928; male, Gainesville, Florida, August 11, 1918 (P. W. Fattig); male, Gainesville, Florida, August 14, 1918 (P. W. Fattig); male, Gainesville, Florida, September 28, 1918 (P. W. Fattig); female, Pomona, Putnam County, Florida, September 7–8, 1917 (Rehn and Hebard); female, Ocala, Marion County, Florida, September 19–20, 1917 (Rehn and Hebard); female, Lake Jackson, Leon County, Florida, June 22, 1922 (J. S. Alexander); male, Orlando, Florida, July 10, 1907 (Russell); male, Orange County, June 29, 1939 (B. O. Hiers, Jr.); female, Lutz, Florida, March 31, 1917 (Krautwurm); female, Dade City, Florida, May 13, 1910 (W. D. Hunter); male, Florida.

The ferruginous color of the thorax of the males appears to be the only difference which can be used to distinguish this Florida subspecies. External structural characteristics are the same in both the type form and the Florida subspecies. The genitalia have been examined and while there are subtle differences, the latter are not different in nature than those found in various individual males of the type subspecies. The extent of ferruginous color on the thorax may be confined to the pronotum and mesonotum, or the scutellum may be slightly ferruginous anteriorly, the propodeum more or less ferruginous laterally and the first abdominal segment almost entirely ferruginous. The females are the same as in the subspecies *vagans*.

Timulla (Timulla) grotei (Blake). (New combination)

- 1871. *Mutilla Grotei* Blake, Trans. Amer. Ent. Soc., iii, p. 228, male.
- 1874. *Mutilla fulviventris* Gerstaecker, Archiv. f. Naturg., xl, p. 323, male. (New synonymy.)
- 1886. *Mutilla Grotei* Blake, Trans. Amer. Ent. Soc. xiii, pp. 195–196, male.

1894. *Mutilla fulviventris* Cameron, Biol. Centr.-Amer., Hymen., ii, pp. 286-287, male.
1897. *Mutilla fulviventris* Dalla Torre, Cat. Hymen., viii, p. 42, male.
1897. *Mutilla grotei* Dalla Torre, Cat. Hymen., viii, p. 45, male.
1899. *Mutilla Grotei* Fox, Trans. Amer. Ent. Soc. xxv, p. 271, male.
1903. *Mutilla fulviventris* André, Gen. Ins., i, fasc. 11, p. 42, male.
1903. *Mutilla Grotei* André, Gen. Ins., i, fasc. 11, p. 42, male.
1903. *Mutilla Grotei* Melander, Trans. Amer. Ent. Soc. xxix, p. 323, male.
1916. *Mutilla (Timulla) grotei* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 207, male.

Type.—Male, Colorado, in collection of American Entomological Society, Philadelphia; holotype of *fulviventris* Gerstaecker in Zoological Museum der Universität, Berlin.

I have examined the holotype of both *grotei* and *fulviventris* and find them to be the same. My examination of the type of *grotei* has also been checked by Mr. E. T. Cresson, Jr., who was kind enough to compare additional specimens for me.

The two sexes have been taken together at Valentine, Texas, July 8, 1917 (H. H. Knight), the male carrying the female, and have also been taken at the same time and place in three other instances, once in Texas and twice in Utah. The female has heretofore been undescribed.

Female.—Head, scape, all the coxae, anterior femora, and thorax ferruginous; head slightly wider than the thorax; abdomen black with pale pubescent markings; scutellar scale broad and conspicuous; pygidial area longitudinally rugose on the proximal third, granulate on the distal two-thirds. Length, 10 mm.

Head ferruginous, sparsely clothed on the front and vertex with short fulvous hairs, on the genae and hind margin of the head with pale hairs; mandibles edentate, proximal half ferruginous, distal half black; posterior margin of clypeus elevated, the elevated margin crenulate; scape ferruginous, flagellum piceous; first segment of flagellum approximately equal in length to the second and third segments united; antennal scrobes very weakly carinate above; front, vertex and genae coarsely and densely punctate; genae not carinate posteriorly; relative widths of head and thorax, 4.7 : 4.5.

Thorax ferruginous, clothed with sparse, recumbent, fulvous hairs, that on the posterior face of propodeum pale and erect; humeral angles rounded; thorax distinctly narrowed medially; dorsum of thorax coarsely, deeply and densely punctate; posterior face of propodeum very deeply and densely reticulate, especially above; mesonotal-scutellar suture prominent; scutellar scale broad and conspicuous; pleura shining, impunctate, except the sides of the propodeum more or less coarsely punctate posteriorly; lateral margins of posterior face of propodeum denticulate.

Abdomen above black with pale pubescent markings; first tergite with scattered, large punctures, the distal margin with a band of pale pubescence; second tergite with large, coarse punctures throughout concealed by the black pubescence except at the sides, entirely black except the lateral margins pale pubescent, and the distal margin with a broad band of pale pubescence, the anterior margin of the latter sinuate, not straight; tergites three to five each with two quadrate spots of pale pubescence, those on tergite five almost touching at the distal margin, thus enclosing a cuneate spot of black pubescence on the median area of tergites three to five, the pale pubescent spots not extending to the lateral margins of the tergites; pygidium longitudinally rugose on the proximal third, granulate on the distal two-thirds; venter of abdomen very dark ferruginous; first sternite with a longitudinal carina; second sternite coarsely punctured, more sparsely so at the distal middle; sternites three to five closely, moderately punctate at the distal margin; sternites two to five with a thin distal fringe of pale pubescence.

All the coxae, anterior trochanters, and anterior femora except at the apex, ferruginous; remainder of anterior, middle and hind legs piceous, clothed with sparse, pale hairs; calcaria pale.

Allotype.—Female, Trenton, Utah, August 17, 1931 (W. L. Thomas), in University of Minnesota collection. A male was taken at the same time and place.

Specimens examined.—

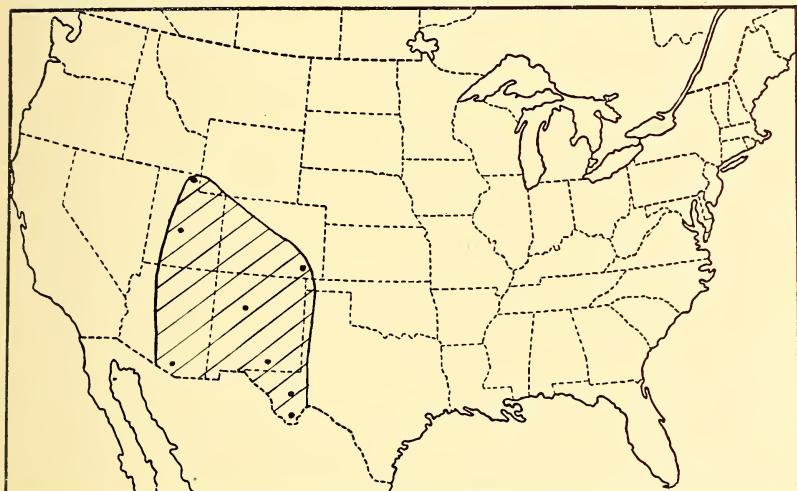
UTAH: female, Logan, July 31, 1925 (A. C. Burrill); female, Logan, August 28, 1925 (A. C. Burrill); female, Vineyard, September 4 (Tom Spalding); male and female, Richfield, August 17, 1904; male, Far West, September 15, 1932 (Lowell Cutler); male, Trenton, August 17, 1931 (W. L. Thomas).

ARIZONA: four males, Santa Rita Mts., July (F. H. Snow).

COLORADO: male, Tobe, August 4, 1933 (Rodeck and James).

NEW MEXICO: female, Jemez Springs, July 17, 1916 (John Woodgate); male, Jemez Springs, July 28, 1914; female, Jemez Springs, August 17, 1916 (John Woodgate); female, Dripping Springs, Organ Mts., August 19 (Cockerell).

TEXAS: three males, two females, Chisos Mts., Brewster County, June 10-12, 1908 (Mitchell and Cushman); female, Chisos Mts., September 7; male, Brewster County, June, 1929; three females, Cherry Canyon, Ft. Davis Quad, Davis Mts., June 29-July 1, 1916 (F. M. Gaige); male, Valentine, July 5, 1917; male and female taken together flying, Valentine, July 8, 1917 (H. H. Knight); female and four males, Limpia Canon, Davis Mts., July 7, 1917; male.



Distribution of *Timulla (Timulla) grotei* (Blake)

This species has a wide distribution in North America, but only a small part of its range lies within the United States. I have seen specimens of both sexes from southern Mexico and Guatemala which are exactly like specimens from Utah, Colorado, Arizona, New Mexico and Texas. The species is closely related to *vagans* Fabricius. The scape of the antennae of the male is perhaps even more flattened and dilated than in *vagans* and has a conspicuous pubescent brush beneath. The outstanding characters distinguishing the two species have been used in the key. The female is related to *suspensa* Gerstaecker but differs in having the second tergite entirely black pubes-

cent except the pale pubescent band at the distal margin. The form of the thorax and the sculpture of the pygidium is the same in both.

Timulla (Timulla) huntleyensis n. sp.

Male.—Head, thorax, first abdominal segment, disk of second abdominal sternite, and legs, all black; remainder of abdomen fulvous; mandibles strongly emarginate beneath and with a prominent tooth near the base beneath; scape conspicuously dilated and flattened distally, the distal half beneath with a dense brush of long, pale, glittering hairs; ocelli large, the distance between the eye margins and the lateral ocelli equal to twice the greatest diameter of the latter; last abdominal tergite with a median, elongate, glabrous area terminating in the arms of a strongly elevated Y-shaped carina, the stem of the Y slightly longer than the arms; mesosternal tubercles transverse; intermediate coxae with a conspicuous tooth on the inner, distal margin; wings fuliginous. Length, 18 mm.

Head entirely black, clothed with sparse, long, erect, fuscous pubescence intermixed with sparse, short, appressed, pale pubescence; mandibles edentate at the tip, with a distinct tooth within remote from the tip, the dorsal surface with a strong, conspicuous, longitudinal carina, strongly emarginate beneath, and with a prominent tooth beneath near the base; median area of clypeus transversely concave, glabrous, impunctate, the posterior margin of the glabrous area evenly arcuate; antennal tubercles prominent, strongly elevated; scape as above, the dorsal surface with small, dense punctures and sparse, erect, fuscous pubescence; first segment of flagellum slightly but distinctly shorter than the second; antennal scrobes distinctly carinate above; ocellar area elevated, the ocelli as above; front with moderate, close, confluent punctures; vertex with somewhat close, less confluent punctures than on the front; genae with moderate, shallow, separated punctures intermixed with fine, shallow punctures; relative widths of head and thorax including the tegulae, 6.2:8.0.

Thorax entirely black, the pronotum, propleura, and anterior fourth of the mesonotum with sparse, erect, pale fuscous pubescence, the remainder of thorax with sparse, erect, fulvo-fuscous pubescence; pronotum, mesonotum and scutellum with moderately large, dense, confluent punctures; mesonotum with a median, glabrous, longitudinal line on the anterior half, the parapsidal furrows present, strong and deep on the posterior

half of mesonotum; scutellum strongly convex; enclosed space of dorsum of propodeum subtriangular, about as long as it is broad at the base; dorsum and posterior face of propodeum with very large, dense, more or less confluent punctures, approaching reticulate; propleura with scattered punctures; dorsal and ventral areas of mesopleura separated by a distinct furrow; mesopleura micropunctate throughout, and also with moderate, close punctures except on the anterior fourth; metapleura glabrous and micropunctate except ventrally with moderately large, close punctures and dorsally somewhat transversely rugose; sides of propodeum shallowly, narrowly reticulate except the anterior fourth glabrous and micropunctate; mesosternal tubercles well developed, transverse; tegulae large, strongly convex, glabrous, impunctate except narrow anterior and inner margins punctate and pubescent.

Abdomen fulvous, except the first segment and the disk of the second sternite black, clothed with erect, fulvous pubescence, except that on the first segment and second sternite pale, the distal fringe of the first tergite and the second sternite fulvous like the remaining tergites and sternites; first tergite with moderately large, more or less close punctures except the distal margin with fine, close punctures; disk of second tergite glabrous, sparsely punctate, the punctures moderate and becoming dense toward the margins except those towards the distal margin small and close; tergites three to six with moderate, close punctures distally; glabrous, impunctate area of last tergite strongly elevated posteriorly and terminating in the arms of a prominent Y-shaped carina, the stem of the Y slightly longer than the arms; distal margin of last tergite bimarginate; first sternite with a median, longitudinal carina on the anterior two-thirds, the carina slightly elevated anteriorly and posteriorly; second sternite with large, distinct punctures, the latter somewhat smaller and sparser towards the distal margin; sternites three to six with moderate, close punctures towards the distal margin; sixth and seventh sternites with a pair of moderate, distinct, lateral tubercles; hypopygium with a pair of prominent, lateral carinae, the latter dentiform posteriorly, that is, terminating in a distinct tooth.

Wings fuliginous; cell 2nd $R_1 + R_2$ subtruncate at the apex; cell R_5 receiving vein M_{3+4} slightly beyond the middle; cell R_4 present and receiving vein M_2 three-fifths the distance from base to apex.

Legs entirely black, clothed with sparse, pale pubescence, the latter slightly tinged with fulvous; intermediate coxae with a strong, prominent tooth at the inner, distal margin; calcaria pale.

Holotype.—Male, Huntley, Montana, August 23, 1915, in University of Minnesota collection.

Related to *grotei* Blake but differs in having larger ocelli, the hypopygial carinae dentiform posteriorly, more uniformly punctate second sternite, the black disk of second sternite and pale fuscous pubescence of the head and pronotum. It differs from the male of *suspensa* subsp. *sonora* in the larger ocelli, darker pubescence of the head and pronotum, the greatly dilated scape with its dense brush of pubescence and the less developed lateral tubercles of the seventh sternite.

Timulla (Timulla) suspensa subsp. **suspensa** (Gerstaecker). (New combination)

- 1874. *Mutilla suspensa* Gerstaecker, Archiv. f. Naturg., xl, p. 299, female.
- 1894. *Mutilla suspensa* Cameron, Biol. Centr.-Amer., Hymen., ii, p. 268, female.
- 1897. *Mutilla suspensa* Dalla Torre, Cat. Hymen., viii, p. 89, female.
- 1903. *Mutilla suspensa* André, Gen. Ins., i, fasc. 11, p. 42, female.

Type.—Female, Mexico (Koppe), in Zoological Museum der Universität, Berlin.

Specimens examined.—

ARIZONA: female, Santa Rita Mts., July (F. H. Snow); female, Chiricahua Mts., August 5, 1932 (D. K. Duncan).

Timulla (Timulla) suspensa subsp. **sonora** n. subsp.

Female.—Head, thorax and legs ferruginous, abdomen ferruginous beneath, more or less blackish above; first and second tergites with distal bands, the second also with a pair of lateral stripes extending from base to apex, of appressed, pale pubescence; scutellar scale broad and distinct; mesonotal-scutellar suture distinct; pygidium irregularly rugose on the basal half, the distal half granulate. Length, 9.5 mm.

Head ferruginous; front and vertex with sparse, erect and recumbent, fulvous hairs, the genae with sparse, pale hairs; mandibles edentate, black distally; clypeus elevated, the elevated area smooth, polished, the elevated margin not dentate

laterally, the posterior area punctate and pubescent; first segment of flagellum one and one-half times longer than the second; antennal scrobes very weakly carinate above; front and vertex coarsely, densely, confluently punctate, the genae with close, moderate punctures; relative widths of head and thorax, 3.5 : 3.2.

Thorax ferruginous; dorsum clothed with sparse, erect and recumbent, fulvous hairs, the posterior face of propodeum with sparse, pale, erect hairs; humeral angles rounded; thorax not broader behind than in front, the mesonotal area distinctly constricted; dorsum and upper half of posterior face of propodeum very coarsely, densely, confluently punctate, more so than the front, the punctures coarser and deeper towards the rear; lower half of posterior face of propodeum with sparse, small punctures, the lateral margins dentate; scutellar scale broad and distinct; mesonotal-scutellar suture distinct; anterior margin of propleura defined by an obscure carina; propleura with a few punctures at the anterior angle; remainder of pro-, meso-, and metapleura smooth, shining, micropunctate, with fine, pale pubescence; sides of propodeum with close, almost confluent, large punctures posteriorly.

Abdomen ferruginous beneath, blackish above; first tergite ferruginous, with large, scattered punctures, sparse, erect, pale hairs, and a distal band of appressed, pale pubescence; second tergite with large, rather close punctures, indistinctly visible through the pubescence, with a pair of rather broad stripes extending from base to apex, lateral margins, and a broad, distal band of appressed, pale pubescence; tergites three to five each with a pair of quadrate, lateral spots of appressed, pale pubescence, those on tergite five almost meeting medially at the distal margin; pygidium irregularly rugose on the proximal half, granulate distally; first sternite with an anterior, small tubercle; second sternite with large, close punctures; sternites two to five finely, densely punctate at the distal margin, and each with a thin distal fringe of pale hairs.

Legs ferruginous, sparsely clothed with pale hairs; calcaria pale.

Male.—Head, thorax, first abdominal segment, second sternite except lateral and distal margins, and legs, all black; remainder of abdomen fulvous; mandibles emarginate beneath and with a prominent tooth beneath near the base; scape moderately dilated distally and with a thin brush of pale pubescence on the distal half beneath; vertex and pronotum clothed with

sparse, pale pubescence; last abdominal tergite with a median, glabrous, elongate area terminating in a Y-shaped carina; lateral tubercles of seventh tergite well developed and conspicuous; lateral carinae of hypopygium dentiform posteriorly. Length, 17 mm.

Head entirely black, clothed with sparse, long, erect, and short, appressed, pale pubescence, except the posterior area of front and anterior area of vertex with sparse, erect, fuscous pubescence; mandibles edentate and with a distinct tooth within remote from the apex, the dorsal surface with a strong, prominent carina, strongly emarginate beneath and with a prominent tooth beneath near the base; median, glabrous area of clypeus subrectangular, transversely concave, the postero-lateral angles rounded and slightly reflexed; scape as above, the dorsal surface with small, dense punctures and sparse, pale fuscous pubescence; front, vertex and genae with moderate, more or less confluent punctures; ocelli moderate in size, the distance between the eye margins and the lateral ocelli equal to three times the greatest diameter of the latter; relative widths of head and thorax including the tegulae, 5.5 : 7.2.

Thorax entirely black, clothed with sparse, long, erect, pale pubescence, except the pronotum and anterior third of mesonotum also with sparse, appressed, pale pubescence, and the remainder of the mesonotum as well as the anterior half of the scutellum with sparse, long, erect, blackish pubescence; pronotum, mesonotum and scutellum with moderately large, dense, confluent punctures; mesonotum with a median, longitudinal, glabrous line on the anterior half; parapsidal furrows present and distinct, strong and deep on the posterior two-thirds; scutellum strongly convex; enclosed area of propodeum elongate, the sides sinuate, about twice as long as it is wide at the base; dorsum and posterior face of propodeum narrowly reticulate; propleura irregularly punctate with fine and moderate punctures; dorsal and ventral areas of mesopleura separated by a furrow, with moderate, dense, confluent punctures, except the anterior fifth glabrous, micropunctate; metapleura micropunctate except ventrally with moderate, close punctures and dorsally transversely rugose; sides of propodeum narrowly reticulate, glabrous and micropunctate at the anterior margin; mesosternal tubercles prominent and transverse; tegulae large, convex, glabrous and impunctate except the anterior and inner margins punctate and black pubescent.

Abdomen fulvous, except the first segment and the most of the second sternite black, clothed with sparse, fulvous pubescence, except the black areas with sparse, erect, pale pubescence, the apical fringe of the first tergite fulvous; first tergite with moderate, distinct punctures, the latter becoming smaller at the distal margin; second tergite with moderate, distinct punctures, becoming dense and somewhat confluent anteriorly and laterally, smaller and shallower distally; tergites three to six with moderately small, close, more or less confluent punctures, the latter becoming small and sparse at the distal margin; median glabrous area of last tergite terminating in the elevated arms of a Y-shaped carina, the arms and the stem of the Y about equal in length; first sternite with a median, longitudinal carina on the anterior two-thirds, the carina elevated at its proximal and distal ends; second sternite with moderately large, close, distinct punctures, the latter sparse along the mid line and on the broad, depressed, distal margin; sternites three to six with moderate, close punctures distally; sixth sternite with a pair of weak, lateral tubercles; seventh sternite with a pair of well-developed, conspicuous, lateral tubercles; hypopygium with a pair of prominent lateral carinae dentiform at the distal end.

Wings fuliginous; cell 2nd $R_1 + R_2$ subtruncate at the apex; cell R_5 receiving vein M_{3+4} three-fifths the distance from the base to apex; cell R_4 present and receiving vein M_2 five-eighths the distance from base to apex.

Legs entirely black, sparsely clothed with pale hairs; inner distal margin of intermediate coxae with a well-developed, conspicuous tooth; calcaria pale.

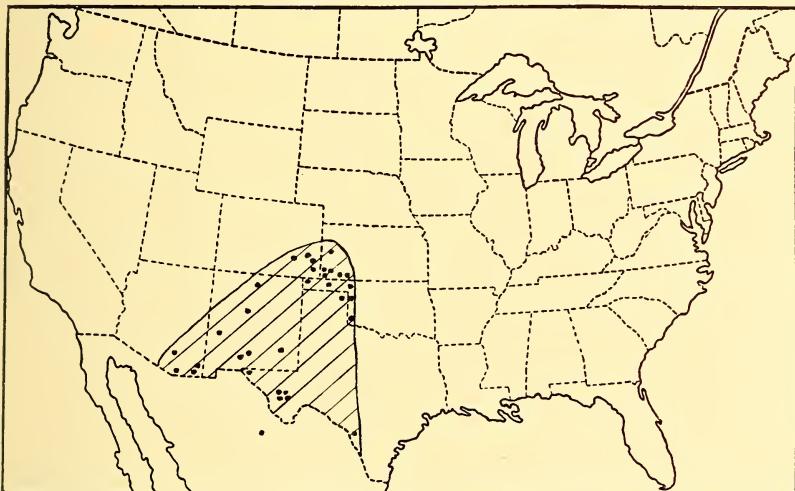
Holotype.—Female, Cat. No. 50948 U. S. National Museum, Mesilla Park, New Mexico (Cockerell).

Allotype.—Male, Marathon, Texas, June 7, 1908 (Mitchell and Cushman), in United States National Museum.

PARATYPES.—Female, Douglas, Arizona, July 20, 1933 (W. W. Jones); female, Douglas, Arizona, July 22, 1933 (W. W. Jones); female, Douglas, Arizona, August 1, 1933 (W. W. Jones); male, Douglas, Arizona, August 2, 1933 (W. W. Jones); male and female, Douglas, Arizona, August 4, 1933 (W. W. Jones); four males, Douglas, Arizona, August 7, 1933 (W. W. Jones); male, Douglas, Arizona, August 8, 1928 (W. W. Jones); two females, Douglas, Arizona, August 21, 1934 (W. W. Jones); male and female (in copula), Douglas, Arizona, August 22, 1933 (W.

W. Jones) ; female, Douglas, Arizona, September 1, 1933 (W. W. Jones) ; two males, Douglas, Arizona, September 20, 1933 (W. W. Jones) ; female, Douglas, Arizona, October 3, 1933 (W. W. Jones) ; female, Douglas, Arizona, October, 6, 1933 (W. W. Jones) ; male, Douglas, Arizona, October 8, 1927 (W. W. Jones) ; female, Douglas, Arizona, October 11, 1933 (W. W. Jones) ; female and two males, Douglas, Arizona, August (F. H. Snow) ; three males, Douglas, Arizona, San Bernardino Ranch, August (F. H. Snow) ; female, Douglas, Arizona (W. W. Jones) ; female, Huachuca Mts., Arizona, August ; female, male, Huachuca Mts., Arizona ; male and female (in copula), Huachuca Mts., Arizona ; female, Tucson, Arizona, September 1, 1925 ; female, Tucson, Arizona, October, 1926 (F. Nichols) ; male, San Bernardino Ranch, Cochise County, Arizona, August (F. H. Snow) ; female, Gila Valley, Arizona, July 20, 1933 (F. H. Parker) ; female, Gila Valley, Arizona, July 29, 1933 (F. H. Parker) ; female, Gila Valley, Arizona (D. K. Duncan) ; six males, Arizona ; female, Mesilla Park, New Mexico, October 1, 1899 (Cockerell) ; female, Mesilla Park, New Mexico, September 12 (Cockerell) ; female, College farm, Mesilla Park, New Mexico, July 18 (Cockerell) ; female, San Augustine, New Mexico, August 29 ; female, Organ Mts., New Mexico, September 2 ; male, Roswell, New Mexico, June 26, 1932 (R. H. Beamer) ; male, El Rito, New Mexico, August 5 ; male, Albuquerque, July 17, 1902 (Oslar) ; male and female, New Mexico ; female, Lamar, Colorado, July 18, 1901 ; three males, Two Buttes, Colorado, August 1, 1933 (Rodeck and James) ; male, Eads, Colorado, July 29, 1933 (Rodeck and James) ; male, Rocky Ford, Colorado, July 9, 1904 ; male, Wichita County, Kansas (F. X. Williams) ; eight males, female, Grant County, Kansas, July 23, 1911 (F. X. Williams) ; male, Grant County, Kansas, July 27, 1911 (F. X. Williams) ; female, Seward County, Kansas, August 18, 1911 (F. X. Williams) ; male, Seward County, Kansas, August 16, 1911 (F. X. Williams) ; three females, five males, Meade County, Kansas, July 10, 1911 (F. X. Williams) ; female, two males, Meade County, Kansas, July 12, 1911 (F. X. Williams) ; two females, Meade County, Kansas (S. J. Hunter) ; seven females, three males, Stanton County, Kansas, July 30, 1911 (F. X. Williams) ; two females, male, Stanton County, Kansas (S. J. Hunter) ; seven females, ten males, Morton County, Kansas, August 5, 1911 (F. X. Williams) ; male, Morton County, Kansas, June, 1902 (F. H. Snow) ; male and female, western Kansas ; male, western Kansas, August 1, 1877 ; male, Laverne, Oklahoma, August 4, 1933 (E. E. Ivy) ; male, Vinson, Oklahoma, July 9, 1934 (J. Stankavich) ; male,

Shattuck, Oklahoma, August 12, 1933 (E. E. Ivy); male, Shattuck, Oklahoma, August 14, 1933 (Reynold Dahms); male, Kenton, Oklahoma, June 26, 1933 (E. E. Ivy); male, Kenton, Oklahoma, June 26, 1933 (A. E. Pritchard); female, Optima, Oklahoma, July 23, 1933 (E. E. Ivy); female, El Paso, Texas, July 24, 1914 (J. C. Bradley); two males, Musquiz Canyon, Ft. Davis, Texas, July 6, 1917; male, Valentine, Texas, July 3, 1933 (S. E. Jones); two males, Valentine, Texas, July 8, 1917; male, Valentine, Texas, July 7, 1917; two females, Cherry Canyon, Fort Davis Quad, Davis Mts., Texas, June 28-29, 1916 (F. M. Gaige); male, Childress, Texas, June 8, 1906 (J. B. Mitchell); male, Marfa, Texas, June 8, 1908 (Mitchell and Cushman); female, Alpine, Texas, June 28-30 (Wickham); female, Chisos Mts., Texas, July 16, 1911 (H. A. Wenzel); female, Dimmit County, Texas, June 10, 1933 (S. E. Jones).



Distribution of *Timulla (Timulla) suspensa* subsp. *sonora* n. subsp.

I have compared female specimens of this subspecies with the holotype of *suspensa* Gerstaecker and find the only difference is in the color of the legs, in subspecies *suspensa* black, and in subspecies *sonora* ferruginous; in pattern of pubescence, sculpture and punctuation of body the two are identical; the color of the abdomen of the female varies from distinctly black to distinctly ferruginous; the series before me includes many intergrades between the two; the male is almost identical with the male of *cyllene* Cameron, differing in having the second sternite black. The two sexes were taken in

copula at Douglas, Arizona, by Mr. W. W. Jones. The close relationship of this female to *suspensa* Gerstaecker and of the male to *cyclene* Cameron leads me to the belief that the latter two are sexes of the same species, as mentioned above. The females vary in length from 8 to 13 mm., the males from 14 to 19 mm. The male has been misidentified in collections as *oajaca* Blake.

Timulla (Timulla) suspensa subsp. *jonesi* n. subsp.

Male.—Head, thorax, first abdominal segment and legs entirely, black; remainder of abdomen fulvous and clothed with fulvous pubescence; mandibles strongly emarginate beneath and with a conspicuous tooth beneath near the base; median, glabrous area of clypeus transversely concave, the posterior elevated margin arcuate, and the postero-lateral borders slightly reflexed; scape with a single carina beneath, moderately dilated distally and with a thin brush of pale hairs beneath on the distal half; ocelli small, the distance between the eye margins and the lateral ocelli equal to slightly more than three times the greatest diameter of the latter; head clothed with sparse, pale pubescence, except the posterior part of front and anterior part of vertex including the ocellar area with sparse, black, erect pubescence; thorax clothed with pale pubescence, moderately dense on the pronotum except the posterior two-thirds of mesonotum and anterior, median half of scutellum with sparse, erect, black pubescence; mesosternal tubercles transverse; first abdominal segment with sparse, erect, pale hairs and a distal fringe of fulvous pubescence; median, elongate, glabrous area of last tergite terminating in the arms of a Y-shaped carina, the arms of the Y equal in length to the stem; sixth sternite with obscure, lateral tubercles; seventh sternite with distinct lateral tubercles; hypopygium with a pair of lateral, slightly oblique carinae, dentiform distally; wings fuliginous throughout; middle coxae with a distinct tooth at the apex within; legs clothed with sparse, pale pubescence.

Holotype.—Male, Douglas, Arizona, July 19, 1933 (W. W. Jones), in University of Minnesota collection.

Paratypes.—Male, Douglas, Arizona, August 7, 1933 (W. W. Jones); male, Douglas, Arizona, August 22, 1933 (W. W. Jones); male, San Bernardino Ranch, Douglas, Arizona, August (F. H. Snow); male, San Antonio, Texas, October 13, 1905 (F. C. Pratt); male, Victoria, Texas, August 3, 1906 (J. D. Mitchell); male, (Texas); male, Victoria, June 19, 1913 (J. D. Mitchell); male, Bexar County, Texas, September 23, 1934 (H. B. Parks).

Closely related to the male of subsp. *sonora* but differs in having the second abdominal sternite entirely ferruginous, the somewhat more dense, pale pubescence of the pronotum, and the slightly less reflexed postero-lateral angles of the clypeal glabrous area. Also similar to *cyllene* (Cameron) from Mexico but the latter has the postero-lateral angles of the clypeal glabrous area strongly reflexed and subangulate.

Timulla (Timulla) ocellaria subsp. **ocellaria** n. sp. and n. subsp.

Male.—Head, thorax, first abdominal segment, and legs, entirely black; abdomen beyond the first segment ferruginous; mandibles emarginate beneath and with a distinct tooth beneath near the base; median area of clypeus subtriangular, only very slightly concave medially; ocelli very large, conspicuous, the distance between the eye margins and the lateral ocelli slightly less than the greatest diameter of the latter; median, glabrous area of last tergite terminating in the arms of a Y-shaped carina; fifth and sixth sternites without lateral tubercles; seventh sternite with a pair of almost obsolete lateral tubercles; hypopygium with a pair of low, inconspicuous, lateral, oblique carinae on the proximal half; wings fuscous throughout. Length, 14 mm.

Head entirely black, clothed throughout with sparse, pale, glittering pubescence; mandibles edentate at the tip and with a distinct tooth within near the tip, the dorsal surface with a high, prominent, longitudinal carina, emarginate beneath and with a distinct tooth beneath near the base; median area of clypeus subtriangular, glabrous, impunctate, except the anterior margin and the posterior angle punctate and pubescent; scape distinctly bicarinate beneath, clothed with sparse, pale pubescence; first segment of flagellum equal in length to the second when viewed from beneath; antennal scrobes carinate above; front and vertex and genae with moderate, close punctures interspersed with fine punctures, the moderate punctures on the genae more distinct and separated than on the front and vertex; ocelli as above; relative widths of head and thorax at the tegulae, 4.85: 7.0.

Thorax entirely black, sparsely clothed with pale, glittering pubescence, except the pronotum, mesonotum and scutellum with sparse, erect, fuscous to black pubescence; pronotum, mesonotum and scutellum with moderately large, dense, more or less confluent punctures; parapsidal furrows distinct the entire

length of mesonotum, but somewhat deeper posteriorly than anteriorly; dorsum of propodeum with an elongate, narrow, triangular enclosed space, the sides of the latter sinuate; dorsum and posterior face of propodeum rather deeply reticulate; propleura with moderately large, close punctures, except the posterior border glabrous, micropunctate; ventral and dorsal areas of mesopleura separated by a slightly oblique furrow, with moderately large, close, somewhat confluent punctures, except at the anterior margin glabrous and micropunctate; metapleura glabrous, micropunctate except for moderate punctures ventrally; sides of propodeum reticulate, the reticulations becoming shallow and obsolete towards the anterior margin; tegulae large, convex, glabrous, impunctate, except the anterior and inner margins punctate and black pubescent; mesosternum not tuberculate.

Abdomen ferruginous, except the first segment black; first and second tergites and all the sternites with sparse, erect, pale, glittering pubescence, the remainder of the tergites with sparse, erect, pale fuscous pubescence, except the first tergite with a thin, distal fringe of black hairs, tergites two, three and four with broad, distal, marginal bands of black pubescence, tergites five and six with sparse, scattered black hairs, and sternites two to six with very thin, distal fringes of fuscous to black hairs; first tergite with large, distinct punctures, except the narrow, distal margin with small, close punctures; second tergite with separated, distinct, moderate punctures on the disk, sparse medially, becoming close and adjacent at the sides, and the broad, distal margin with small, close punctures; tergites three to six with moderate, distinct punctures anteriorly, becoming smaller and closer towards the distal margin; median, glabrous area of last tergite terminating in the arms of a Y-shaped carina, the arms of the Y shorter than the stem; first sternite with a median, longitudinal carina on the anterior three-fourths; second sternite with large, distinct punctures somewhat closer at the sides than at the middle and becoming moderate and close at the distal margin; sternites three to six with moderate, close punctures distally; fifth and sixth sternites without lateral tubercles; seventh sternite with a pair of almost obsolete lateral tubercles; hypopygium with a pair of low, inconspicuous, lateral oblique carinae on the proximal half.

Wings fuscous throughout; cell 2nd $R_1 + R_2$ subtruncate at the apex; cell R_5 receiving vein M_{3+4} almost two-thirds the dis-

tance from base to apex; cell R_4 distinct and receiving vein M_2 almost two-thirds the distance from base to apex; vein $m-cu$ received by cell Cu distinctly anterior to vein $M_4 + Cu_2$.

Legs entirely black, sparsely clothed with erect and appressed, pale, glittering pubescence; intermediate coxae with a small tubercle at the inner posterior margin; calcaria pale.

Holotype.—Male, Knoxville, Tennessee, August 16, 1927, in University of Minnesota collection.

Paratypes.—Male, Knoxville, Tennessee, July 11, 1928; two males, Knoxville, Tennessee, July 12, 1928; male, Knoxville, Tennessee, July 18, 1928, at light; two males, Knoxville, Tennessee, July 24, 1928, at light; male, Knoxville, Tennessee, July 25, 1928, at light; male, Knoxville, Tennessee, July 27, 1927; male, Knoxville, Tennessee, July 30, 1928, at light; male, Knoxville, Tennessee, August 2, 1927; male, Knoxville, Tennessee, August 9, 1927; male, Knoxville, Tennessee, August 14, 1928, at light; two males, Knoxville, Tennessee, August 21, 1928, at light; male, Knoxville, Tennessee, August 23, 1928, at light; two males, Knoxville, Tennessee, August 28, 1928, at light; male, Knoxville, Tennessee, August 30, 1927; male, Knoxville, Tennessee, September 10, 1928, at light; male, Knoxville, Tennessee, September 13, 1928, at light; male, Knoxville, Tennessee, September 28, 1927; male, Knoxville, Tennessee, September 30, 1927; male, Knoxville, Tennessee, October 14, 1928, at light; male, Knoxville, Tennessee, October 15, 1928, at light; male, Knoxville, Tennessee (G. G. Ainslie); male, Columbus, Ohio, July 13, 1930 (Charles H. Hicks); male, Borden, Indiana, July 16–18, 1913 (Harold Morrison).

Very similar in appearance to *hollensis* subsp. *melanderi* but differs in the mandibles being excised and toothed beneath and the extremely large ocelli. This species is evidently more or less nocturnal since most of the paratypes were taken at light at Knoxville, Tennessee. The paratypes vary in length from 10 to 16 mm.

Timulla (Timulla) ocellaria subsp. *rufidorsa* n. subsp.

1916. *Mutilla (Timulla) sayi* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 214, male (nec Blake).

Male.—Head, thorax except the prothorax, mesonotum and tegulae, first abdominal segment, and legs, all black; prothorax, mesonotum and abdomen beyond the first segment, all ferruginous; tegulae dark ferruginous; mandibles emarginate beneath and with a distinct tooth beneath near the base; median area of clypeus subtriangular, only slightly concave medially; scape

bicarinate beneath; ocelli very large, the distance between the eye margins and the lateral ocelli slightly less than the greatest diameter of the latter; median, glabrous area of last tergite terminating in the arms of a Y-shaped carina; fifth and sixth sternites without lateral tubercles; seventh sternite with a pair of almost obsolete, lateral tubercles; hypopygium with a pair of low, oblique, inconspicuous carinae on the proximal half; wings fuscous throughout; calcaria pale. Length, 13 mm.

Holotype.—Male, Cat. No. 50950 U. S. National Museum Durant, Oklahoma, July 1, 1910, at light (Hunter).

Paratypes.—Male, Baldwin, Kansas, July 31, 1906 (Bridwell), two males, Seward County, Kansas, August 16, 1911 (F. X. Williams); four males, Kansas; male, Durant, Oklahoma, July 1, 1910, at light (Hunter); male, Payne County, Oklahoma, July 1, 1926 (W. J. Brown); male, Paris, Texas, September 30, 1904; male, October 9, 1904; two males, Paris, Texas; two males, Corsicana, Texas, July 19, 1905 (Hunter); male, Dallas, Texas, October 4, 1905 (C. R. Jones); two males, Terrell, Texas, June 19, 1904, at light; male, Columbia, Missouri, July 13, 1905; male, Columbia, Missouri, July 22, 1905; three males, Columbia, Missouri, July 29, 1905; male, Columbia, Missouri, September 2, 1905; male, Missouri; male, Agricultural College, Mississippi, June 10, 1913 (J. G. Hester); male, Agricultural College, Mississippi, May 11, 1922 (S. F. Crawford).

Exactly like *ocellaria* subsp. *ocellaria* except the prothorax and the mesonotum ferruginous with pale pubescence, and the tegulae dark ferruginous. Similar in appearance to *sayi* Blake with which it has been confused, but differs in the mandibles excised and toothed beneath, in the slightly larger ocelli, in the thorax being much less ferruginous and in the darker wings. This subspecies is also more or less nocturnal as several of the paratypes have been taken at light.

Timulla (Timulla) kansana n. sp.

Male.—Head entirely, thorax except pronotum, mesonotum and tegulae, first abdominal segment, and legs, all black; prothorax, mesonotum, tegulae, and abdomen except first segment, ferruginous; narrow, thin, distal fringe of first tergite, band at distal margin of second and third tergites, and scattered hairs at distal fringe of fourth and fifth tergites, black; remainder of abdominal pubescence pale and glittering; mandibles emarginate beneath and with a distinct tooth beneath near the base; median area of elyptus subtriangular, slightly concave medially; ocelli small; enclosed area of dorsum of propodeum small

and inconspicuous; last abdominal tergite with the median, elongate, glabrous area terminating in the arms of a Y-shaped carina, the arms distinctly shorter in length than the stem; hypopygium with a pair of distinct, lateral, oblique carinae on the proximal half; seventh sternite with a pair of obscure, lateral tubercles; fifth and sixth sternites without lateral tubercles; wings subfuscous. Length, 11 mm.

Head entirely black, sparsely clothed throughout with pale, glittering pubescence, somewhat thicker on the front; mandibles edentate at the apex and with a tooth within near the apex, with a prominent longitudinal carina on the dorsal aspect, emarginate beneath and with a distinct tooth beneath near the base; median area of clypeus subtriangular, mostly glabrous, the anterior margins and posterior angle punctate, the glabrous area slightly concave medially; scape bicarinate beneath, sparsely clothed with pale, glittering pubescence; first segment of flagellum slightly shorter than the second; antennal scrobes carinate above; front, vertex and genae with moderate, close, more or less confluent punctures, closer and more confluent on the front than elsewhere, and a small, glabrous, impunctate area present behind each lateral ocellus; ocelli small, the distance between the eye margins and the lateral ocelli about equal to three times the greatest diameter of the latter; relative widths of head and thorax at the tegulae, 4.0 : 5.2.

Thorax black, except the prothorax and mesonotum, ferruginous, and the tegulae dark ferruginous; thorax clothed with sparse, pale, glittering pubescence, except the posterior five-sixths of mesonotum with very sparse, blackish pubescence; pronotum, mesonotum and scutellum with moderately large, dense, confluent punctures; scutellum slightly convex; enclosed area of dorsum of propodeum small, elongate, subtriangular, inconspicuous; dorsum and posterior face of propodeum deeply, narrowly reticulate; propleura micropunctate throughout, and indistinctly, moderately punctate posteriorly; ventral and dorsal areas of mesopleura separated by a transverse furrow, with moderate, close, more or less confluent punctures, except a narrow area adjacent to the anterior margin only micropunctate; metapleura glabrous, micropunctate and with a few moderate punctures ventrally; sides of propodeum with large, close punctures, approaching reticulate, except the anterior margin only micropunctate; mesosternum without well-defined tubercles; tegulae large, convex, glabrous, impunctate, except the anterior and inner margins punctate and blackish pubescent.

Abdomen ferruginous, except the first segment entirely black, clothed throughout with sparse, mostly erect, pale, glittering pubescence, except the thin, distal fringe of the first tergite, a broad band of erect pubescence at the distal margin of the second and third tergites, and a very thin, distal fringe on the fourth and fifth tergites, all black; first tergite with moderately large, distinct punctures becoming small and close at the distal margin; second tergite with moderate, distinct punctures, very close distally and laterally, somewhat separated on the disk; tergites three to six with moderate, distinct, close punctures, the latter even somewhat confluent laterally; median, elongate, glabrous area of last tergite terminating in the arms of a high, sharp, Y-shaped carina, the arms of the Y distinctly shorter than the stem; first sternite with a median, longitudinal carina on the anterior three-fourths; second sternite with large punctures, distinct and separated medially, close and somewhat confluent laterally; sternites three to six with moderately small, close punctures at the posterior margin; fifth and sixth sternites without lateral tubercles; seventh sternite with obscure lateral tubercles; hypopygium with a pair of lateral, oblique carinae on the proximal half.

Wings subfuscous throughout; cell 2nd $R_1 + R_2$ subtruncate distally; cell R_5 receiving vein M_{3+4} slightly beyond the middle; cell R_4 present but much less distinct than R_5 and receiving vein M_2 at the middle.

Legs black, sparsely clothed with erect, pale, glittering pubescence; intermediate coxae not toothed within but with a small tubercle at the inner posterior margin; calcaria pale.

Holotype.—Male, McPherson County, Kansas, June 27, 1923 (Clarence Bare), in University of Kansas collection.

Paratypes.—Male, Riley County, Kansas, September 11 (J. B. Norton); male, Riley County, Kansas, September 21 (E. E. Faville); male, Riley County, Kansas, October 1 (E. E. Faville).

Similar in appearance to *ocellaria* subsp. *rufidorsa* but differs in the much smaller ocelli and the paler pubescence of the abdomen. Also very similar in appearance to *sayi* Blake but differs in having the mandibles emarginate and toothed beneath and in the much smaller ocelli.

Timulla (Timulla) sayi (Blake). (New combination)

1871. *Mutilla Sayi* Blake, Trans. Amer. Ent. Soc., iii, p. 229, male.

1886. *Mutilla Sayi* Blake, Trans. Amer. Ent. Soc., xiii, p. 197, male.
 1897. *Mutilla sayi* Dalla Torre, Cat. Hymen., viii, p. 84, male.
 1899. *Mutilla Sayi* Fox, Trans. Amer. Ent. Soc., xxv, p. 271, male (in part).
 1903. *Mutilla Sayi* André, Gen. Ins., i, fasc. 11, p. 42, male.
 1916. *Mutilla (Timulla) hexagona* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 213, male (Texas specimens only).

Type.—Male, Texas, in collection of American Entomological Society, Philadelphia.

Specimens examined.—

TEXAS: male, Plano, July (E. S. Tucker); two males, Plano, August (E. S. Tucker); male, Plano, October (E. S. Tucker); six males.

Several species have been confused by previous writers under the name *sayi*; the latter is characterized by very large ocelli, so large that the space between the eye margins and the lateral ocelli is reduced to a distance equal to or slightly less than the greatest diameter of the lateral ocelli. Only one other species has such large ocelli, namely, *ocellaria*, which has even larger ocelli and which has the mandibles strongly excised and toothed beneath. *Ocellaria* subsp. *rufidorsa* is superficially very much like *sayi* but the two are easily separated by the structure of the mandibles. The above specimens have been compared with Blake's type and are identical with it. I have only seen specimens from Texas.

Timulla (Timulla) suhyalina n. sp.

1899. *Mutilla Sayi* Fox, Trans. Amer. Ent. Soc., xxv, p. 271, male (in part, Colorado and Montana specimens).
 1903. *Mutilla Sayi* Melander, Trans. Amer. Ent. Soc., xxix, p. 324, male (in part, Nebraska specimens).
 1916. *Mutilla (Timulla) hexagona* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 213 (in part, Colorado and Montana specimens).

Male.—Ferruginous, except the head, mesosternum and ventral area of mesopleura, first abdominal segment, and legs, all black; mandibles not excised beneath nor toothed near the base beneath; median area of clypeus triangular, very slightly concave; ocelli moderately large, the distance between the eye margins and the lateral ocelli equal to about one and one-fourth times the greatest diameter of the latter; mesosternum not

tuberculate; median, glabrous area of last tergite terminating in a Y-shaped carina, the arms of the Y distinctly shorter than the stem; fifth and sixth sternites without lateral tubercles; seventh sternite with the lateral tubercles practically obsolete; hypopygium with a pair of obscure, oblique carinae on the antehior half; wings subhyaline. Length, 11 mm.

Head entirely black, clothed throughout with sparse, long and erect, as well as short and appressed, pale pubescence; mandibles edentate at the apex, with a distinct tooth within near the apex, the dorsal face with a distinct, longitudinal carina, and not at all excised nor toothed beneath; median area of clypeus triangular, glabrous except the anterior margin and posterior angle punctate and pale pubescent, slightly concave medially; scape distinctly bicarinate beneath; first and second segments of flagellum approximately equal in length; antennal serobes carinate above; front, vertex and genae with moderate punctures thickly interspersed with fine punctures, the front and vertex with the moderate punctures close, the genae with the same punctures distinctly separated; ocelli as above; relative widths of head and thorax at the tegulae, 4.1 : 5.2.

Thorax ferruginous, except the ventral area of mesopleura and the mesosternum, black, clothed throughout with sparse, erect, pale pubescence, that on the mesonotum and scutellum tinged with ferruginous; pronotum, mesonotum and scutellum with moderate, dense, confluent punctures; parapsidal furrows distinct throughout, though somewhat deeper posteriorly than anteriorly; enclosed area of dorsum of propodeum elongate, triangular, the sides slightly sinuate; dorsum and posterior face of propodeum distinctly, shallowly reticulate; propleura with moderate, sparse punctures interspersed with very fine punctures; ventral and dorsal area of mesopleura separated by a furrow, with moderately large, close punctures interspersed with very fine punctures; metapleura micropunctate except ventrally with moderate, close punctures, the ventral margin tinged with black; sides of propodeum shallowly reticulate, the meshes smaller and less distinct than elsewhere on the propodeum, almost shallowly, closely punctate, and with an obscure dark, oblique line at the region of the spiracle; tegulae ferruginous, large, convex, glabrous, the anterior half and inner margin punctate and pale pubescent.

Abdomen ferruginous, except the first segment blackish, clothed with sparse, pale pubescence, except the first, second and

third tergites with black pubescence at the distal margins, that on the first tergite a narrow fringe, that on the second and third tergites broad bands; first tergite with moderately large, close punctures, the latter becoming small at the distal margin; second tergite with moderate, distinct, separated punctures, sparser on the disk than laterally or anteriorly and becoming small at the distal margin; tergites three to six with moderate, distinct punctures, the latter closer laterally than medially; median, elongate, glabrous area of last tergite as above; first sternite with a median, longitudinal carina on the anterior three-fourths, elevated anteriorly and posteriorly; second sternite with moderately large, distinct, close punctures, the distal margin with small punctures; sternites three to six with moderately small, close punctures towards the distal margin; fifth and sixth sternites without lateral tubercles; seventh sternite with practically obsolete lateral tubercles; hypopygium with a pair of obscure, oblique carinae on the anterior half.

Wings subhyaline; cell 2nd $R_1 + R_2$ subtruncate at the apex, approximately equal in length to cell $R + 1st\ R_1$; cell R_5 receiving vein M_{3+4} at half the distance from base to apex; cell R_4 present but less distinct than R_5 and receiving vein M_2 at eight-thirteenths the distance from base to apex; vein $m-cu$ received by cell Cu slightly before the apex.

Legs entirely black, sparsely clothed throughout with pale pubescence; calcaria pale.

Holotype.—Male, LeSeuer County, Minnesota, September 2, 1923 (Wm. E. Hoffmann), at light, in University of Minnesota collection.

Paratypes.—

ILLINOIS: male, Lake Forest, August 22, 1906 (J. G. Needham).

IOWA: male, Ames.

MINNESOTA: male, St. Paul, August 16, 1930 (Dwight Buchanan).

NORTH DAKOTA: male, Fargo, July 7, 1919 (O. A. Stevens); three males, Medora, August 3, 1923 (O. A. Stevens); male, Beach, August 15, 1921 (C. N. Ainslie).

SOUTH DAKOTA: male, Lake Albert, August 22, 1923; male, Castle Rock, September 8, 1927 (H. C. Severin); male, Platte, July 20, 1923 (C. N. Ainslie); male, Nowlin County; two males.

NEBRASKA: male, Plattsmouth, September 3, 1923 (C. B. Philip); male, West Point, June 24; male, West Point, July, 1887.

KANSAS: male, Riley County, June (Marlatt); male, Decatur County (F. X. Williams); male, Norton County, August 24, 1912 (F. X. Williams); male, Cheyenne County (F. X. Williams); male, Scott City, August 21 (Lantz).

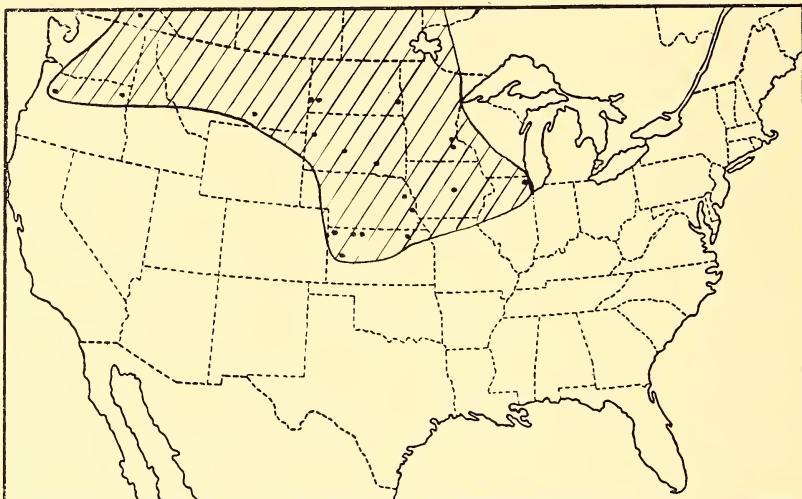
COLORADO: seventeen males.

MONTANA: male, Huntley, July 23, 1917; two males, Huntley, August 23, 1915; six males.

OREGON: male, Union, September 1, 1896 (C. V. Piper); male, Corvallis, July 20, 1925 (D. A. Wilbur); male, Corvallis, August 16, 1925 (D. A. Wilbur).

BRITISH COLUMBIA: male, Vernon, July 25, 1917 (Sladen).

Without locality data: twenty-eight males.



Distribution of *Timulla (Timulla) subhyalina* n. sp.

This species has been incorrectly identified in the past as *hexagona* Say and has also been confused with *sayi* Blake. Superficially it appears much like *sayi*, but has smaller ocelli, much paler wings, and almost entirely ferruginous thorax. It is easily recognized by these three characters. In the seventy-six specimens ranging in distribution from Illinois, Minnesota and Kansas to Oregon and British Columbia, which have been examined, there is almost no variation in the color of the thorax or in the transparency of the wings, and while there is some variation in the size of the ocelli, it is slight and they are always distinctly smaller than in *sayi*. One specimen from Corvallis, Oregon, has the ocelli moderate in size; space between eye margins and lateral ocelli equal to one and one-half times the diameter of the latter; the other has the ocelli large, i.e., the two dimensions approximately equal; otherwise the two specimens are identical. Although previous workers have believed this species to be the

same as Say's *hexagona*, that view is not tenable, since Say described the latter as having the thorax entirely black and the wings fuliginous. The specimens range in length from 9 to 16 mm.

Timulla (Timulla) hollensis subsp. *hollensis* (Melander). (New combination)

1903. *Mutilla Sayi* var. *hollensis* Melander, Trans. Amer. Ent. Soc., xxix, p. 324, male.

1916. *Mutilla (Timulla) hexagona* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 213, male (in part).

Type locality, Wood's Hole, Massachusetts. Location of type unknown.

Specimens examined.—

MASSACHUSETTS: male, Nantucket, September 9; male, Nantucket, September 10; two males, Nantucket, September 12.

NEW YORK: male, Cold Spring Harbor, Long Island, August 4, 1921 (E. G. Anderson); male, Yaphank, Long Island, September 22, 1911; male, Yaphank, Long Island, October 11, 1913.

MARYLAND: male, Frederickstown.

Without data: male.

Very similar in appearance to *sayi* Blake from Texas, but differs in the fuscous to black color of the pubescence of the vertex, mesonotum and scutellum, the tegulae conspicuously darker in color than the mesonotum, and the smaller ocelli.

Timulla (Timulla) hollensis subsp. *melanderi* n. subsp.

1916. *Mutilla (Timulla) hexagona* Bradley, Trans. Amer. Ent. Soc., xlvi, pp. 213–214, male (in part).

Male.—Head, thorax, first abdominal segment, and legs, entirely black; remainder of abdomen ferruginous; head and thorax clothed with sparse, pale pubescence, except the mesonotum and anterior portion of scutellum with sparse, black pubescence; thin, apical fringe of first abdominal tergite black; second tergite with a broad, distal band of sparse, black pubescence; third and fourth tergites sparsely black pubescent distally; remaining tergites with mostly pale pubescence; distance between eye margins and lateral ocelli approximately one and one-half times the greatest diameter of the latter; mandibles not excised beneath; wings dark fuscous. Length, 13 mm.

Holotype.—Male, Falls Church, Virginia, August 7 (Nathan Banks), in collection Cornell University, Ithaca, New York.

Paratypes.—Male, Falls Church, Virginia, September 4, 1915 (C. T. Greene); male, Plummer's Island, Maryland, August 5, 1914 (R.

C. Shannon); male, Baltimore, Maryland, July, 1909; male, Clementon, New Jersey, July 29, 1900 (G. M. Greene); male, Gloucester County, New Jersey, September 7, 1890; male, Philadelphia, Pennsylvania, August 17, 1891; male, Enola, Pennsylvania, August 20, 1910 (W. S. Fisher).

Exactly like subsp. *hollensis* except the thorax entirely black, and the vertex and posterior part of scutellum with pale pubescence.

Timulla (Timulla) dubitatiformis n. sp.

1909. *Mutilla (Timulla) briaxis* Rohwer, Trans. Amer. Ent. Soc., xxxv, pp. 132–133, female (not male).
 1909. *Mutilla (Timulla) dubitatiformis* mss. Rohwer, Trans. Amer. Ent. Soc., xxxv, p. 133, female.

Female.—Ferruginous, the flagellum and legs blackish, broad distal margin of the first and second abdominal tergites, and exposed areas of tergites three to five, all black; first tergite with a narrow, distal band of black pubescence; second tergite with a narrow, distal band narrowly dilated at the anterior middle, of dense, glittering, pale pubescence; tergites three to five with distal bands of dense, glittering, pale pubescence, that on the third interrupted medially; lateral margins of thorax slightly but distinctly emarginate medially; thorax not broader posteriorly than anteriorly; scutellar scale obscure, almost obsolete; mesonotal-seutellar suture obscure; pygidial area weakly, longitudinally rugose, the surface granulate throughout. Length, 9 mm.

Head ferruginous, the flagellum blackish, slightly tinged with ferruginous; tips of mandibles black; front and vertex with sparse, erect and recumbent, ferruginous pubescence, elsewhere the head with sparse, pale, glittering pubescence; mandibles slender, edentate at the tips and with a slight tooth within near the apex; posterior margin of clypeus strongly, arcuately elevated, the elevated margin obscurely serrate; surface of clypeus anterior to elevated margin concave, glabrous; clypeus with a small, distinct, median tubercle immediately posterior to the elevated margin; antennal tubercles approximate; first segment of flagellum slightly shorter than segments two and three united; antennal scrobes distinctly carinate above; front and vertex with moderate, dense, confluent punctures; genae with moderate, close punctures interspersed with very fine punctures; relative widths of head and thorax, 3.8 : 3.5.

Thorax entirely ferruginous, the dorsum clothed with sparse,

erect and recumbent, ferruginous pubescence, elsewhere with sparse, pale, glittering pubescence, that on the pleural areas appressed; lateral margins of dorsum of thorax slightly but distinctly emarginate; humeral angles broadly rounded; scutellar scale obscure, almost obsolete; mesonotal-scutellar suture obscure; dorsum of thorax with moderately large, dense, confluent punctures, the latter somewhat larger than on the front and vertex; dorsum and posterior face of propodeum reticulate, the posterior half of the latter only very faintly reticulate; lateral margins of posterior face of propodeum slightly crenulate; pleural areas micropunctate and micropubescent; sides of propodeum with small, scattered punctures as well as micropunctate.

Abdomen ferruginous, except the distal margin of the first tergite, broad, distal margin of second tergite, and exposed areas of tergites three to five, all black; first tergite with a narrow, distal band of black pubescence; tergites two to five with pale, glittering pubescence at the distal margin as described above; first tergite with moderate, separated punctures interspersed with fine punctures, clothed with sparse, erect, pale pubescence except at the distal margin; lateral areas of second tergite with moderate, distinct punctures, the posterior third dilated at the anterior middle with fine, close punctures, clothed with sparse, erect and recumbent, dark ferruginous pubescence, the recumbent pubescence black in certain lights, and both erect and recumbent pubescence becoming pale and glittering towards the lateral margins; distal margin of second tergite with a pale pubescent band as described above; tergites three to five with fine, close punctures and sparse, erect and recumbent, dark pubescence except the distal bands as mentioned above; pygidial areas as described above; first sternite with a median, longitudinal carina on the anterior two-thirds; second sternite with moderate, distinct punctures interspersed laterally and posteriorly with fine punctures; sternites three to five with small, close punctures towards the distal margin; hypopygium with small, close punctures; all the sternites with sparse, pale, glittering pubescence, and sternites two to five each with a thin, distal fringe of pale pubescence.

Legs very dark ferruginous, more or less blackish; coxae, and femora beneath distinctly ferruginous; tibial spines ferruginous; legs clothed throughout with sparse, pale pubescence; calcaria pale.

Holotype.—Female, Cat. No. 18463 U. S. National Museum, Boulder, Colorado, May 26, 1908 (T. D. A. Cockerell).

Paratypes.—

MASSACHUSETTS: female, Nantucket, September 13, 1927 (C. W. Johnson).

CONNECTICUT: female, Lyme, May 13, 1911 (A. B. Champlain).

NEW YORK: female, Orient, Long Island, May 22, 1933 (Roy Latham); female, Riverhead, Long Island, July 1, 1933 (Roy Latham); female, Riverhead, Long Island, August 7, 1933 (Roy Latham); female, Sag Harbor, Long Island, May 6, 1932 (Roy Latham); female, Calverton, Long Island, June 19, 1932 (Roy Latham); two females, Cold Spring Harbor, Long Island, June 17, 1923 (E. G. Anderson); female, Cold Spring Harbor, Long Island, June 22, 1921 (E. G. Anderson); three females, Cold Spring Harbor, Long Island, June 27, 1921 (E. G. Anderson); female, Cold Spring Harbor, Long Island, June 27, 1921 (S. H. Emerson); female, Cold Spring Harbor, Long Island, August 9, 1921 (S. H. Emerson); female, Cold Spring Harbor, Long Island, September 13, 1922 (E. G. Anderson).

NEW JERSEY: female, Cold Spring, July 14, 1903.

MARYLAND: female, Chesapeake Beach, July 27, 1913 (R. C. Shannon); female, College Park, August 23, 1925 (C. E. Green); female, Beltsville, July 4, 1912 (W. L. McAtee); female, Plummer's Island, June 11 (H. S. Barber).

VIRGINIA: female, Arlington, May 15, 1925 (D. H. Blake); female, Clifton, May, 1933 (J. C. Bridwell); female, East Falls Church, June 18, 1912; female, Falls Church, August 2; female, Falls Church, August 4 (Nathan Banks); female, Falls Church, September 1, 1915 (C. T. Greene); female, Gunston Cove, June 4, 1922 (Budlong and Barber).

OHIO: female, Athens, July 29, 1932 (W. C. Stehr); female, Columbus, April 13, 1902 (Bridwell).

GEORGIA: female, Stone Mountain, August 16, 1913.

FLORIDA: female, Orange County, June 24, 1929 (A. J. Wafford).

MISSISSIPPI: female, Agricultural College, April 21, 1918 (R. G. Prescott); female, Agricultural College, April 25, 1917 (E. E. Johnson); female, Agricultural College, May 6, 1922 (H. G. Miller); female, Agricultural College, May 22, 1922 (Hewes); female, Agricultural College, July 8, 1913 (J. G. Hester); female, Agricultural College, July 11, 1913 (T. F. McGehee); female, Agricultural College, July 22, 1922 (W. C. Avens); female, Agricultural College, September 21 (S. R. Evans).

LOUISIANA: two females, New Orleans.

MISSOURI: female.

IOWA: female, Iowa City (Wickham); female, Ames, August 18, 1926; female, Sioux City, September 5, 1927 (C. N. Ainslie).

MINNESOTA: female, Fridley Sand Dunes, Anoka County, June 19, 1926 (R. W. Dawson).

SOUTH DAKOTA: female, Medicine Lake, Florence, June 23, 1927 (H. C. Severin); three females.

NEBRASKA: female, Plattsmouth, September 3, 1923 (C. B. Philip); two females, Lincoln, June 21, 1912 (E. J. Taylor); female, Lincoln, September 9, 1924 (R. W. Dawson); female, West Point; female, Scribner, June 18, 1913 (L. T. Williams).

KANSAS: female, Riley County, June 24 (Popenoe); female, Riley County, July 24 (G. A. Dean); female, Riley County (F. Marlatt); female, Baldwin, May (Bridwell); female, Baldwin, June (Bridwell); female, Baldwin, July 14, 1906 (J. C. Bridwell); female, Baldwin, August 5, 1906 (J. C. Bridwell); female, Baldwin, August 16, 1906 (J. C. Bridwell); two females, Clay County, August, 1901 (Bridwell); female, Douglas County, May 21, 1922 (W. J. Brown); female, Ottawa, July 13, 1923 (W. J. Brown); female, Emporia, August 7, 1932 (R. C. Smith); female, Sumner County (R. H. Beamer); two females, Rawlins County (F. X. Williams).

OKLAHOMA: female, Norman, April 11, 1932 (J. Smith).

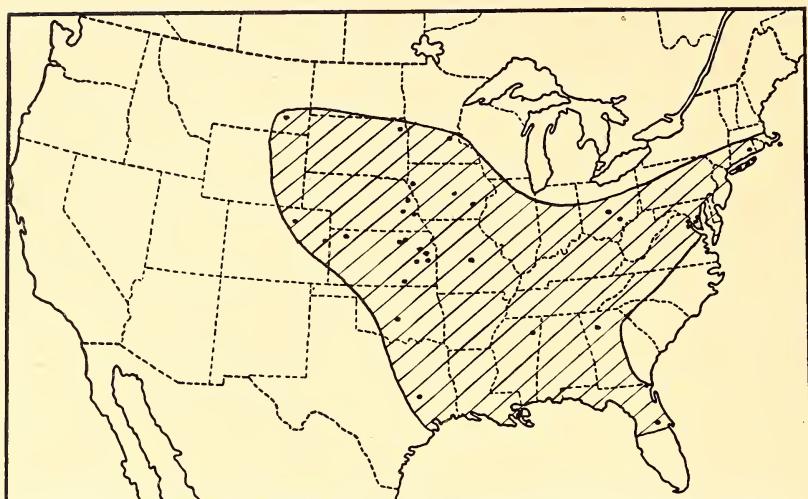
TEXAS: female, Madison County, August 22, 1932 (F. F. Bibby); two females.

COLORADO: female, Burlington, July 26, 1933 (Rodeek and James); female, Ft. Collins: two females.

MONTANA: female, Forsyth.

Without data: two females.

Dubitatiformis differs from all other female *Timullas* north of Mexico except *euterpe* and *euphrosyne* in the distal black pubescent band of the first abdominal tergite. It is readily distinguishable from the two latter species by the dusky to black color of the last three abdominal tergites, and the pale pubescent markings of the same tergites. The almost obsolete scutellar scale and the absence of pale pubescent markings on the anterior half of the second abdominal tergite are additional characters which are of aid in identification. The paratypes vary in length from 5 to 10 mm.; the color of the terminal abdominal segments varies from black to ferruginous, but they are clothed with pale pubescence, not with fulvous as in *euterpe* and *euphrosyne*.

Distribution of **Timulla (Timulla) dubitatiformis n. sp.**

This female has an exceptionally wide distribution and no male of which the female is unknown has a similar distribution. I am of the opinion that one or all of the group of males including *rufosignata*, *tolerata*, *subhyalina*, *hollensis* subsp. *hollensis*, *hollensis* subsp. *melanderi*, and *sayi* represent the male sex. All of these have a more limited distribution than *dubitiformis*, and I have attempted without success to find some basis for separating the latter into geographical groups which could be correlated with the above males. The situation may be that the males have differentiated into geographical groups, while the females have remained stable; this has been found to be true of certain other species of Mutillidae both in the United States and the Philippine Islands. All that can be said at present is that the male will probably prove to be among those mentioned above.

This female was recognized by Rohwer as new as early as 1909, and specimens were labeled by him as *dubitiformis* mss. Later Rohwer came to the conclusion that *dubitiformis* mss. was the female sex of *briaxus* Blake and published a description of his specimen under the name *briaxus*. Through an oversight the name “*dubitiformis*” was not changed to “*briaxus*” in the last paragraph of his discussion (p. 133). Specimens of *briaxus* Blake (= *vagans* Fabr.) taken in copula with females have demonstrated that the latter are entirely different from Rohwer’s *dubitiformis* mss., thus leaving the species without a valid name. In order to

avoid confusion I have used Rohwer's manuscript name *dubitatiformis* and based the description on the specimen selected and labeled by him as the holotype specimen. I am indebted to Mr. S. A. Rohwer and Miss Grace Sandhouse for the information regarding the manuscript name *dubitatiformis* and the specimens on which it was based.

Timulla (Timulla) contigua n. sp.

Female.—Head, thorax, first abdominal segment except posterior half of tergite, and anterior two-thirds of second abdominal segment, all ferruginous, the remainder of abdomen, antennae and legs, black; head and dorsum of thorax contiguously but not coarsely punctured; scutellar scale entirely absent; sides of dorsum of thorax distinctly but weakly emarginate medially; second abdominal tergite finely punctured throughout, without anterior, pale pubescent spots; pygidium faintly, longitudinally rugose anteriorly, granulate posteriorly. Length, 9 mm.

Head ferruginous, the antennae and tips of mandibles black, clothed with scattered, erect, fuscous hairs, and sparse, recumbent, ferruginous pubescence, except that on the genae, pale; mandibles edentate at the tips and with a small tooth within near the apex; clypeus strongly elevated posteriorly, the elevated margin strongly arcuate, slightly dentate at the lateral extremities and narrowly emarginate medially; antennal tubercles approximate medially; antennal scrobes distinctly carinate above; front, vertex and genae with moderate punctures, the latter close and confluent immediately behind the antennal scrobes, distinct and contiguous on the front and vertex, separated and interspersed with fine punctures at the posterior margin of vertex and on the genae; relative widths of head and thorax, 3.4 : 3.1.

Thorax entirely ferruginous, clothed with sparse, recumbent, ferruginous pubescence on the dorsum, with sparse, erect, pale hairs on the posterior face of propodeum and pale micropubescece on the pleural areas; thorax subrectangular, elongate, the width in relation to length, 3.1 : 5.5, the lateral margins of the dorsum distinctly but shallowly emarginate medially; relative widths of thorax at humeral angles, middle of prothorax, anterior spiracles, middle of mesothorax, posterior spiracles and at dorsum of propodeum, 2.6 : 3.1 : 2.7 : 2.6 : 2.8 : 3.1; humeral angles rounded; dorsum of thorax with moderate, contiguous

punctures anterior to the mesonotal-scutellar suture, coarsely punctured merging into reticulate posterior to the latter; scutellar scale entirely absent; lateral margins of posterior face of propodeum denticulate; propleura micropunctate and with obscure, moderate, shallow punctures; meso- and metapleura micropunctate and with moderate, shallow, close punctures.

Abdomen black, except anterior half of first tergite, first sternite entirely, anterior two-thirds of second segment, and the last two sternites, all ferruginous; first tergite with an inconspicuous, pale pubescent band at the posterior margin, second tergite with a broad, conspicuous band of pale pubescence at the posterior margin, the anterior margin of the band strongly, narrowly, angulately dilated medially; tergites three to five each with a band of pale pubescence at the posterior margin not interrupted medially, that on the third tergite most prominent; all the sternites with fringes of pale hairs at the posterior margin; second tergite with fine, distinct punctures interspersed with scattered, small punctures, the fine punctures becoming obsolete on the antero-lateral areas; tergites three to five with fine, distinct punctures interspersed with scattered, small punctures; pygidium faintly, longitudinally rugose anteriorly, granulate posteriorly; first sternite with a strong, longitudinal, median carina on the anterior half; second sternite with moderately small punctures on the disk, becoming interspersed with fine, distinct punctures at the lateral and posterior margins; sternites three to five with moderately small, close punctures posteriorly; last sternite with moderately small, dense punctures.

Legs entirely black, clothed with sparse, pale pubescence; calcaria pale.

Holotype.—Female, Brownsville, Texas, May 25, 1934 (J. N. Knull), in collection of Ohio State University, Columbus, Ohio.

Paratype.—Female, Texas.

Superficially resembles *dubitatiformis* but the thorax is more elongate, the scutellar scale is lacking, the front, vertex and dorsum of thorax are much less coarsely punctured, the punctures moderate and contiguous, not dense and confluent, and the first tergite with the posterior, marginal pubescent band pale instead of black. Also resembles *euphrosyne* in the color, punctuation and pattern of the second abdominal tergite, but that species has the head and thorax much more strongly punctured, the pubescent band at the posterior margin of the first tergite black, and has the last three abdominal

segments entirely ferruginous and clothed with ferruginous pubescence.

Timulla (Timulla) rufosignata (Bradley). (New combination)

1916. *Mutilla (Timulla) rufosignata* Bradley, Trans. Amer. Ent. Soc., xlvi, p. 212, male.

Holotype.—Male, Everglade, Florida, April 11, 1912 (Wm. T. Davis), in collection of Cornell University, Ithaca, New York.

Specimens examined.—

GEORGIA: two males, Tifton.

FLORIDA: male, Gainesville, Alachua County, May 13, 1914; male (paratype).

Characterized by the very small ocelli, the mandibles not emarginate nor toothed beneath, the deeply, coarsely reticulated propodeum, and the ferruginous pronotum and mesonotum.

***Timulla (Timulla) tolerata* n. sp.**

Male.—Black, except the pronotum, mesonotum, anterior margin of scutellum, tegulae, and abdomen beyond the first segment, ferruginous; mandibles not at all emarginate nor toothed beneath; median area of clypeus triangular; ocelli moderately small, the distance between the eye margins and the lateral ocelli equal to slightly more than twice the greatest diameter of the latter; propodeum moderately reticulate; mesosternum not tuberculate; median, elongate, glabrous area of last tergite terminating in a Y-shaped carina; fifth and sixth sternites without lateral tubercles; seventh sternite with the lateral tubercles almost obsolete; hypopygium with a pair of obscure, oblique carinae on the anterior half; wings fuscous throughout; legs clothed with black pubescence. Length, 12 mm.

Head black, the mandibles subterminally, vertex, and genae tinged with ferruginous, clothed with sparse, intermixed pale and fuscous pubescence; mandibles edentate at the apex and with a small tooth within near the apex, the dorsal aspect with a distinct, longitudinal carina, not at all emarginate nor toothed beneath; median area of clypeus triangular, the anterior margin and the posterior angle punctate, the remainder glabrous, impunctate; scape distinctly bicarinate beneath; first segment of flagellum approximately equal in length to the second; antennal scrobes carinate above; front, vertex and genae with moderate, close, more or less confluent punctures, the latter more separated on the genae, close and confluent on the front and vertex; ocelli as above; relative widths of head and thorax at the tegulae, 4.05 : 5.00.

Thorax black, except the pronotum, mesonotum, anterior margin of scutellum and tegulae, all ferruginous and the remainder of scutellum tinged with ferruginous; pronotum, mesonotum and scutellum with moderate, dense, confluent punctures, clothed with sparse, erect, fuscous pubescence; enclosed area of dorsum of propodeum elongate, subtriangular; dorsum and posterior face of propodeum distinctly but moderately reticulate, clothed with sparse, erect, pale pubescence; propleura obscurely punctate, clothed with sparse, pale pubescence; ventral and dorsal areas of mesopleura separated by a deep furrow, with moderate, close punctures interspersed with fine, shallow punctures, and clothed throughout with sparse, pale pubescence; metapleura glabrous, micropunctate and micropubescent except ventrally with moderate, close punctures; sides of propodeum reticulate, the meshes small, almost reduced to large, shallow punctures; mesosternum not tuberculate; tegulae large, convex, glabrous, the anterior half with scattered, setigerous punctures, the hairs black.

Abdomen ferruginous except the first segment entirely black and the distal margins of the second and third tergites infuscated, blackish; first and second segments clothed with sparse, erect, pale pubescence, the broad, distal margin of the second tergite, the distal fringe of the second sternite and all the remaining segments with erect, black pubescence; first tergite with large, close punctures becoming small at the distal margin; second tergite with moderate, distinct punctures, more separated on the disk than laterally and becoming small at the distal margin; tergites three to five with moderately small, distinct, close punctures; last tergite with the median, elongate, glabrous area terminating in the arms of a Y-shaped carina, the arms of the Y shorter than the stem; distal margin of the last tergite strongly bimarginate; first sternite with a median, longitudinal carina on the anterior three-fourths; second sternite with moderate, distinct, more or less separated punctures, and small punctures at the distal margin; sternites three to six with moderately small, close punctures distally; fifth and sixth sternites without lateral tubercles; seventh sternite with obsolete, obscure, lateral tubercles; hypopygium with a pair of low, obscure, oblique carinae on the anterior half.

Wings fuscous throughout; cell 2nd $R_1 + R_2$ subtruncate at the apex; cell R_5 receiving vein M_{3+4} five-ninths the distance from base to apex; cell R_4 present but less distinct than R_5 and

receiving vein M_2 almost two-thirds the distance from base to apex.

Legs entirely black, clothed with obscure, sparse, short, appressed, pale pubescence, and sparse, erect, black hairs; intermediate coxae with an obscure tubercle at the inner posterior margin; calcaria pale.

Holotype.—Male, Cat. No. 50952 U. S. National Museum, St. Louis, Missouri (Rau).

Resembles *rufosignata* Bradley but the ocelli are larger, the reticulation of the propodeum is much less deep and coarse, and the pubescence of the legs is black. *Tolerata* also resembles *sayi* Blake but the ocelli of the latter are much larger and more elevated, the distal margin of the second and third tergites is not infuscated, the punctuation of the thorax is denser, and the pubescence of the legs is pale.

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EXPLANATION OF PLATES

Last abdominal tergite of the males of *Timulla* in North America north of Mexico.

PLATE I

- Fig. 1. *Timulla (Timulla) ferrugata* (Fabricius).
- Fig. 2. *Timulla (Timulla) ornatipennis* (Bradley).
- Fig. 3. *Timulla (Timulla) barbata* (Fox).
- Fig. 4. *Timulla (Timulla) oajaca* (Blake).
- Fig. 5. *Timulla (Timulla) leona* (Blake).
- Fig. 6. *Timulla (Timulla) dubitata* subsp. *fugitiva* n. subsp.

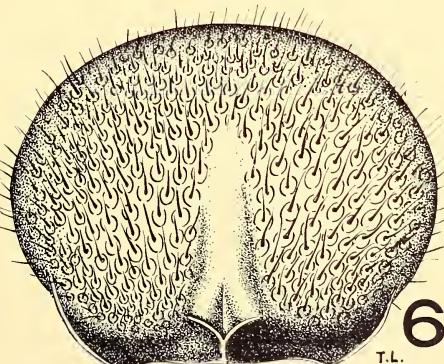
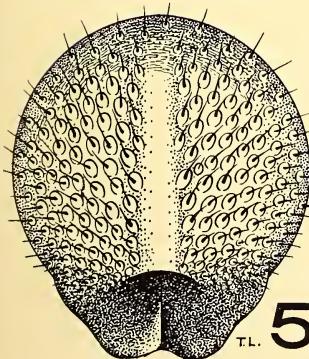
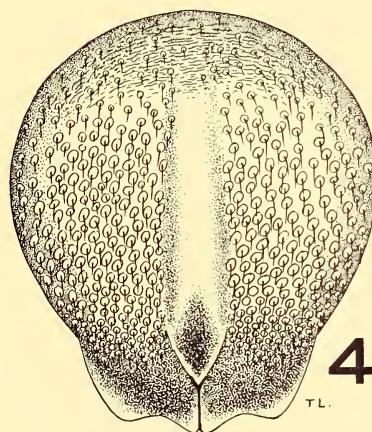
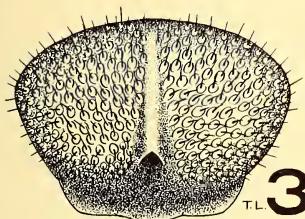
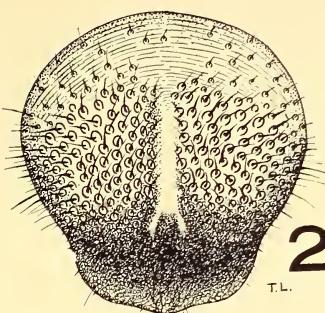
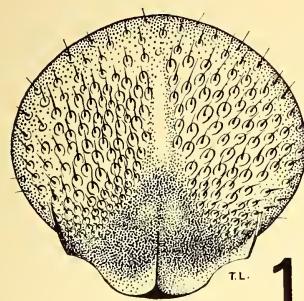
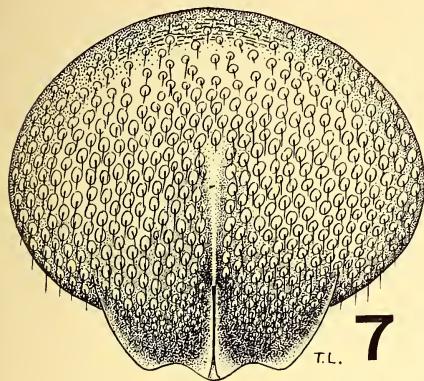
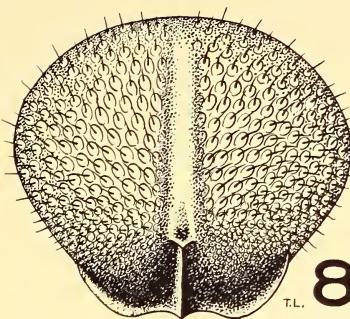


PLATE II

- Fig. 7. *Timulla (Timulla) navasota* subsp. *nebulosa* n. subsp.
Fig. 8. *Timulla (Timulla) floridensis* (Blake).
Fig. 9. *Timulla (Timulla) navasota* subsp. *nebulosa* n. subsp.
Profile, lateral view.
Fig. 10. *Timulla (Timulla) compressicornis* n. sp.
Fig. 11. *Timulla (Timulla) barbigera* subsp. *barbigera* (Bradley).
Fig. 12. *Timulla (Timulla) vagans* subsp. *vagans* (Fabricius).



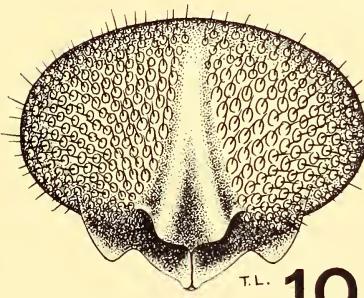
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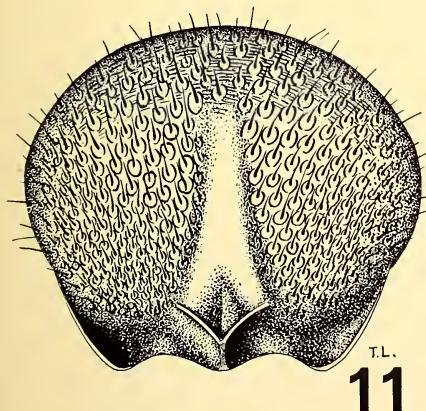
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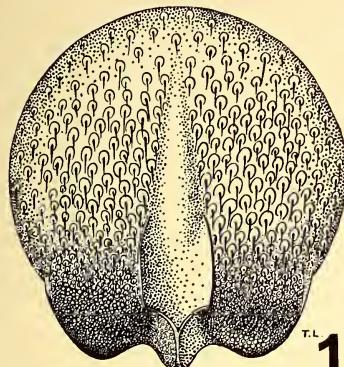
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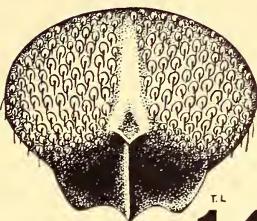
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PLATE III

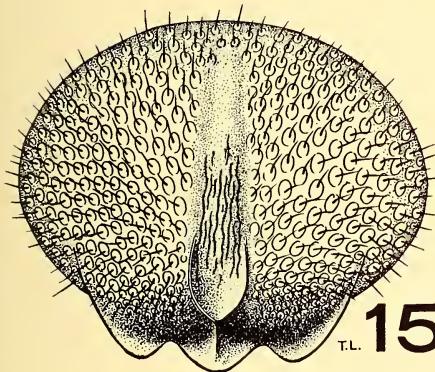
- Fig. 13. *Timulla (Timulla) grotei* (Blake).
- Fig. 14. *Timulla (Timulla) ocellaria* subsp. *rufidorsa* n. subsp.
- Fig. 15. *Timulla (Timulla) suspensa* subsp. *sonora* n. subsp.
- Fig. 16. *Timulla (Timulla) subhyalina* n. sp.
- Fig. 17. *Timulla (Timulla) rufosignata* (Bradley).



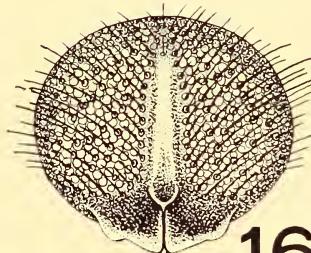
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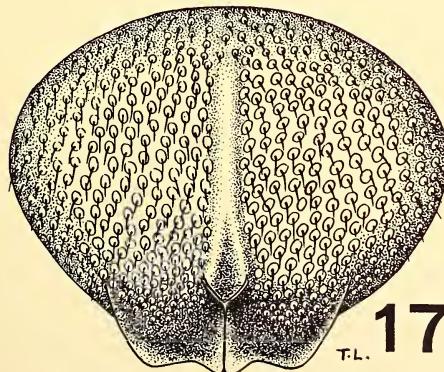
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STUDIES ON THE BIOLOGY OF THE DAMSELFLY *ISCHNURA VERTICALIS SAY*, WITH NOTES ON CERTAIN PARASITES

BY EVELYN GEORGE GRIEVE

ITHACA, N. Y.

INTRODUCTION

Although *Ischnura verticalis* is a common and widely distributed damselfly its biology has been little studied. In the present investigation more than one hundred nymphs were hatched from eggs laid in the laboratory, and each was reared in a separate container to make possible individual life history records. In conjunction with the rearing experiments, observations were made on oviposition, hatching, growth, molting and transformation, and on female poly-chromatism. There was discovered a disease, due to the presence of certain green protozoa in the rectum of the nymphs, that was associated with their high mortality. This led to a preliminary survey for parasites; and the cercariae of two Distome Trematodes were found in many of the nymphs and adults, during part of the season. All these matters are discussed in the following pages.

THE IMMATURE STAGES

Rearing work was begun with the full-grown nymphs which were collected early in the spring of 1931 from one of the trout ponds of the Cornell Experimental Fish Hatchery, at Ithaca, N. Y. From the first generation, which were the stock adults, eggs were obtained for the life history studies.

The females will oviposit in various soft-stemmed aquatic plants. The most convenient for my purpose was a round-stemmed spike rush, *Eleocharis palustris*, which was kept growing in the screen-covered tanks. These stems are flexible, and one or two could be bent into the water each day, and held down by the surface film. The females would oviposit only in these floating stems, and each day's eggs could be conveniently removed and dated. In Fig. 1 E is shown a longitudinal section of a stem, with the eggs embedded in the plant tissue.

The Egg and the Sperm.—Ripe spermatozoa were taken from the spermatheca of a mature female. Head and nucleus could not be clearly distinguished although the anterior third was blacker than the remainder of the sperm. The width is fairly uniform, though tapering slightly posteriorly; and the whole body of the sperm has an undulating, possibly spiral, form. It terminates in a short forked tail. The length, exclusive of the forked tail, averages about 0.04 mm., and the forks of the tail, approximately 0.007 mm.

The eggs of this species are elliptical, slightly curved, the head end being a little enlarged and surmounted by an operculum or cap. The eggs are quite uniform in size, averaging 0.83 mm. long, and tapering in width from 0.18 mm. near the anterior end to 0.12 mm. near the posterior end.

The length of the egg stage is quite uniform within any one lot of eggs, each lot consisting of all those collected from the oviposition tank in one day. It varies from twelve to twenty days, dependent apparently on temperature, with ratios as shown in the accompanying table.

	Duration of egg stage									
No. of days	12	13	14	15	16	17	18	19	20	
No. of lots	1½	4½	3	2	1	1	1	1	1	

Hatching.—The percentage of eggs which hatch is remarkably high. From one group of six hundred eggs, five hundred and sixty nymphs hatched, or ninety-three percent.

The hatching of the Odonate nymph is interesting in that it has a pronymphal instar between the embryo and the first active nymph.¹ In 1904 Pierre described the hatching from the egg, and the remarkable behavior of the pronymph of *Lestes viridis*. Balfour-Browne

¹ The occurrence of a pronymphal instar in some species of Orthoptera is mentioned by Balfour-Browne (1909). And Smith (1920) records it for *Corydalis cornuta*.

followed in 1909 with a description of the phenomenon in *Agrion pulchellum* and *Ischnura elegans*. Tillyard (1917) gives an account of it for an anisopterous species, *Anax papuensis*.

In the present study, observations were made on the hatching of some thirty-five pronymphs of *I. verticalis*.² A pulsating organ was observed, corresponding to the so-called "cephalic heart." After reading Shafer's (1923) description of molting in *Anax*, I was impressed by the resemblance of these pulsations to swallowing movements. Since the pronymph is quite transparent, it was possible to see that the organ was in the proper position for the fore-intestine, and that the pulsations began anteriorly in the mouth region and progressed backward.

On one occasion, a pronymph was observed from the ventral surface (at magnifications of sixty and of one hundred and twenty) and the mouth was seen opening and closing rhythmically. The labrum, lying between the bases of the antennae, was being raised and lowered. From the frontal aspect, peristaltic contractions could be seen passing along the pharynx and oesophagus, corresponding in point of time to the movements at the mouth. The end view of another specimen, observed under high magnification, while the pronymph was still within the embryonic sheath, revealed muscular movements in the dorsal part of the head, coinciding with movements in the mouth region. These continued until the head filled the capsule. Shafer's (1923, pp. 321-324) assumption to the contrary, my impression of these dorsal contractions was that they were of muscles originating in the head exoskeleton, and inserted in the pharynx.³

The visible phenomena of hatching commence when the tip of the egg capsule appears above the plant stem. The operculum surrounds an expanding vesicle, as shown in Fig. 1, F.

The expanding vesicle is clearly not the whole egg, embryo and all, moving forward, but simply an anterior expansion of the shell filled with fluid. Tillyard suggested that the fluid might be blood—but if that were so, one should be able to see the corpuscles, for they are visible in transparent nymphs at a magnification of thirty. If it be only water, it must have been absorbed through the thin membrane of the vesicle by osmosis. Whether the vesicle represents merely the expanded egg shell, or whether the chorion has been ruptured, leaving the operculum stranded on top of an expanding

² And in addition, quite a number were killed in fixing fluid, for subsequent study.

³ Verified by a study of sections. See—Grieve, (1937).

embryonic sheath, is not satisfactorily established. The latter view seems more logical, and is partially supported by the fact that by careful manipulation of needles, the operculum could be made to slip around as if over the surface of the expanding vesicle.

Gradually the pronymph expands until the head fills the vesicle, as shown in Fig. 1, F. Here it is not a question of slipping forward bodily, but of stretching forward. Apparently the pronymph swallows the fluid which filled the vesicle, and uses it to produce the increased body pressure which causes the rupture of the embryonic sheath. In one individual the pulsations of the pharynx were counted. They numbered sixty-eight per minute and continued with decreasing rapidity for two minutes and thirty-five seconds. It is not certain whether the capsule always bursts in the same place, but sometimes, at least, the rupture is a dorsal longitudinal slit.

After the capsule bursts and the pronymph begins to slip out, swallowing movements again become more rapid. They continue until the pronymph is about half out of the sheath, or for about thirty seconds. Then the anterior opening of the digestive tube is closed (Fig. 1, J), and as the pronymph bulges out through the opening in the stem of the plant, the visible part of the digestive tube swells noticeably. A dorsoventral movement of the pronymph takes place, in a series of little jerks, accompanied by forward peristaltic contractions of the abdomen. This continues until the pronymph is about two-thirds out of the sheath, requiring about one minute and thirty seconds. Then, the sphincter at the posterior end of the mid-intestine seems to be closed. Rhythmic contractions arise in the hind-intestine, first in the vestibule, then in the rectum, and act with a pumping motion, forcing the distended mid-intestine forward like a piston. This is accompanied by forward peristaltic contractions of the abdomen, which tend to force the whole digestive tube forward, and which produce the pronounced thoracic hump (Fig. 1, L), a distinctive feature of the brief pronymphal period. At this time, the anterior end of the mid-intestine extends up into the metathorax, and the crop and gizzard fill the remainder of the thorax.

A dorsal longitudinal slit occurs in cuticula of the thorax, and the second instar nymph begins to swell out of the cleft. Gradually the sheath slips off the face; but the thorax is still humped and the head bent forward, until the labium is released.

The period from the splitting of the embryonic sheath until the splitting of the pronymphal sheath is considered as the duration of the pronymphal instar. It varied, in ten individuals that were

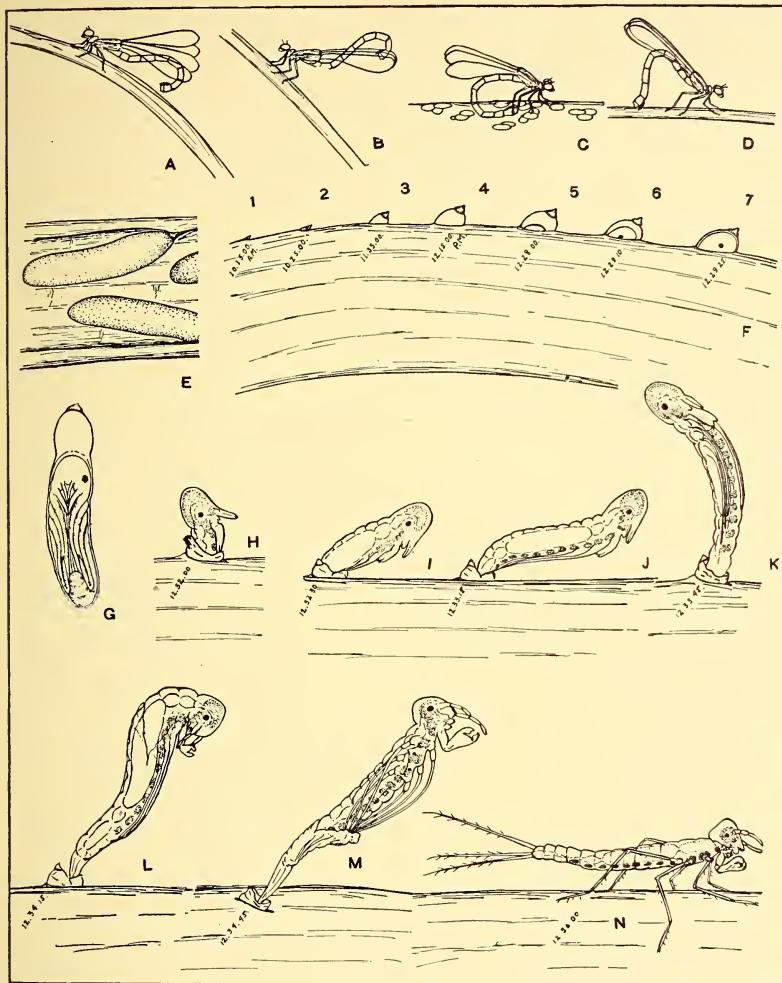


FIG. 1.—A and B, Positions assumed by mature unmated females, to attract males. C and D, Positions assumed by females depositing eggs. E, Plant stem opened to show eggs embedded in the tissue. F, 1 to 7, The egg capsule expanding and becoming visible above the plant stem, previous to hatching of the pronymph. G, Ventral view of the embryo at the stage represented in figures 4 and 5, F. H, I, J, K, Successive positions in the emergence of the pronymph. L, The "thoracic hump" phase, in which the pronymphal cuticle is ruptured, and the first molt commences. M, The second instar nymph emerging from the skin. N, The second instar, or first active nymph.

timed, from one minute fifteen seconds to two minutes fifty seconds, with an average of two minutes four seconds.

Following the bursting of the pronymphal sheath, the crop, gizzard, and mid-intestine still occupy the entire body cavity from the mesothorax to the end of the seventh abdominal segment. The rectum continues pumping while the mouthparts and legs are withdrawn from the sheath, with a little backward wiggling of the body. Then the nymph sways forward, places its feet on the plant stem, rests for a minute or less, draws out its caudal gills from the pronymphal sheath, and uses its feet to push off the cast skin.

The size and position of the various chambers of the digestive tract, relative to the body segments, varies slightly in different individuals. At about forty minutes after molting, the midintestine has come to occupy three and a half or four abdominal segments, extending from segment two to just past the middle of segment five. The yolk material then appears opaque, showing the outlines of the mid-intestine very distinctly, and constituting the "yolk plug" distinctive of very young nymphs.

Rectal movements are characteristic of young nymphs when at rest, and may have a respiratory function. They consist of three, four, or five rapid pulsations of the vestibule, and the water is then expelled by a forceful contraction of the rectum. The number of intake movements is subject to considerable variation. In six individuals timed, the counts ranged from thirty-four to forty-six per minute, with an average of thirty-nine.

The Pronymph.—The appearance of the pronymph before hatching is illustrated in figure 1, G (corresponding to figure 1, F, 4 or 5). The antennae lie close together, partially covering the mandibles and maxillae. The second maxillae are as yet not entirely fused to form the labium, and extend beyond the antennae. The three pairs of legs lie side by side, slightly curved, as shown. Those of the third pair, being longest, are folded back at about the junction of the tibia and tarsus, the latter lying forward below the tibia. The other two pairs lie straight, their termination marked by the slightly darker claws. The posterior abdominal segments curve ventrally, the tenth, ninth, and most of the eighth lying next to the shell on the ventral surface. The three long caudal appendages lie close together along the median line. They extend up under the labium, and are partially covered laterally by the first pair of legs.

There is a slight difference here from the condition in *I. elegans*, as described by Balfour-Browne. In that species, only the tenth

abdominal segment is turned forward, and the gills are said to lie between the legs and the shell. Another point of difference is that the pronymph does not emerge "in exactly the same position in which it has lain in the shell, the lamellae bent under the body, coming out points first." In *I. verticalis* it straightens out as it emerges, the tips of the caudal lamellae remaining within the egg shell even after the nymph has emerged from the pronymphal skin.

The pronymphal sheath surrounds each appendage separately, as was clearly shown by examination of cast skins floating on the water; and does not "closely follow the form of all the limbs, which are held down by it, close alongside the body," as described for *Anax papuensis* by Tillyard (1917).

The most conspicuous structure in the transparent pronymph is the opaque central nervous system. The brain and the three-lobed suboesophageal ganglion almost entirely fill the head. The bi-lobed ganglia of the ventral nerve cord extend along the ventral surface of the body like a row of buttons. There is a ganglion in each of the thoracic segments and in each of the first eight abdominal segments.

Since the pronymphal sheath appears to be of the same cuticular nature as all the other exuviae, there can be little doubt that the pronymph conforms with the accepted definition of a true larval instar. Hence the writer has followed Tillyard in considering the first active nymph as the second instar.

The Mechanism of Molting.—This subject has been very ably dealt with by Shafer (1923) for two representatives of the order, *Anax junius* and *Aeschna multicolor*; and by previous writers for other species of Odonata and Diptera. The present study of the molting and transformation of *I. verticalis* corroborates the main points of Shafer's hypothesis, but differs in some details. Such points of difference were checked on *Anax junius* and *Sympetrum vicinum*, and these were found to correspond with *I. verticalis*.

Some twenty-five or thirty specimens were studied. Most of them were killed in warm fixative, at various stages during and after transformation.

At the final transformation, the nymph always crawls out of the water, and remains so for some time before molting. During this time air must be swallowed, for specimens killed during the act of transformation had the *whole* digestive tract (not simply the mid-intestine) distended to almost fill the body cavity.

With reference to the morphology of the swallowing apparatus, previous authors seem to assume that the musculature of the fore-

intestine consists only of the circular and longitudinal muscles of the intestinal wall. But in addition to these there are, in *I. verticalis*, sets of dorsal, ventral and lateral dilators of the pharynx and buccal cavity, with their origin in the skeleton of the head.

The slit in the thoracic cuticula is preceded by abdominal contractions of a peristaltic nature, which probably tend to force the body fluid into the thorax, under the increased pressure produced by the distended digestive tract. Apparent swallowing movements continue meanwhile. Then, due to the "developmental preparatory weakening" along the middorsal line of the thorax, the cuticula ruptures in this spot, and the thorax of the imago begins to swell out of the cleft.

As the head is withdrawn from the nymphal skin, the cuticula of the fore-intestine is not drawn out through the mouth, as Shafer supposed, but becomes detached in the mouth region, and is subsequently swallowed. Hence the fore-intestine does not deflate at this time. Some individuals killed in fixative during transformation had the old cuticula loosened, but still lying against one wall of the still-distended fore-intestine. Just after the molt, the entire cuticula of the fore-intestine can be found, neatly folded in the anterior part of the newly formed peritrophic membrane. It is easily recognized by the chitinized teeth of the proventriculus.

Often the posterior end of this cuticula is still continuous with the anterior end of the peritrophic membrane of the previous instar. All of which is in accord with the recent findings (Wigglesworth, 1930, and Butt, 1934) regarding the structure and mode of formation of the peritrophic membrane.

In the hind-intestine, the cuticula is detached anteriorly (a sphincter closing off the mid-intestine), and as the molting insect slips forward out of the exuviae the cuticular lining is left behind in the cast skin. And yet, in certain of the dragonflies that were killed while the wings and body were still very soft, the rectum and pre-rectal ampulla were fully distended. Similarly in nymphs of *I. verticalis* that are very transparent just after molting, it can be seen that the hind-intestine is expanded in the same manner as the rest of the digestive tract. It might be refilled from the ventriculus, after the cuticula has been pulled out, or it might be filled by inhalation through the anus. The fact that in fixed specimens the pre-rectal ampulla was sometimes contracted although the rectum was distended, tends to indicate that the latter was refilled through the anus. The hind-intestine is then either held in a distended condition during transformation and while the body and wings harden, or it

may have a pumping action during actual transformation, similar to that of the pronymph. It may also be distended previous to the molt, as in the case of the pronymph. The presence of dilator muscles of the vestibule,⁴ acting in combination with the sphincters, makes it possible to draw in water at this end of the digestive tube.

Hence I would revise Shafer's hypothesis of the mechanism of molting as follows:

The nymph swallows water, or air, until the *whole* digestive tube becomes distended. The blood pressure is consequently increased. Abdominal contractions of a peristaltic nature proceed from the posterior end forward, decreasing the lumen of the abdomen, and concentrating the body fluid, under pressure, in the thorax. The rupture of the thoracic cuticula takes place subsequent to these contractions of the abdomen (which often are accompanied by apparent swallowing movements). As the thorax swells out through the cleft in the cuticula, the pressure in the head and legs is reduced, and they can be drawn out. When the head and thorax have reached their full size, the insect places its feet on the support and draws the abdomen out of the exuviae. A considerable additional quantity of air must be swallowed after the insect has come out of the exuviae, in order to stretch the body and wings, and maintain the tension until the chitin has hardened.

Thus by swallowing water, or air, to increase the volume of the *whole* intestine, the muscular pharynx furnishes an important part of the motive power for emergence. Additional power is furnished by the abdominal contractions.

Rearing Procedure.—The most successful containers used for rearing young nymphs were the small "boats" pictured in figures A and B, of Plate III. It was necessary, if the nymphs were to retain all their appendages, that they be kept in separate vessels. The frame of the boat was of balsa wood which is very light and buoyant, and the "hold" of the vessel was made of silk, the meshes of which were small enough (144 threads to the inch) to confine both the nymph and its prey, while permitting the advantages of the more even temperature of a large vessel of water (figure B, of Plate III). The silk was fastened to the frame with paraffin, and the frame covered with a film of paraffin to prevent "water-logging." The little "sail" was a tag used to keep a record of the dates of molting.

During the eighth, ninth, or tenth instars, the nymphs were transferred to tall glasses (figure C, of Plate III), provided with a piece

⁴ Described by Whedon (1918) for other members of the Order.

of wire screen to serve as a perch. Previous to transformation the glasses were covered with cheese-cloth, fastened down with an elastic band, thus making convenient emergence chambers in which to observe the changes taking place. Aquarium cages (figures E and D, of Plate III) were used for individual adult specimens whose records were to be kept, and similar, larger cages for stock adults. The cage was made of wire screen, fitted to the dimensions of the aquarium. The opening for admitting specimens, food, etc., was protected by a cheese-cloth sleeve.

After an unsuccessful trial of Paramecia as food for the very young nymphs, Chironomid larvae were used, and proved satisfactory for nymphs between the second and seventh instars. The method was to collect Chironomid egg-masses and, when they hatched, to transfer the newly hatched larvae with a pipette to the "boats" in which the nymphs lived.

From the sixth or seventh to the ninth or tenth instars, the nymphs were fed *Ceriodaphnia*, and *Daphnia pulex*; after the ninth or tenth, the larger *Daphnia magna*.

The adults, as they emerged, had to be fed living insects, preferably Diptera. One method was to stock the tank of the rearing cage with large blood worms, so that the damselflies could feed on the emerging midges. Mosquito larvae and pupae were also introduced. But it often became necessary to supplement these with midges collected with a net in the woods.

The Nymphs.—The grown nymph of *I. verticalis* has been described by Needham (1903), Garman (1917, 1927), and Howe (1921). The accompanying figure (Plate I, A) of a nymph in the early eleventh instar, illustrates the external structure, and such pattern as is common to all nymphs.

In most respects the younger nymphs resemble the mature ones, but each instar has fewer specializations than the succeeding one. Previous developmental studies on various Odonata have shown that characters of labium, antennae, tarsi, genitalia, and wing buds, furnish means of differentiating successive instars. The accompanying table summarizes such characters. Inspection of it will show that instars II to VI are readily distinguishable, but that because of the variability of the mental setae, it is impossible to separate with certainty instars VII, VIII, and IX. Instar X can be distinguished by the number of the lateral setae. In the cases of XI and XII, supplementary measurements of various dimensions are useful, but not infallible.

TABLE I.—DIAGNOSTIC CHARACTERS OF NYMPHAL INSTARS
Instars II to XII

Character	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Ant. seg.	3	4	5	5	6	6	6	6	6	6, 7	7
Trs. seg.	1	1	1	2	2	3	3	3	3	3	3
Lat. set.	1	2	2	3	3	4	4	4	5	6	6
Men. set.	0	0	1	2	$\left\{ \begin{array}{l} 2, \\ 2+1 \end{array} \right.$	$\left\{ \begin{array}{l} 2+1, \\ 3 \end{array} \right.$	$\left\{ \begin{array}{l} 3, \\ 3+1 \end{array} \right.$	$\left\{ \begin{array}{l} 3, \\ 3+1, \\ 4 \end{array} \right.$	$\left\{ \begin{array}{l} 3+1, \\ 4 \end{array} \right.$	$\left\{ \begin{array}{l} 4+1, \\ 5, \\ 5+1 \end{array} \right.$	$\left\{ \begin{array}{l} 5, \\ 5+1 \end{array} \right.$
Wing buds	0	0	0	0	vis.	rud.	rud.	inc.	inc.	inc.	inc.
Body 1.* (ave.)	1.18*	1.6	1.9	2.6	3.8	4.6	5.2	6.6	9.0	11.9	12.5
% inc.		35.6	18.8	36.8	46.2	21.1	13.0	26.9	36.4	32.2	5.1
No. spec.	20	18	13	14	11	8	12	12	10	22	8
Body 1.* (max.)	1.30	1.90	2.17	2.79	4.28	5.10	5.71	7.95	10.54	14.30	15.0
% inc.		46.2	14.2	28.6	53.4	19.2	12.0	39.2	32.6	35.4	4.9
Body 1.* (min.)	.99	1.30	1.77	2.23	3.16	3.94	4.76	5.78	7.34	10.0	10.9
% inc.		31.3	36.2	26.0	41.7	24.7	20.8	21.4	27.0	36.2	9.0
Gill 1.* (ave.)	.96	1.2	1.6	1.9	2.5	3.2	3.7	4.2	4.7	5.9	6.0
% inc.		25.0	33.3	18.7	31.6	28.0	15.6	13.5	11.9	25.5	1.7
Head wid.* (ave.)	.30	.43	.54	.75	1.0	1.3	1.55	1.85	2.1	3.1	3.3
% inc.		43.3	25.6	38.9	33.3	30.0	19.2	19.4	13.5	47.6	6.5

Abbreviations:

- Ant. seg. Antennal segments.
- Trs. seg. Tarsal segments.
- Lat. set. Lateral setae of labium.
- Ment. set. Mental setae of labium; $2 + 1$, etc., = 2 long, 1 short.
- vis. Barely visible.
- rud. Rudimentary.
- inc. Increasing in size.

No. spec. Number of specimens on which averages are based.

* Measurements of length and width are in millimeters.

Growth.—Measurements on body length were made daily on five nymphs during instars II to VII, to determine the increase between molts as well as at the molt. It was found that there was a definite

progression in size as the instar advances, followed by a slight step up at molt.

The data on size, recorded in Table I are the maximum, minimum, and averages of measurements of a collection of nymphs chosen indiscriminately as to age, except that there were always some recently emerged, some on the verge of molting again, and some intermediate ones. In order to get an estimate of the rate of growth from instar to instar, the percentage of increase was calculated from the measurements given in the table. In every case, the percentage of increase fluctuates, as though growth occurred in cycles, rather than at a constant rate.⁵ But there was no very marked agreement between the percentage of increase of the various structures measured, in any instar.

Hence, in order to determine whether sets of measurements made at the same period in each instar would give more constant rates of growth, exuviae were examined—ten for each instar. Measurements were made on width of mentum and length of hind femur. These are sufficiently rigid structures to eliminate error from wrinkling or collapse. The results, given in Table II, show a similar inconstancy.

TABLE II.—MEASUREMENTS OF PARTS OF EXUVIAE
Instars II to XI

	II	III	IV	V	VI	VII	VIII	IX	X	XI
Width of mentum*	.48	.64	.82	.95	1.18	1.49	1.96	2.36	2.79	2.99
% increase	33.3	28.1	15.9	24.2	26.3	31.5	20.4	18.2	7.2	
Length of femur*	.68	.95	1.23	1.54	1.84	2.35	3.05	3.77	4.47	4.99
% increase	39.7	29.5	25.2	19.5	27.7	29.8	23.6	18.6	11.6	

* Measurements in millimeters.

Factors Affecting Length of Instars.—The duration of any instar is subject to the influence of a number of factors, the most obvious of which are temperature, food, and disease. My object was to simulate normal optimum conditions—as nearly as possible. It was comparatively easy to supply the nymphs with all the food they would eat. To avoid excessively high temperatures, the aquaria

⁵ Balfour-Browne (1909) distinguishes between "growth moults" and "developmental molts."

were kept in a cool part of the insectary in hot weather, and they were moved out under the glass in the greenhouse when the weather was cool. The influence of disease was probably the most important factor affecting the period between ecdyses.

During the latter part of August there was a noticeable lengthening of the instars. Early in September the morality increased alarmingly. On September 20 inspection of a number of the dead nymphs revealed that in almost every one the post-abdomen was darkened. Upon dissection, each of these had three black plates in the rectum, corresponding to the pads of specialized tissue that are sometimes called rectal "glands." Evidently this tissue is subject to some disease which may be fatal to the nymph.

The diseased condition could be noted in the living nymphs as well, and a record was kept of their behavior. Sometimes after a molt the nymph seemed to be normal again and recovered. Otherwise death usually occurred within a day or two after the diseased nymph had molted.

Duration of Instars.—The object of rearing a relatively large number of individuals was to determine the average length of each instar, and to insure having some of them complete the life cycle. Table III shows the data obtained. The instars are arranged horizontally. The ordinates are the instar periods, and the plotted figures represent the numbers of individuals which molted within a given number of days. There is a fluctuation in totals in the early instars, due to the occasional loss of the cast skins, whereby the data on the instar period were lost, for the preceding and succeeding instars.

It will be seen from inspection of these data that the first five instars show normal curves, sloping up sharply to a single peak, and down again a little more gradually. These instars presumably represent an almost normal condition, with the most nearly optimum in the fifth, whose range is narrowest. The slightly longer period of the second instar, since it is uniform, must be influenced by some one factor, affecting all the individuals.

A possible unfavorable factor might be the inaccessibility of food; for even newly hatched Chironomid larvae were almost as large as the infant nymphs and therefore difficult for them to manage. However, in the last lot in the experiment (a group of nineteen) the second instar period was shortened to a mean of 6.3 days, probably because of improved technique and feeding facilities. From which one may infer that if optimum conditions could be secured, the second instar would not be longer than the others.

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TABLE III.—DURATION OF NYMPHAL INSTARS

Vertical columns are the number of individuals per instar in each day-group
Lower table gives the mean length of instars

Period in days	INSTARS										
	II	III	IV	V	VI	VII	VIII	IX	X	XI	
2		2	1		1						
3		16	7	15	5	4	1				
4		26	45	33	19	6	2	4	2		
5	4	21	29	28	24	21	8	8			
6	14	8	6	8	18	8	9	6	1		
7	23	5	2	3	11	10	9	4	6		
8	20	3			3	7	6	2	4	1	
9	14	4	1			4	4	2	3	1	
10	10				1	2	8	4	2	1	
11	5					4	5	5	4	1	
12						6	3	3	2	3	
13						1	3	2	1	6	
14							1	2	2		
15						2		3	2		
16							1	1	1		
17	1						4	2	1	1	
18							2		1	1	
19							1				
20							2				
21								1	2	1	
22								1	1		
23							1	1			
24								2			
25								2			
26									1	1	
27											
28											
29							1				
30											
31											
32											
33									1		
Total no. individuals	91	85	91	87	82	76	70	55	36	81	
Mean in days	7.8	4.8	4.5	4.4	5.3	7.1	7.9	10.9	11.5	13.7	
σ	1.7	1.6	1.1	.97	1.4	2.9	4.8	6.0	5.2	4.3	
S. E.	.18	.18	.11	.10	.16	.34	.59	.81	.87	1.0	

The later instars, seven to eleven, show irregular curves, and prolonged periods, indicating the influence of one or more unfavorable factors. And the irregularity coincides with the outbreak of disease.

The very low error in proportion to the mean in instars II to VI shows the significance of these figures. In the later instars the de-

creasing number of individuals makes the value of statistical treatment doubtful, but the data are included to complete the present record.

However, to show that the average period is fairly uniform for all stages up to the penultimate, I present the record of eight individuals which I think may be considered normal. These were a group that maintained steady growth throughout, transforming early in September, at the end of eleven instars. Apparently they escaped the disease entirely. The data for these nymphs are given in table IV. There is nonconformity in the second instar as in all other individuals of the same age. But the following instars show a nice degree of uniformity, with a slightly lengthening period in the later instars, and a noticeable increase in X. The ultimate instar is remarkably constant at twelve to thirteen days. In these eight individuals, the total nymphal period ranged between fifty-seven and sixty-four days.

TABLE IV.—DURATION OF NYMPHAL INSTARS OF EIGHT NORMAL INDIVIDUALS
Vertical columns are number of individuals per instar in each day-group

Period in days	INSTARS										
	II	III	IV	V	VI	VII	VIII	IX	X	XI	
3		1	1	2	1	1					
4		3	4	3	3	4	2	1	1		
5		4	3	3	3	2	5				
6	1				1	2	4	1			
7								1	2		
8		2				1			3		
9		4							1		
10	1										
11									1		
12										3	
13										5	
Average in days	8.5	4.4	4.3	4.1	4.5	5.0	5.3	5.3	7.8	12.6	

Variation in the Number of Instars.—There were eight other nymphs, with a record of disease in August and September, in which the whole nymphal period was extended beyond the normal time for transformation. These all molted into the twelfth instar. One died from disease. Six others, finding themselves in an environment that continued the warm temperatures and abundance of food of summertime on into November and December, finally transformed

after a much prolonged ultimate instar, viz., thirty-eight to sixty days. Hence it would appear that eleven is the normal number of instars for the summer generation, and that twelve⁶ or thirteen is common for those (nearly mature ones) that live over the winter. One individual, however, molted into the thirteenth instar in October, after nineteen days in the twelfth, and died shortly after from disease.

Mortality.—The mortality figures are based on the actual number of nymphs in the experiment, beginning with 120. A few of the dead or missing were replaced at first, if individuals of the same age were still available.

The mortality due to so-called natural causes and accidents decreased from fifteen percent in the second, to three percent in the fifth. This would be expected as the nymphs grow stronger and better able to cope with circumstances. Obviously these nymphs were protected from adverse conditions to a much greater extent than in their natural habitat.

The mortality rate in instars VI and VII was about stationary at six percent, but VIII began to show the effects of disease. Thereafter the rate increased to twenty percent, thirty-five percent, and fifty percent when the epidemic reached its peak.

INSTARS II TO XI

	II	III	IV	V	VI	VII	VIII	IX	X	XI
Total	120-	110-	98-	92-	89-	83-	78-	71-	54-	36-
nymphs	102	98	93	89	83	78	71	55	36	18
% mort.	15	11	5	3.2	6.7	6	9	20	35	50

Pre-transformation Changes in the Ultimate Instar.⁷—Early in the ultimate instar, the eye is similar in shape and position to that of the preceding instars (Pl. I, fig. A). Careful examination under the binocular shows that a considerably greater area of cuticula is marked off in minute facets (fig. B). Bands of black pigment (present also during several previous instars), are visible, as shown, extending to the margin of the faceted area. The ventral aspect is quite similar to the dorsal. The ocelli are inconspicuous at this time. Their position is marked by transparent areas in the cuticula.

⁶ Overwintered nymphs molt at least once in the spring, before transformation.

⁷ This record taken from those nymphs that transformed at the end of eleven instars.

Usually about the fifth day, the conspicuous black part of the eye becomes somewhat longer, by increase along the inner margin, making the whole eye appear less lateral, and more frontal (Pl. I, fig. C). At the same time there are slightly darkened crescents in the region of the ocelli, and sometimes it is possible to see their nerve trunks leading from the brain.

By the sixth or seventh day the eyes have assumed their oblong shape and frontal position. There are also certain changes in the shape of the whole head (Pl. I, fig. D). The altered external appearance of the eye is due no doubt to the growth and pigmentation of a great many new ommatidia, that will constitute a considerable part of the functional imaginal eye (Lew, G. T., 1934). By this time the ocelli are distinct, brownish, crescent shaped structures, beneath the cuticula (fig. D).

Immediately following the development of the oblong eye, the wings change from their blade-like shape and overlapping position to a more cylindrical shape and a parallel position.

Usually during the two or three days before transformation a certain definite color sequence can be noted. The wings take on a pale orange or brownish tint, and the thorax becomes brownish. The colors gradually deepen, and the day before transformation, the whole nymph is an orange-brown, the thorax darkest, sometimes forecasting the imaginal pattern; and the thoracic spiracles are conspicuously black.

Several hours previous to the last molt the nymph climbs partially out of the water, either vertically with the head and thorax out, or horizontally, with one side of the thorax out. Sometimes this behavior was noted in the afternoon, in which case the nymph would transform the following morning. This probability indicates that the caudal gills have become non-functional, and that direct respiration has commenced, making first use of the thoracic spiracles.

THE ADULT

Réaumur (1734-42) gave us the first recorded description of the emergence of the odonate imago. Since then the phenomenon has been described for various members of both Anisoptera and Zygoptera. The thesis (in Cornell University Library) of which this paper is a condensed version, contains a detailed description of the transformation of *Ischnura verticalis*.

Female Polychromatism.—There are records in the literature of at least four color variations in the adult females of *I. verticalis*, with the male resembling one of them. The predominant colors of

the male are green and black, with a conspicuous blue marking on the tip of the abdomen. The four color forms of the female may be summarized as follows:

- Orange Forms: (1) "Heterochromatic" of Calvert^s with blue-tipped abdomen.
 (2) "Orange variety" of Garman^s and of Lyon,^s with dorsum of segments four to ten entirely bronze.
- Dark Forms: (1) "Black variety" of Williamson^s and of Garman, like the male, but with dorsum of abdomen entirely dark.
 (2) "Homeochromatic" of Calvert; "blue-tipped" variety of Garman; "green form" of Ris;^s resembling the male.

Note: For additional descriptions of adult females, see: Say (1839); Hagen (1861); Selys-Longchamps (1876); Calvert (1893); Walker (1908); Garman (1917), and Needham and Heywood (1929). All agree that these forms all become pruinose with age.

Of these four types of females, *only* the second, the non-blue-tipped orange variety seems (with a single individual exception) to be present at Ithaca, New York. This fact leads to the suggestion that the color differences may represent different geographic races, for it will be noted in the literature that the specimens described are from various parts of North America, over an extensive geographic range.

In the vicinity of Ithaca, N. Y., specimens showing varying degrees of confluence of the postocular spots are not uncommon and there is one specimen in the Cornell collection (collected at Ithaca in 1897), in which the postocular spots are entirely isolated from the pale color of the occiput. In this specimen the pale color is greenish brown and the dorsum of the abdomen is dark on all segments. It is, no doubt, the "black variety" of Garman and of Williamson, and it appears to be the only representative of any type other than the "orange variety" of Garman and of Lyon recorded from this vicinity. In the same individual, the antehumeral pale stripe is interrupted, forming an inverted exclamation mark, as in *I. posita*. This latter variation was also occasionally noted among the specimens reared for experimental work. It occurred in both males and females.

^s Calvert (1915); Garman (1927); Lyon (1915); Williamson (1900); Ris (1903).

For observation on developmental changes in female coloration, adults were kept in aquarium cages (Pl. III, figs. E and D), both collectively and singly. They were fed daily, allowed to mate and oviposit, and were under constant observation during their entire adult life. Their color changes were noted carefully, especially during and immediately following transformation, and in no case was the abdomen of the female blue-tipped, nor were any specimens colored like the male.

During and after transformation, the color sequence is as follows: At first pale all over, until the imago has attained its full size (requiring three-fourths of an hour after actual emergence). Gradually the dark parts of the thorax assume an olivaceous hue, while the light parts are still buff. Then the dorsum of the abdomen becomes slightly olivaceous, an orange tint can be seen on segments one, two, and three, and on the thorax. After about one hour the imago begins to walk about and soon after is able to fly. A half hour later, the thorax is ochre yellow and dark brown, the dorsum of abdomen ochre yellow on segments one, two, and part of three, and dark olivaceous on the remainder. In some specimens there are light buff areas on the posterior margins of eight and nine, or only of eight. After two hours the colors are all somewhat darker. After four more hours, or about seven and one-half hours from emergence, the colors are mature, *i.e.*, orange and bronze on the thorax, bronze on the dorsum of segments four to ten, with light strips on eight and nine (when present) scarcely noticeable.

The blue tail pattern of the male is developed gradually, appearing orange at one hour from emergence, grey after four hours, pale blue after six and one-half hours, and mature blue the following day.

It is not true that blue is present early in the life of orange females of this type, and later disappears. It must certainly be a condition present in some, and absent in others. It might even be, since in the ontogeny of the male orange or buff is a forerunner of blue, that those females with buff or tawny bands on eight or nine are intermediate forms in the evolution of the blue-tipped females.

After wearing these colors for four to seven days, the orange becomes distinctly darker, and more reddish, followed by very dark brown, and at the same time the metallic bronze-black becomes dull, lustreless black. This transition phase has a duration of from one to two and a half days. Then the individual becomes pruinose, *i.e.*, the orange markings are replaced by bluish-grey and the bronze areas become pollinose. The pruinose phase lasts for the remainder of adult life, which may be several weeks.

Dissection of females of various ages showed the ovaries immature in the earliest imaginal state, while, at the time of color change, one egg at the end of each ovarian tube or egg string is mature. This fact explains the various records in the literature of slender abdomens in the orange variety, and plump abdomens in the pruinose ones. Oviposition never occurred before the color change, but usually directly after, hence color change is evidently more or less coincident with sexual maturity.

The fact that imagos may live for over a month, and are in the pruinose phase for three-quarters of that time, accounts for the predominance of these individuals in the latter part of the season.

No doubt the generations overlap considerably, with more or less continual emergence of adults from May to August, but the cycle is probably as follows: Adults emerge in the latter part of May from overwintered nymphs, and adults emerge in early August from summer nymphs to produce the next crop of winter nymphs.

Mating and Oviposition.—Mating usually takes place during or just after the color change of the female, namely between the fourth and eighth days.

The courtship behavior of unmated, mature, females is more conspicuous than that of the males. The female, perched on a blade of grass, with the post-abdomen flexed ventrally (as shown in fig. 1, A and B) and wings fluttering, will, on the approach of a male, commence a vigorous fanning with her wings, to attract his attention.

Oviposition may begin within a few hours after mating, or not for several days thereafter. I have records of first oviposition varying up to ten days after transformation. Some females have been known to deposit eggs unfertilized. Plate I, figs. C and D show the positions assumed by females while depositing eggs.

As many as four hundred eggs may mature simultaneously (*viz.*, the terminal ones of all egg-strings of both ovaries), and are deposited in the course of a few hours. Then after an interval of about five days another lot is matured and deposited; and this procedure may be repeated several times. I have a record of one veteran female which lived thirty-four days of adult life, and deposited eggs on five successive occasions, although the last lot, which was laid just before she died, was incomplete. Her total egg production amounted to approximately sixteen hundred fifty eggs. This female was fertilized but once, yet all the batches of eggs hatched.

PARASITES

Trematodes.—While nymphs were being dissected, small flat-worms were frequently noticed in the haemocoele. The fluke popu-

lation then became a matter of interest, and a preliminary investigation was undertaken. Both nymphs and imagos of *I. verticalis* are subject to invasion by certain immature stages of two quite different trematodes, which may be described as follows:

Fluke no. 1 is a tailless Distome cercaria, occurring in the haemocoel of nymphs and adults. Living specimens measure approximately 1.5 mm. long, by 0.15 mm. wide, when fully extended, and about 0.55 mm. \times 0.19 mm., when contracted. The Y-shaped excretory canal is conspicuous. Oral and ventral suckers are present; the former measuring about 0.07 mm. and the latter 0.05 mm. in diameter. The piercing organ, if present, was not observed.

A similar fluke, designated as Fluke no. 1A, a metacercaria of a Distome, was found encysted in the respiratory tissue of *Anax junius* and *Sympetrum vicinum*. When the metacercaria escapes from the cyst, it moves about actively, by means of its two suckers. The living individual is indistinguishable from Fluke no. 1. The size is approximately the same. The following description is from preserved and stained material. There is an anterior oral sucker measuring 0.07 mm. to 0.08 mm. in diameter. The oral cavity opens into a short muscular pharynx about 0.05 mm. wide (Pl. II, G.) The esophagus is extremely short, dividing at once into a pair of intestinal coeca, which extend back to within an eighth of the body length from the posterior end. The Y-shaped excretory canal is dorsal to the intestinal coeca where they cross, but it seems to be somewhat ventral at the extremities. The ventral sucker is situated slightly caudad to the middle of the body, just posterior to the forking of the excretory canal, and measures 0.05 mm. in diameter.

Rudimentary gonads are present. The paired testes are located ventrally, behind the ventral sucker, and between the coeca, just posterior to the forking of the excretory canal. The left testis is slightly anterior to the right one. The ovary lies slightly to the left of the ventral sucker. Its extent is variable, and it is rather indistinct.

Attempts at vital staining with neutral red have thus far been unsuccessful in demonstrating the penetration glands, but in some of the living material and in some preserved specimens it is possible to distinguish a structure which is indicated in Pl. II, G, just in the crotch of the intestinal coeca. Whether this represents the remains of the penetration glands, or whether it is a rudimentary uterus, could not be ascertained. It seems to have a duct leading to the exterior at the anterior end of the animal, to the right of the oral sucker.

The above description, although incomplete, seems sufficiently similar to descriptions of other metacercariae recorded from Odonate hosts, to warrant placing this form with them, in the family Plagiorthyidae.

Fluke no. 2 is also a tailless Distome cercaria. It occurs within the mid-intestine of both nymphs and adults of *I. verticalis*. Living specimens exhibit two conspicuous characteristics. There is an enormous bowl-shaped ventral sucker (see lateral view, in Pl. II, J2). And the excretory canal appears to be an inverted V-shaped structure, which probably represents the union anteriorly of the cornua of a Y-shaped canal, whose posterior portion is inconspicuous. The supposition is substantiated by a fairly definite median opening at the caudal extremity, in some of the preserved specimens. This type of excretory canal is said to be characteristic of only one family of Digena, the Hemiuridae.

The extended, living cercaria measures about 1 mm. in length, with proportions as indicated (drawn to scale) in Plate II, K. The oral sucker, which is sub-apical, measures about 0.14 mm. \times 0.07 mm.; the large ventral sucker is 0.22 mm. in diameter, situated just behind the middle of the body.

The oral cavity opens into a muscular pharynx, which in turn leads into a sac-like oesophagus. The intestinal coeca do not open directly out of the oesophagus, but are connected with it by means of a pair of lateroventral, bulb-like structures, which leave the oesophagus about midway of its length (see Plate II, L). The intestinal coeca are narrowed in the region of the ventral sucker, and they extend almost to the posterior extremity of the body.

The gonads appear as very rudimentary structures. The paired testes are ventrally located behind the ventral sucker, toward the lateral margins of the intestinal coeca, the right one slightly anterior to the left. A median structure near the posterior end of the body probably represents the ovary.

Occurrence and Infestation—From July 10 to August 10 cercariae of Fluke no. 1 were found in the haemocoel of nymphs and adults of *I. verticalis*, although with decreasing frequency. Nymphs commonly harbored six to eight flukes, but there were seldom more than two or three in imagos. This fact may be an indication of a lethal dose. After the middle of August the flukes disappeared.

Meanwhile the encysted metacercariae, mentioned above as Fluke no. 1A had been discovered in great abundance in nymphs and imagos of the large Anisopterous dragonflies, *Sympetrum vicinum*

and *Anax junius*, and to a limited extent in *Libellula pulchella* and *Plathemis lydia*—all collected from the same pond from which the infected *I. verticalis* were taken.

In these larger nymphs, the cysts were always found within the tracheal gills of the branchial chamber. There seems to be a proliferation of host tissue, in the nature of a gall, surrounding the trematode cyst. When carried over into the imaginal dragonflies, the cysts undergo a change of location. The branchial basket is no longer used for respiration when the insect becomes aerial, and the rectum is consequently greatly reduced. So, in the adult dragonflies, the cysts are found thickly clustered around the reduced rectal region, held together by a connective-tissue-like structure.

This trematode seems always to select a location within the host that will ensure it a ready supply of oxygen. In the older imagoes it was especially noticeable that each cyst was connected with at least one fairly large trachea, and sometimes the cysts were located somewhat away from the rectal region. Plate II (figure H) illustrates this remarkable response by the host to the trematode invasion. Tracheal ramifications completely envelope the cyst in a glistening white sheath, or gall. The figure shows two galls in the process of formation, one small gall from which the cyst has been removed, and one large gall showing the extensive ramifications of the tracheae. Occasional bulging of the sides of the gall indicated that the fluke was moving inside, and when this gall was opened, it revealed a thin-walled cyst of the same proportions as the others in the figure, namely about 0.3 mm. in diameter.

It is important to state that in all cases of encystment, when the galls were opened carefully with dissecting needles, the thus liberated metacercariae were enclosed in a thin transparent sheath, or cyst wall. None were found with the thick striated wall possessed by a percentage of the specimens recorded by Szidat (1926), Ono (1928), and Kotlan and Chandler (1927), for various *Prosthogonimus* sp. taken from odonate hosts.

The significance of this point did not appear until the paper by Ono came to hand, which was only after some attempted infection experiments on domestic chickens had produced negative results. Ono observed that only the metacercariae from thick walled cyst produced infection. It may be that the thin-walled transparent cysts developed into the ones with the thick striated walls, or that the above mentioned authors have been dealing with more than one kind of trematode, as suggested by Kotlan and Chandler (1927).

Regarding the possible rôle of the damselflies in the life history of the fluke, assuming that Fluke no. 1 and Fluke no. 1A might be different stages of the same species, it has been noted above that long after the cercariae ceased to be present in the damselflies, the similar, encysted metacerariae continued to be abundant in dragonflies. In fact, infected nymphs were taken from the pond as late as December. It is possible that dragonflies could be infected by eating infected damselflies. This hypothesis is especially plausible since the larger dragonfly nymphs prefer insect prey to the small plankton organisms which form the diet of damselflies.

Szinitzin (1907) records certain cercariae, having a form and mode of locomotion resembling *Culex*, being eaten by *Agrion* and *Epitheca* and producing infection in the latter. Hence it is theoretically possible that *Ischnura*, and perhaps *Anax* also, could be infected in this manner.

On the other hand Krull (1931) reports "active" infection by the cercariae of *Pneumonoeces medioplexus* and *Pneumobites parviplexus*. These cercariae enter the rectum, caught by the respiratory currents, and there they penetrate the gill tissue.

The occurrence of Fluke no. 2 was first noted on July 16. It continued to be present until August 24, although with decreasing frequency after August 17. Of the sixty-two nymphs and adults of *I. verticalis* in which the presence or absence was noted, fifty-five percent were infected. The infection rarely exceeded six parasites per host.

A Green Flagellate—The nymph infected by this protozoan may often be noted waving the tip of the abdomen back and forth in a restless manner. If the nymphal cuticula is transparent, microscopic examination shows that the interior of the posterior end of the abdomen is dark greenish. The instar period of infected nymphs is always longer than that of normal individuals. When the infected nymph molts or transforms, the rectal cuticula of the cast skin contains a multitude of unicellular green organisms.

Within two days the nymph again exhibits the uneasy, waving movements of the abdomen. Closer examination shows three elongate blackish structures within the posterior abdomen. These are the diseased "rectal pads." Sectioned material shows that the rectal pads are badly disintegrated after infection, in spite of the fact that the protozoans do not penetrate the cuticula, but remain in the lumen of the rectum.

In the majority of cases the nymphs die before the fourth day after the molt. Occasionally they recover, if the infection has been slight.

Studies were made of the living material in many stages of the life cycle as possible. Scarcely any two nymphs harbored protozoans of exactly the same phase of development. Both sessile and motile forms occur. The former may be attached to the cuticular lining of the rectum of the nymph, or may be free in the lumen of the rectum. The shape may be globular or ovoid; the individuals may be separate, or in clusters loosely attached to a central matrix. The ovoid individuals exhibit limited metabolic movement. The periplast is transparent and colorless, and there is an irregular peripheral structure, diffusely green, with clear granules distributed through it. The nucleus is central and colorless in living material, but deeply staining in sections. A pair of reddish-brown pigmented bodies is present, centrally or eccentrically located (Plate II, C). Asexual reproduction in the sessile stage is by fission or multiple cell formation, (Plate II, B1 and B2).

The motile forms were obtained when ovoid organisms from cast skins were kept for one-half hour to several hours on a slide in a moist chamber. On several occasions individuals changed from the nonmotile to the motile phase while under observation. The motile form is a flagellate. Only one flagellum was seen, and it was longer than the body. The form is elongately cylindrical, with transparent periplast prolonged into an acute process posteriorly. The cell contents are green peripherally, as in the sessile forms, with clear granules distributed throughout. A transparent central nucleus, and a pair of dark pigmented bodies are present. Anteriorly a clear area seems to represent a gullet, opening into an anterior reservoir.

Other Parasites or Epizoians—Unidentified gregarines were frequently found in the lumina of the mid-intestines of nymphs and adults of *I. verticalis*. They lie between the peritrophic membrane and the intestinal wall, with the anterior tip of the organism buried in the epithelium. About forty percent of the insects examined for parasites were infected with gregarines, varying from one to twenty or thirty per damselfly. In about six percent of the nymphs examined, round, opaque, white cysts were found.

During mid-season it was common to find nymphal stages of aquatic mites attached to the *Ischnura* nymphs. Their favorite places of attachment were the ventral conjunctiva of the thorax, the bases of the legs, or occasionally the region between the wing pads

and the body. About thirty percent of the nymphs examined were infected, as many as twenty mites sometimes being present on one host. Through the kindness of Dr. Ruth Marshall, these mites have been identified as belonging to the genus *Arrhenurus*.

A discussion of the parasites of *I. verticalis* would not be complete without mention of *Hydrophylax aquivolans* a minute Trichogrammid egg-parasite, described by Matheson and Crosby (1912).

SUMMARY

In this paper life history data have been compiled on all stages of the development of *I. verticalis*, beginning with one hundred twenty eggs, and ending with thirteen adults.

The phenomenon of hatching, repeatedly observed, was found to be analogous with molting and transformation. The myth of a transient "cephalic heart" in the pronymph is replaced by the explanation that water is swallowed into the digestive tract, thus increasing the body pressure and assisting in the rupture of the embryonic or nymphal sheath.

Diagnostic characters of the instars are described. Measurements were made on various body structures from instar to instar, to study growth. The duration of nymphal instar has a mean period of about five days under optimum experimental conditions. In the later instars, many of the nymphs were affected by a disease which produced a pronounced lengthening of the instars period and an increased mortality.

The subject of female polychromatism is discussed, and the fact established that only one of the four known color varieties is present in the Ithaca fauna.

A brief study of the parasites of *I. verticalis* reveals a green protozoan, frequently fatal to the nymph inhabiting the rectal cavity; and two widely different distome Trematode cercariae, one in the haemocoel and one in the mid-intestine, of both nymphs and adults.

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Fuhrman, O. Hemiuridae. (in Handbuch der Zoologie. by Kükenthal und Krumbach. Berlin und Leipzig. W. De Gruyter und Co., 1923-) Bd. 2 (2) 1928, pp. 108-109. figs.

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Krull, W. H. Life History Studies on Two Frog Lung Flukes, *Pneumonoeces medioplexus*, and *Pneumobites parvplexus*. Amer. Microsc. Soc. Trans. 1931, 50 : 215-277. figs.

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Szidat, L. Der Ueberträger der Trematoden krankheit unserer Legenhühner. Cetralbl. f. Bakt. und Parasit. I. Originale. 1926, 99 : 561-564. 6 figs.

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PLATE I

Figure A.—A nymph in the early ultimate instar, with lateral view of the median gill.

Figures B, C, and D.—Successive changes in the compound eye during the ultimate instar.

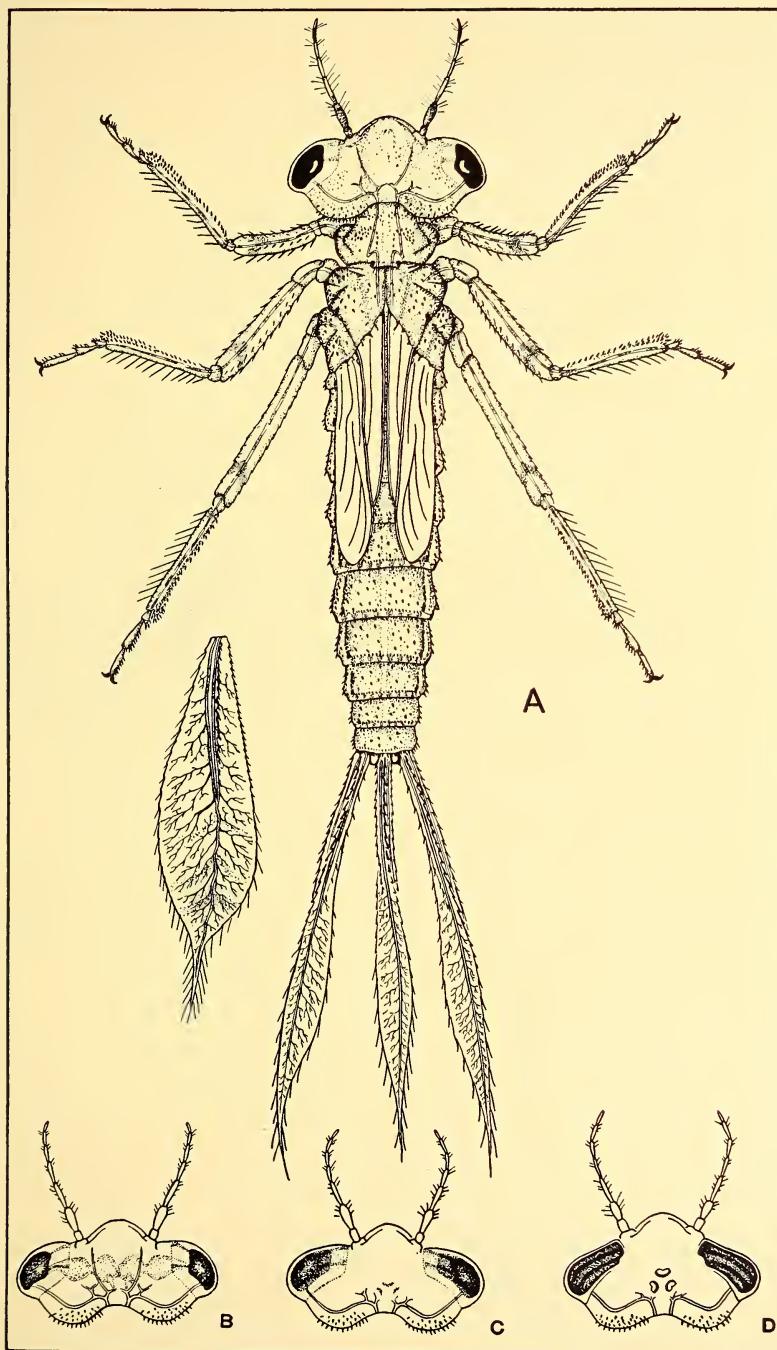


PLATE II

Figures A-E.—Green protozoan, drawn from living material.

A.—Typical sessile form.

B1.—Division by fission.

B2.—A late stage in multiple division.

C and D.—Sessile ovoid pre-flagellate forms.

E.—The flagellate.

Figure F, 1-5.—Fluke no. 1. Cercaria from hemocoele of *I. verticalis*. Sketches from living specimens, showing change of shape in locomotion.

Figure G.—Fluke no. 1A. Metacercaria from cyst in *Anax junius*.

Drawn from preserved and stained specimen. Ventral view $\times 120$.

Figure H.—Fluke no. 1A. Encysted metacercariae from *Anax junius* imago, $\times 120$, showing formation of tracheated galls.

Figurs J, K, L.—Fluke no. 2. Cercariae from lumen of mid-intestine of *I. verticalis*.

Figure J, 1 and 2.—Sketches of dorsal and lateral views of living specimens.

Figure K.—Dorsal view $\times 120$ of extended living specimen.

Figure L.—Ventral view $\times 120$ of mounted and stained specimen.

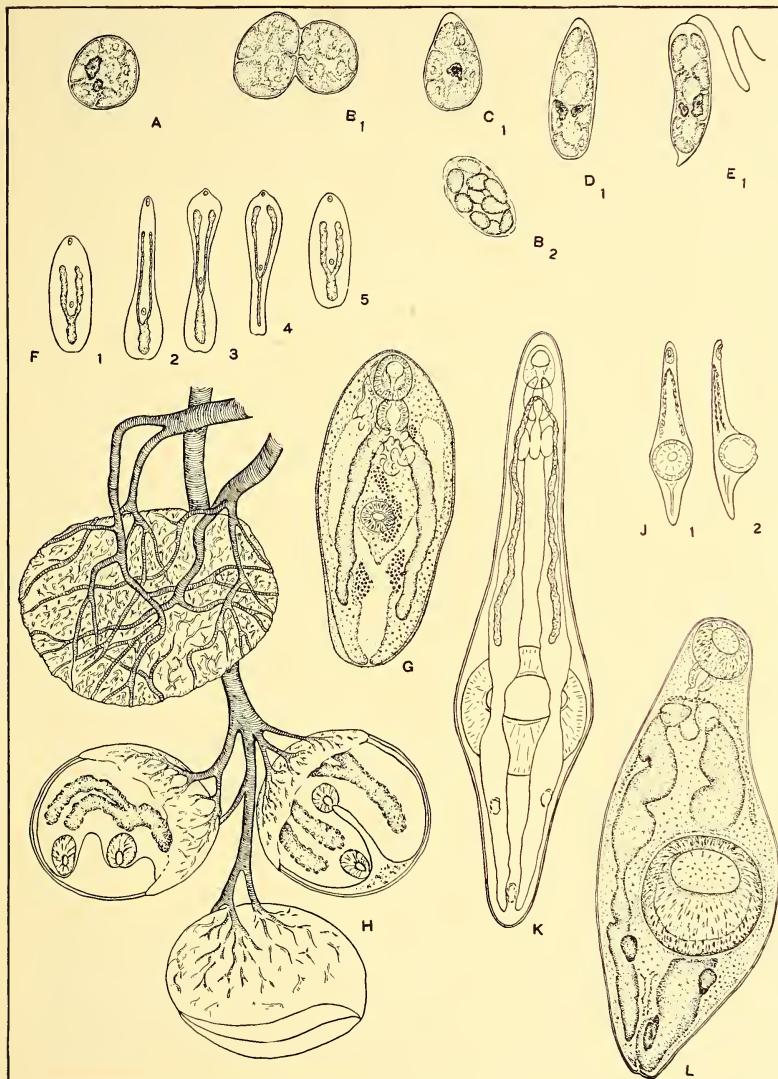
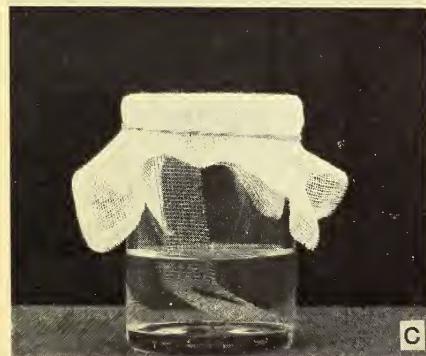
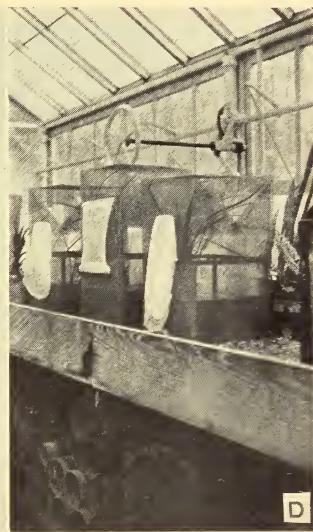


PLATE III

- Figure A.—Side view of a “boat” used for rearing small nymphs.
About two-thirds natural size.
- Figure B.—Enamel tray with a group of “boats” floating in the water.
- Figure C.—Glass tumbler in which larger nymphs were kept, until transformation. Note nymph on lower side of bent screen perch.
- Figure D.—Three such rearing cages on a bench in the greenhouse where the work was carried on.
- Figure E.—Aquarium covered by screen cage, used for rearing stock adults, and for oviposition. Note grasses and sedges growing in the water, and sleeve for removing insects, etc. Size of aquarium, 11" × 11" × 11"; cage 12" × 12" × 24".



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ENTOMOLOGICA AMERICANA

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BIBLIOGRAPHY OF THE DESCRIBED LIFE-HISTORIES OF THE RHOPALOCERA OF AMERICA NORTH OF MEXICO 1889-1937

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AND

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PREFACE

This work is an attempt to bring up to date the section on Rhopalocera of the Bibliographical Catalogue published by Henry Edwards in 1889 (Bul. U. S. Nat. Mus., no. 35).

The specific names adopted are those used by the authors cited. We have no way of knowing if the authors' names are correct and cannot be held responsible for their names. The generic names follow those of Edition III of Holland's Butterfly Book, and the sequence of genera and species is also as in that work. Although entomologists disagree on the use of some of these names, we have felt it most advisable to follow the arrangement in the manual most available to both amateur and professional entomologists. The priority and synonymy of names constitute a problem with which we are not concerned.

The citations to Holland are to Editions I and III; Edition II is a reprint of I.

JUN 30 1938

We have endeavored to guard against any errors or omissions and shall appreciate having any called to our attention. Finally we are deeply indebted to Mr. L. E. Chadwick for his help and suggestions.

D. D.
V. G. D.

Danais plexippus (Linnaeus). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 724-726, 737-744; pl. 64, fig. 1; pl. 67, fig. 4; pl. 62, fig. 6; pl. 70, fig. 3; pl. 74, fig. 5; pl. 78, figs. 1-5; pl. 86, figs. 1, 37; pl. 78, figs. 10, 16; pl. 62, fig. 5; pl. 83, figs. 1-3; pl. 86, fig. 17; pl. 87, fig. 20, 1889 (life history). Frohawk, F. W. Entomologist, 44 (583) : pp. 377-382, 1911 (life history). Aiken, J. Entomologist, 45 (588) : pp. 146-147, 1912 (larva, chrysalis). Girault, A. A. Ent. News, 23 (9) : p. 407, 1912 (metamorphosis). Figueroa, C. S. Rev. Chil. Hist. Nat., 33 : pp. 49-53, fig. 13, 1929 (habits). Holland, W. J. Butterfly Book, (1), p. 82; (1, 3) : pl. 3, fig. 5; pl. 4, figs. 1-3; figs. 4, 16, 24; pl. 7, fig. 1 (life history).

Food plant: *Asclepias*, *Apocynum androsaemifolium*, *Acerates*.

D. berenice strigosa Bates. Coolidge, K. R. Trans. Am. Ent. Soc., 51 : pp. 27-33, 1926 (life history). Comstock, J. A. Bul. S. Cal. Acad. Sci., 31 (1) : pp. 16-18, pls. 8, 9, 1932 (larva, chrysalis).

Food plant: *Nerium*, *Asclepias*, *Funastrum lineare heterophyllum*, *Vincetoxicum*, *Philabertia linearis*, *P. heterophylla*, *Stapelia*.

Heliconius charithonius (Linnaeus). Dammers, C. M. Bul. S. Cal. Acad. Sci., 36 (1) : pp. 23, 24, 1937 (food plant). Holland, W. J. Butterfly Book, (1), p. 92; (3), p. 75 (food plant, chrysalis).

Food plant: *Passiflora*.

Dione vanillae (Linnaeus). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1816-1819, 1889 (life history). Randolph, V. Trans. Kans. Acad. Sci., 30 : pp. 351-362, 1922 (life history). Holland, W. J. Butterfly Book, (1), pp. 97, 98; (3), p. 79 (larva, chrysalis). O'Byrne, H. Ent. News, 43 (4) : pp. 97-99, 1932 (food plant). Parks, H. B. Bul. Brooklyn Ent. Soc., 30 (5) : p. 213, 1935 (food plant).

Food plant: *Passiflora*.

Euptoieta claudia (Cramer). Scudder, S. H. Butterflies of

E. U. S. and Can., pp. 523–527, pl. 64, fig. 23; pl. 67, fig. 8; pl. 75, figs. 6, 7; pl. 79, fig. 1; pl. 84, fig. 89, 1889 (life history). Giacomelli, E. An. Soc. Cient. Argent., 78: p. 171, 1914 (larva). Holland, W. J. Butterfly Book, (1), pp. 99, 100; (3), pp. 80, 81 (life history).

Food plant: *Viola*, *Passiflora*, *Sedum*, *Desmodium*, *Portulaca*, *Podophyllum*.

E. hegesia (Cramer). Swainson, E. M. J. N. Y. Ent. Soc., 9 (2): p. 79, 1901 (larva).

Food plant: "wild yellow primrose."

Argynnis idalia (Drury). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 540–541, 542–543, pl. 64, fig. 34; pl. 67, fig. 19; pl. 72, fig. 10; pl. 75, fig. 10; pl. 79, fig. 2; pl. 84, fig. 4, 1889 (life history). Holland, W. J. Butterfly Book, (1), p. 103, pl. 5, fig. 4; (3), p. 84 (larva, chrysalis).

Food plant: *Violaceae*.

A. diana (Cramer). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1800–1802, 1889 (life history). Holland, W. J. Butterfly Book, (1), p. 104; (3), pp. 84, 85 (life history).

Food plant: *Violaceae*.

A. nitocris nigrocaerulea Cockerell and Cockerell. Skinner, H. Ent. News, 18 (7): p. 318, 1907 (egg, larva). Cockerell, W. P. Ent. Rec., 22 (3): p. 72, 1910 (oviposition).

Food plant: *Violaceae*.

A. apacheana (Skinner). Comstock, J. A. Bul. S. Cal. Acad. Sci., 27 (3): p. 89, pl. 17, 1928 (egg, larva).

Food plant: *Violaceae*.

A. cybele (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 558–562, pl. 64, fig. 39; pl. 67, fig. 12; pl. 75, fig. 4; pl. 79, figs. 4–6; pl. 84, figs. 1–3, 1889 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Argy. 11, figs. a–i, 1897 (life history). Holland, W. J. Butterfly Book, (1), p. 106, pl. 5, figs. 1–3, (3), pp. 86, 87 (life history).

Food plant: *Violaceae*.

A. cybele carpenterii Edwards. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Argy. 11, 1897 (life history).

Food plant: *Violaceae*.

A. aphrodite (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 566–569, pl. 64, fig. 35; pl. 67, fig. 11; pl. 72, fig. 5; pl. 79, fig. 3; pl. 85, fig. 5, 1889 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Argy. 5, figs. a–h, 1897 (life history). Forbes, W. T. M. J. N. Y. Ent. Soc., 15

(1) : p. 56, 1907 (larva). Holland, W. J. Butterfly Book, (1), p. 107, pl. 5, fig. 5; (3), p. 88 (larva, chrysalis).

Food plant: *Violaceae*.

- A. *alcestis* Edwards. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1803–1805, 1889 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Argy. 6, figs. a–g, 1897 (life history). Holland, W. J. Butterfly Book, (1), p. 108; (3), pp. 88, 89 (life history).

Food plant: *Violaceae*.

- A. *atlantis* Edwards. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 574–577, pl. 64, fig. 22; pl. 67, fig. 13; pl. 84, fig. 6, 1889 (life history). Holland, W. J. Butterfly Book, (1), p. 109, pl. 5, fig. 6; (3), p. 90 (life history).

Food plant: *Violaceae*.

- A. *semiramis* Edwards. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 30 (2) : p. 44, 1931 (larva, chrysalis). Food plant: *Violaceae*.

- A. *macaria* Edwards. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 30 (2) : pp. 40–41, pl. 18, 1931 (larva, chrysalis). Comstock, J. A. Bul. S. Cal. Acad. Sci., 33 (1) : p. 34, pl. 14, 1934 (egg).

Food plant: *Violaceae*.

- A. *callipe* Boisduval. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 30 (2) : pp. 42–44, pls. 19, 20, 1931 (egg, larva, chrysalis).

Food plant: *Violaceae*.

- A. *liliana* Hy. Edwards. Holland, W. J. Butterfly Book, (1), p. 120; (3), pp. 98, 99 (egg, larva). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Argy. 3, (pl. V), figs. a, b, 1897 (egg larva).

Food plant: *Violaceae*.

- A. *atossa* Edwards. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 30 (2) : p. 42, 1931 (larva, chrysalis).

Food plant: *Violaceae*.

- A. *egleis* Boisduval. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Argy. 9, figs. a–d, 1897 (life history).

- Brenthis myrina* (Cramer). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 596–600, pl. 64, fig. 28; pl. 67, fig. 18; pl. 72, fig. 2; pl. 75, figs. 2, 3; pl. 79, figs. 7–9; pl. 86, fig. 81; pl. 84, figs. 12–14, 1889 (life history). Holland, W. J. Butterfly Book, (1), pp. 129–130, pl. 5, figs. 12–14; (3), p. 106 (life history).

Food plant: *Violaceae*.

B. montinus Scudder. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 604–607, pl. 64, fig. 38; pl. 67, fig. 16, 1889 (egg). dos Passos, C. F. Can. Ent., 68 (11) : pp. 239–241, pl. 1, 1936 (egg, larva).

Food plant: *Violaceae*.

B. frigga Thunberg. Sheldon, W. G. Entomologist, 46 (598) : pp. 80, 81, 1 fig., 1913 (life history).

Food plant. Sallow, *Violaceae*.

B. bellona (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 611–617, pl. 64, fig. 27; pl. 67, fig. 17; pl. 75, figs. 1, 5; pl. 79, figs. 10, 11; pl. 84, figs. 10, 11, 1889 (life history). McMurray, N. Ent. News, 37 (2) : pp. 57, 58, 1926 (oviposition, egg). Holland, W. J. Butterfly Book, (1), pp. 134, 135, pl. 5, figs. 10, 11; (3), p. 112 (life history).

Food plant: *Violaceae*.

B. alberta (Edwards). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Argy. 7, figs. a, b, 1897 (egg, larva).

Melitaea phaeton (Drury). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 693–701, pl. 64, figs. 37, 43; pl. 75, fig. 11; pl. 79, figs. 29–31; pl. 82, fig. 3; pl. 84, figs. 7, 15, 16, 1889 (life history). Holland, W. J. Butterfly Book, (1), pp. 138–139, pl. 5, figs. 15, 16; p. 4, fig. 8; (3), p. 115 (life history).

Food plant: *Chelone glabra*, *Lonicera ciliata*.

M. chalcedona Doubleday and Hewitson. Ramsay, L. Psyche, 13 (6) : p. 136, pl. 8, 1906 (chrysalis). Coolidge, K. R. Bul. Brooklyn Ent. Soc., 19 (2) : p. 45, 1924 (food plant). Holland, W. J. Butterfly Book, (1), p. 139; (3), p. 116 (life history).

Food plant: *Scrophulariaceae*, *Rosa*, *Mimulus*, *Castilleja*.

M. quino Behr. Comstock, J. A. Bul. S. Cal. Acad. Sci., 26 (3) : p. 67, 1927 (egg).

M. magdalena Barnes and McDunnough. Comstock, J. A. Bul. S. Cal. Acad. Sci., 34 (2) : pp. 145–147, pls. 38–40, 1935 (life history).

Food plant: *Plantago*.

M. sierra Wright. Comstock, J. A. Bul. S. Cal. Acad. Sci., 20 (2) : pp. 46–47, pl. A, 1921 (larva, chrysalis). Comstock, J. A. Bul. S. Cal. Acad. Sci., 36 (1) : p. 19, 1937 (food plant).

Food plant: *Mertensia ciliata v. stomatechoides*.

M. taylori Edwards. Danby, W. H. Can. Ent., 22 (6) : pp. 121, 122, 1890 (food plant).

Food plant: *Plantago lanceolata*.

- M. baroni* Edwards. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Melitaea 1, figs. a-f, 1897 (life history).
- M. gabbi* Behr. Coolidge, K. R. Bul. Brooklyn Ent. Soc., 19 (2) : pp. 45-47, 1924 (egg, larva). Comstock, J. A. Bul. S. Cal. Acad. Sci., 30 (1) : pp. 15-17, pl. 5, 1931 (life history). Comstock, J. A. Bul. S. Cal. Acad. Sci., 30 (3) : p. 89, 1931 (egg, larva).
- Food plant: *Corethrogyne filaginifolia* var. *bernardina*, *Hazardia squarrosa*.
- M. neumoegeni* Skinner. Comstock, J. A. Bul. S. Cal. Acad. Sci., 22 (2) : p. 69, pl. 15, 1923 (larva, chrysalis). Comstock, J. A. Bul. S. Cal. Acad. Sci., 27 (2) : p. 66, pl. 5, fig. C. 1928 (egg, oviposition, larva, food plant). Comstock, J. A. Bul. S. Cal. Acad. Sci., 30 (1) : p. 18, pl. 6, 1931 (larva).
- Food plant: *Aster tortifolius*.
- M. harrisi* Seudder. Seudder, S. H. Butterflies of E. U. S. and Can., pp. 677-682, pl. 64, fig. 41; pl. 67, fig. 14; pl. 72, fig. 1; pl. 75, figs. 13, 14; pl. 79, figs. 20-24; pl. 82, fig. 8; pl. 86, figs. 54-57; pl. 84, figs. 17, 18, 1889 (life history). Holland, W. J. Butterfly Book, (1), pp. 144, 145, pl. 5, figs. 17, 18; (3), p. 127 (life history).
- Food plant: *Aster*, *Diplopappus umbellatus*.
- M. pola* Boisduval. Sperry, J. L., and Sperry, G. H. Bul. S. Cal. Acad. Sci., 31 (1) : p. 8, 1932 (larva, food plant).
- Food plant: *Penstemon alpinus*.
- M. theoria bollii* Edwards. Comstock, J. A., Sperry, G. H., and Sperry, J. L. Bul. S. Cal. Acad. Sci., 32 (3) : pp. 99-101, pls. 42, 43, 1933 (larva, chrysalis).
- Food plant: *Castilleja lanata*.
- M. leanira wrighti* Edwards. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 31 (1) : pp. 9-11, pls. 3, 4, 1932 (life history).
- Food plant: *Cordylanthus pilosus*, *Castilleja foliolosa*.
- M. fulvia* Edwards. Comstock, J. A., Sperry, G. H., and Sperry, J. L. Bul. S. Cal. Acad. Sci., 32 (3) : pp. 102-104, pls. 44, 45, 1933 (larva, chrysalis).
- Food plant: *Castilleja*.
- M. chara* Edwards. Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (3) : pp. 50-52, pls. 25, 26, 1929 (life history). Comstock, J. A. Bul. S. Cal. Acad. Sci., 33 (1) : p. 35, pl. 15, 1934 (larva).
- Food plant: *Beloperone californica*.
- Phyciodes tharos* (Drury). Seudder, S. H. Butterflies of E. U. S.

and Can., pp. 634–641, pl. 64, figs. 29, 31; pl. 67, fig. 15; pl. 72, fig. 6; pl. 75, figs. 8, 9; pl. 79, figs. 12–15; pl. 84, figs. 20–22, 1889 (life history). Holland, W. J. Butterfly Book, (1), p. 153, pl. 5, figs. 20–22; (3), p. 135 (life history).

Food plant: *Compositae*, *Actinomeris helianthoides*, *Aster novae angiae*.

P. nycteis (Doubleday and Hewitson). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 661–666, pl. 64, fig. 32; pl. 75, figs. 12, 15; pl. 79, figs. 16–19; pl. 84, fig. 19, 1889 (life history). Holland, W. J. Butterfly Book, (1), p. 152, pl. 5, fig. 19; (3), p. 136 (life history).

Food plant: *Helianthus*, *Actinomeris*.

P. phaon (Edwards). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (2) : pp. 22, 23, pl. 8, 1929 (larva, chrysalis, food plant).

Food plant: *Lippia nodiflora*, *L. lanceolata*.

P. campestris (Behr). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (3) : p. 53, pl. 27, 1929 (egg). Comstock, J. A. Bul. S. Cal. Acad. Sci., 29 (3) : pp. 136–138, pl. 29, 1930 (life history).

Food plant: *Aster foliaceus v. hesperius*.

P. mylitta (Edwards). Dyar, H. G. Can. Ent., 23 (10) : pp. 203–204, 1891 (larva, chrysalis). Holland, W. J. Butterfly Book, (1), p. 155; (3), p. 138 (life history).

Food plant: *Carduus*.

P. picta (Edwards). Holland, W. J. Butterfly Book, (1), p. 156; (3), p. 139 (life history).

Food plant: *Aster*.

P. ismeria (Boisduval and Leconte). Scudder, S. H. Butterflies of E. U. S. and Can., p. 1811, 1889 (larva, chrysalis). Holland, W. J. Butterfly Book, (1), p. 152; (3), p. 139 (larva, chrysalis).

Food plant: *Helianthus tracheliiifolius*.

P. gorgone (Hübner). Handford, R. H. Can. Ent., 65 (4) : p. 95, 1933 (habits).

Food plant: *Helianthus scaberrimus*.

P. carlota (Reakirt). Dyar, H. G. Can. Ent., 25 (4) : p. 93, 1893 (larva, chrysalis).

Food plant: *Quercus chrysolepis*.

Chlosyne janais (Drury). Dyar, H. G. Proc. Ent. Soc. Wash., 13 : p. 228, 1911 (larva).

C. lacinia (Geyer). Edwards, W. H. Can. Ent., 25 (11) : pp. 288–291, 1893 (life history). Cockerell, T. D. A. Ent. News, 11 (6) : p. 503, 1900 (food plant). Dyar, H. G. Proc. Ent. Soc. Wash., 13 : p. 228, 1911 (larva).

Food plant: *Helianthus annuus*, *H. ciliaris*, *Polypteris hookeriana*, *Xanthium canadense*.

C. californica (Wright). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (3) : pp. 53-55, pl. 28, 1929 (larva, chrysalis).

Polygonia interrogationis (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 325-329, pl. 64, figs. 16, 17; pl. 74, figs. 23, 27; pl. 78, figs. 37-41; pl. 83, figs. 21, 22, 24, 25, 26, 40, 1889 (life history). Edwards, W. H. Butterflies of N. Am., 3rd Ser., Grapta 1, figs. a-d, 1897 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, figs. 23, 27; pl. 4, figs. 21, 22, 24-26, 40 (larva, chrysalis).

Food plant: *Humulus*, *Ulmus*, *Urtica*, *Tilia*, *Boehmeria*.

P. comma (Harris). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 336-341, pl. 64, figs. 18-20; pl. 74, fig. 38; pl. 78, fig. 36; pl. 81, fig. 9; pl. 86, fig. 67; pl. 83, figs. 27, 29, 30, 39, 46-48, 1889 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Grapta 1, 1897 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 38; pl. 4, figs. 27, 29, 30, 39, 46-48 (larva).

Food plant: *Urticaceae*.

P. satyrus (Edwards). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 346-347, pl. 74, fig. 33; pl. 83, figs. 41, 42, 1889 (larva, chrysalis). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 33; pl. 4, figs. 41, 42 (larva, chrysalis).

Food plant: *Urtica*.

P. faunus (Edwards). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 351-356, pl. 64, fig. 21; pl. 67, fig. 10; pl. 70, fig. 8; pl. 74, fig. 32; pl. 78, figs. 42-46; pl. 86, fig. 82; pl. 83, figs. 31, 33-35, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 32; pl. 4, figs. 31, 33-35 (larva, chrysalis).

Food plant: *Salix*, *Betula*.

P. gracilis (Grote and Robinson). Scudder, S. H. Butterflies of E. U. S. and Can., p. 360, 1889 (egg).

P. progne (Cramer). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 366-371, pl. 64, fig. 25; pl. 74, fig. 31; pl. 78, figs. 47-49; pl. 86, fig. 68; pl. 83, figs. 32, 37, 38, 1889 (life history).

Food plant: *Grossulaceae*, *Ribes*, *Ulmus*.

Aglais j-album Boisduval and Leconte. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 383-386, pl. 83, figs. 36, 44, 45, 1889 (life history). Denton, S. W. Can. Ent., 21 (9) : pp. 164, 165, 1889 (larva, chrysalis, food plant). Dawson, P. M. Can. Ent., 21 (9) : pp. 179, 180, 1889 (larva, food plant). Fletcher, J.

Can. Ent., 32 (9) : pp. 273-276, 1900 (larva, chrysalis).
 Durand, N. N. Psyche, 9 (292) : p. 87, 1900 (larva, chrysalis).

Food plant: *Salix*, *Betula alba*, *B. papyrifera*.

A. californica Boisduval. Grinnell, F. Bul. S. Cal. Acad. Sci., 12 : pp. 14-17, 1913 (habits). Comstock, J. A. Bul. S. Cal. Acad. Sci., 31 (1) : p. 17, pls. 10, 11, 1932 (larva, chrysalis).

Food plant: *Ceanothus thyrsiflorus*.

A. milberti (Godart). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 423-428, pl. 64, figs. 36, 40; pl. 74, fig. 36; pl. 78, figs. 54-57; pl. 81, figs. 3, 4; pl. 86, fig. 66; pl. 83, figs. 43, 49, 50, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 36; pl. 4, figs. 43, 49, 50 (larva, chrysalis).

Food plant: *Urtica*.

A. antiopa (Linnaeus). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 400-407, pl. 64, figs. 26, 33; pl. 67, figs. 3, 6; pl. 70, fig. 12; pl. 74, fig. 28; pl. 78, figs. 50, 51; pl. 81, fig. 1; pl. 86, figs. 83, 84; pl. 87, figs. 13, 21; pl. 83, figs. 51, 58, 59, 1889 (life history). Scudder, S. H. Psyche, 5 (167, 168) : pp. 330-332, 1890 (habits). Weeks, A. C. J. N. Y. Ent. Soc., 8 (3) : pp. 181-182, 1900 (oviposition). Field, W. L. W. Ent. News, 15 (1) : pp. 6-9, 1904 (metamorphosis). Fletcher, J. Can. Ent., 38 (12) : pp. 411-412, 1906 (habits). Florsheim, C. Ent. Rec., 19 (12) : pp. 275-277, 1907 (life history). Weed, C. M. Bul. N. H. Exp. Sta., 67 : pp. 123-141, fig. 19 (larva). Girault, A. A. Ent. News, 23 (9) : pp. 407-411, 1912 (metamorphosis). Holland, W. J. Butterfly Book, (1), p. 5, fig. 11; pl. 3, fig. 28; pl. 4, figs. 51, 58, 59 (life history).

Food plant: *Salix*, *Populus*, *Ulmus*.

Vanessa atalanta (Linnaeus). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 445-452, pl. 64, fig. 24; pl. 70, fig. 10; pl. 74, fig. 35; pl. 78, figs. 58, 59; pl. 81, figs. 2, 6; pl. 86, figs. 61-65; pl. 83, figs. 52, 53, 55, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 35; pl. 4, figs. 52, 53, 55 (larva, chrysalis). Schindler, P. Ent. Zeitschr., 46 (6) : p. 69, 1932 (life history).

Food plant: *Humulus*, *Boehmeria*, *Urtica*, *Parietaria*.

V. huntera (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 461-468, pl. 74, fig. 34; pl. 78, figs. 52, 53, 60; pl. 81, fig. 11; pl. 83, figs. 53, 54, 64, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 34; pl. 4, figs. 54, 63, 64 (larva, chrysalis).

Food plant: *Gnaphalieae*.

V. cardui (Linnaeus). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 475-477, 481-485, pl. 64, fig. 30; pl. 67, fig. 7; pl. 74, fig. 37; pl. 78, figs. 61-63; pl. 81, fig. 10; pl. 86, figs. 69-73; pl. 83, figs. 60-62, 1889 (life history). Rowland-Brown, H. Entomologist, 40 (535) : pp. 292, 293, 1907 (food plant). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 37; pl. 4, figs. 60-62 (larva, chrysalis).

Food plant: *Carduus*, *Urtica*, *Cnicus*, *Althaea*, *Echium vulgare*, *Lappa*, *Gnaphalium*, *Parietaria*, *Filago*, *Nonnea*, *Silybum*, *Helichrysum*, *Eryngium*, *Chenopodium*, *Malva sylvestris*.

V. carye (Hübner). Dyar, H. G. Can. Ent., 21 (12) : pp. 237, 238, 1889 (life history). Rivers, J. J. Bul. S. Cal. Acad. Sci., 2 (6) : p. 77, 1903 (food plant). Giacomelli, E. An. Soc. Cient. Argent., 78 : p. 172, 1914 (larva, chrysalis). Heguenin, J. C. Ent. News, 32 (7) : pp. 216, 217, 1921 (life history). Coolidge, K. R. Bul. Brooklyn Ent. Soc., 20 (3) : pp. 146, 147, 1925 (food plant).

Food plant: *Malvaceae*, *Fabaceae*, *Urtica holosericea*, *Lavatera assurgentiflora*.

Junonia coenia Hübner. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 497-498, 500-501, pl. 64, fig. 14; pl. 74, figs. 29, 30; pl. 78, figs. 64-66; pl. 83, figs. 56, 57, 65-67, 1889 (life history). Holland, W. J. Butterfly Book, (1), p. 173, pl. 3, figs. 29, 30; pl. 4, figs. 56, 57, 65-67; (3), p. 156 (life history).

Food plant: *Plantago*, *Gerardia*, *Antirrhinum*.

J. genoveva (Cramer). Swainson, E. M. J. N. Y. Ent. Soc., 9 (2) : p. 79, 1901 (larva).

Anartia jatrophae (Linn. and Johans.). Scudder, S. H. Proc. Amer. Acad. Sci., 27 : p. 289, 1892 (larva, chrysalis). Bates, D. M. Fla. Entomologist, 7 (3) : p. 42, 1924 (larva, chrysalis).

Food plant: *Lippia*.

Callicore clymena Cramer. Scudder, S. H. Proc. Amer. Acad. Sci., 27 : p. 241, 1892 (life history).

Eunica monima (Cramer). Dyar, H. G. Proc. Ent. Soc. Wash., 14 : p. 54, 1912 (larva).

Food plant: *Zanthoxylum pentanome*.

Timetes chiron Fabricius. Scudder, S. H. Proc. Amer. Acad. Sci., 27 : p. 249, 1892 (food plant).

Food plant: *Maclura tinctoria*, *Morus*.

Athena peleus (Sulz.). Scudder, S. H. Proc. Amer. Acad. Sci., 27 : p. 247, 1892 (larva, chrysalis, food plant). Bates, D. M. Fla. Entomologist, 7 (3) : p. 43, 1924 (food plant). Robertson-Mil-

ler, E. Fla. Entomologist, 15 (2) : pp. 34, 35, 1931 (larva, chrysalis). Robertson-Miller, E. Fla. Entomologist, 18 (2) : pp. 29, 30, 1934 (larva, chrysalis).

Food plant: *Ficus, Anacardium*.

- A. pellenis* Godt. Scudder, S. H. Proc. Amer. Acad. Sci., 27 : p. 248, 1892 (food plant).

Food plant: *Ficus*.

- Basilarchia arthemis* (Drury). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 297-303, pl. 54, fig. 15; pl. 67, fig. 5; pl. 74, fig. 26; pl. 78, figs. 21-24; pl. 81, fig. 5; pl. 83, figs. 14, 23, 1889 (life history). Holland, W. J. Butterfly Book, (1), p. 184, pl. 3, fig. 26; pl. 4, figs. 14, 23; (3), p. 164 (life history).

Food plant: *Crataegus, Salix, Betula, Populus*.

- B. astyanax* (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 283-287, pl. 64, fig. 12; pl. 74, figs. 17, 21, 25; pl. 78, fig. 30; pl. 86, fig. 60; pl. 83, figs. 12, 13, 1889 (life history). Scudder, S. H. Psyche, 8 (265) : p. 210, pl. 5, 1898 (larva). Unzicker, R. Lepidopterist, 1 (12) : pp. 93, 94, 1917 (food plant). Holland, W. J. Butterfly Book, (1), pp. 183, 184, pl. 3, figs. 17, 21, 25; pl. 4, figs. 12, 13; (3), p. 164 (life history).

Food plant: *Tilia, Cerasus, Ribes, Quercus, Salix*.

- B. weidemeyeri* (Edwards). Edwards, W. H. Can. Ent., 24 (5) : pp. 107-108, 1892 (egg, larva). Bruce in Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (life history). Comstock, J. A. Bul. S. Cal. Acad. Sci., 33 (3) : pp. 113, 114, 1933 (egg, larva).

Food plant: *Populus, Salix*.

- B. archippus* (Cramer). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 269-276, pl. 64, fig. 13; pl. 67, fig. 9; pl. 70, fig. 7; pl. 74, figs. 19, 22, 24; pl. 78, figs. 31-35; pl. 81, figs. 7, 8; pl. 86, figs. 58, 59; pl. 83, figs. 18-20, 1889 (life history). Girault, A. A. Ent. News, 24 (2) : pp. 58, 59, 1913 (larva, chrysalis). Holland, W. J. Butterfly Book, (1), pl. 3, figs. 19, 22, 24; pl. 4, figs. 18-20 (larva, chrysalis).

Food plant: *Salix, Populus*.

- B. obsoleta* (Edwards). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 32 (1) : pp. 27-35, pl. 5, 1933 (life history).

Food plant: *Salix, Populus*.

- B. lorquinii* (Boisduval). Dyar, H. G. Can. Ent., 23 (8) : pp. 172-174, 1891 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (egg, larva). Comstock, J. A. Bul. S. Cal. Acad. Sci., 30 (3) : pp. 87, 89, pl. 27, fig. C, 1931 (egg).

Food plant: *Populus*, *Prunus demissa*, *Salix*, *Quercus*.

Heterochroa bredowi californica Butler. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 30 (3) : pp. 83-87, pl. 26, 1931 (life history).

Food plant: *Quercus*.

Asterocampa celtis (Boisduval and Leconte). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1789-1792, 1889 (life history).

Food plant: *Celtis occidentalis*.

A. clyton (Boisduval and Leconte). Murtfeldt, M. E. Ent. Am., 2 (9, 10) : pp. 180, 181, 1887 (habits). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 244-247, pl. 64, figs. 6, 7; pl. 74, fig. 20; pl. 87, fig. 7; pl. 83, figs. 15-17, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 20; pl. 4, figs. 15-17 (larva, chrysalis).

Food plant: *Celtis occidentalis*.

A. flora (Edwards). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Apatura 1, figs. a-h, 1897 (life history).

Food plant: *Celtis integrifolia*.

Ageronia fornax Hübner. Seudder, S. H. Proc. Amer. Acad. Sci., 27 : p. 250, 1892 (life history).

Food plant: *Dalechampia*.

Victorina steneles (Linnaeus). Scudder, S. H. Proc. Amer. Acad. Sci., 27 : p. 238, 1892 (larva, food plant). Bates, D. M. Fla. Entomologist, 7 (3) : p. 43, 1924 (larva).

Food plant: *Blechum*.

Historis orion Fabricius. Scudder, S. H. Proc. Amer. Acad. Sci., 27 : p. 245, 1892 (larva, chrysalis, food plant).

Food plant: *Cecropia*.

Anaea andria Seudder. Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1795-1798, 1889 (life history). Holland, W. J. Butterfly Book, (1), p. 8, fig. 21 (larva, chrysalis).

Food plant: *Croton capitatum*.

Enodia portlandia (Fabricius). Scudder S. H. Butterflies of E. U. S. and Can., pp. 184-186, pl. 64, fig. 4; pl. 70, fig. 9; pl. 74, fig. 16; pl. 78, figs. 17-20; pl. 83, fig. 6, 1889 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Debis I, figs. a-i, 1897 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 16; pl. 4, fig. 6 (larva, chrysalis).

Food plant: Grasses.

Satyrodes eurydice (Linn. and Johans.). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 195-198, pl. 64, fig. 10; pl. 67, fig.

2; pl. 70, fig. 1; pl. 74, fig. 9; pl. 78, figs. 9–11; pl. 86, figs. 19, 38; pl. 83, fig. 9, 1889 (life history).

Food plant: Grasses.

S. canthus (Linnaeus). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., *Satyrodes* 1, figs. a–h, 1897 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 9; pl. 4, fig. 9 (larva, chrysalis).

Food plant: Grasses.

Euptychia cornelia (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1783–1785, 1889 (life history).

E. gemma Hübner. Holland, W. J. Butterfly Book, (1), p. 202; (3), p. 179 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., *Neonympha* 1, figs. a–h, 1897 (life history).

Food plant: Grasses.

E. henshawi (Edwards). Holland, W. J. Butterfly Book, (1), p. 202; (3), p. 179 (egg). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., *Neonympha* 1, fig. i, 1897 (egg).

E. phocion (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 205–207, pl. 64, fig. 9; pl. 70, fig. 11; pl. 74, figs. 8, 12; pl. 78, figs. 15, 16; pl. 83, figs. 10, 11, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, fig. 8; pl. 4, figs. 10, 11 (larva, chrysalis).

Food plant: Grasses.

E. areolatus (Smith and Abbot). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., *Neonympha* 2, figs. a–h, 1897 (life history).

Food plant: Grasses.

E. eurytus (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 216–221, pl. 64, figs. 5, 11; pl. 70, fig. 4; pl. 74, figs. 3, 6, 10, 13, 14; pl. 78, figs. 25–29; pl. 86, figs. 40, 42; pl. 83, fig. 28, 1889 (life history). Holland, W. J. Butterfly Book, (1), p. 203, pl. 3, figs. 3, 6, 10, 13, 14; pl. 4, fig. 28; (3), p. 180 (life history).

Food plant: Grasses.

E. sosybius (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1787–1788, 1899 (life history).

Coenonympha galactinus Boisduval. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., *Coenonympha* 1, figs. a–g, 1897 (life history).

Neominois ridingsii Edwards. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., *Neominois* 1, figs. a–g, 1897 (life history).

Cercyonis alope (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 166–169, pl. 67, fig. 1; pl. 70, fig. 6; pl.

74, fig. 18; pl. 78, figs. 12, 13; pl. 86, fig. 39, 1889 (life history).

C. alope nephele (Kirby). Holland, W. J. Butterfly Book, (1), pl. 4, figs. 7, 8 (chrysalis).

C. nephele (Kirby). Seudder, S. H. Butterflies of E. U. S. and Can., pp. 173, 174, pl. 64, fig. 3; pl. 83, figs. 7, 8, 1889 (life history).

C. meadi (Edwards). Holland, W. J. Butterfly Book, (1), pp. 216, 217; (3), p. 190 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Satyrus 2, figs. a-d, 1897 (life history).

Food plant: Grasses.

C. charon (Edwards). Holland, W. J. Butterfly Book, (1), pp. 217-218; (3), p. 192 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Satyrus 3, figs. a-h, 1897 (life history).

Oeneis gigas Butler. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 11, figs. a-d, 1897 (egg, larva).

O. californica (Boisduval). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 12, figs. g-k, 1897 (egg, larva).

O. iduna (Edwards). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 12, figs. a-f, 1897 (egg, larva).

O. macounii (Edwards). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1776-1777, 1889 (egg, larva). Beutenmuller, W. Can. Ent., 21 (8): p. 160, 1889 (egg, larva). Fletcher, J. Insect Life, 2 (2): pp. 45-46, 1889 (larva). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 10, figs. a-f, 1897 (egg, larva).

O. invallda (Mead). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (egg, larva).

O. chryxus (Westwood). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 1, figs. a-h, 1897 (life history).

O. jutta (Hübner). Holmgren, E. Ent. Tidskr., pp. 151-154, 1 fig., 1886 (egg, larva). Scudder, S. H. Butterflies of E. U. S. and Can., pl. 64, fig. 2; pl. 70, fig. 2; pl. 74, fig. 11; pl. 78, fig. 14; pl. 84, figs. 17, 18, 1889 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 5, figs. a-g, 1897 (life history).

O. uhleri (Reakirt). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 3, figs. a-h, 1897 (life history).

O. varuna (Edwards). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 13, figs. a-h, 1897 (life history).

O. daura (Strecker). Comstock, J. A., Sperry, J. L., and Sperry,

- G. H. Bul. S. Cal. Acad. Sci., 35 (3) : pp. 165-169, pls. 37, 38, 1936 (egg, larva, food plant).
- O. alberta* Elwes. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 14, figs. a-g, 1897 (life history).
- O. crambis* (Edwards). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 7, fig. a, 1897 (egg).
- O. brucei* (Edwards). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 6, figs. a-g, 1897 (life history).
- O. oeno* (Boisduval). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 13, figs. i-o, 1897 (life history).
- O. semidea* (Say). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 137-139, 141-145, pl. 64, fig. 8; pl. 70, fig. 5; pl. 74, figs. 1, 2, 4, 7, 15; pl. 78, figs. 6-8; pl. 83, fig. 45; pl. 86, fig. 18; 1889 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Chionobas 9, figs. a-e, 1897 (life history). Holland, W. J. Butterfly Book, (1), pl. 3, figs. 1, 2, 4, 7, 15; pl. 4, figs. 4, 5 (larva, chrysalis).
- O. melissa semidea*. Scudder, S. H. Psyche, 9 (301) : pp. 195-197, pl. 1, 1901 (habits).
- Erebia discoidalis* (Kirby). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (egg).
- E. epipsodea* Butler. Lyman, H. H. Can. Ent., 28 (11) : pp. 274-278, 1896 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Erebia 3, figs. a-g, 1897 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 [egg (correction)].
- E. epipsodea brucei* Elwes. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Erebia 3, 1897 (life history).
- E. magdalena* Strecker. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Erebia 1, figs. a-e, 1897 (egg, larva).
Food plant: "It is believed that the larvae of the Satyrinae feed exclusively on various species of Grasses and Carices" (Edwards).
- Libythea bachmanni* Kirtland. Seudder, S. H. Butterflies of E. U. S. and Can., pp. 762-763, 765-766, pl. 64, fig. 42; pl. 75, fig. 19; pl. 84, figs. 23, 24, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, figs. 23, 24 (chrysalis).
Food plant: *Celtis*.
- L. carinenta* (Cramer). Seitz, A. Stet. Ent. Zeit., 51: p. 2, 1890 (habits).
- Apodemia mormo* (Felder). Coolidge, C. R. Ent. News, 17 (4) : p. 140, 1906 (correction of life history).

- A. mormo virgulti* (Behr). Coolidge, C. R. Ent. News, 17 (4) : p. 140, 1906 (correction of life history). Coolidge, K. R. Trans. Am. Ent. Soc., 50 : pp. 324-329, 1925 (life history). Comstock, J. A. Bul. S. Cal. Acad. Sci., 29 (1) : p. 22, pl. 4, 1930 (chrysalis).
- A. palmerii marginalis* (Skinner). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 31 (2) : pp. 37-40, pls. 17-19, 1932 (life history).
Food plant: *Beloperone californica*, *Prosopis juliflora v. glandulosa*.
- Polystigma nais* (Edwards). Holland, W. J. Butterfly Book, (1), p. 231; (3), p. 215 (life history).
Food plant: *Prunus*.
- Calephelis borealis* Grote and Robinson. dos Passos, C. F. Can. Ent., 68 (8) : pp. 167-170, pl. 1, 1936 (life history).
Food plant: *Senecio obovatus*.
- C. multicum* McAlpine. Bul. B. E. S., 32 : pp. 43-50, pl. I, 1937 (life history, food plant).
Food plant: *Cirsium muticum*.
- C. nemesis* (Edwards). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 31 (1) : pp. 12-15, pls. 5-7, 1932 (life history).
Food plant: *Baccharis glutinosa*.
- C. australis* (Edwards). Comstock, J. A. Bul. S. Cal. Acad. Sci., 27 (3) : pp. 80-82, pls. 9-11, 1928 (life history).
- Thecla halesus* (Cramer). Scudder, S. H. Butterflies of E. U. S. and Can., p. 1828, 1889 (larva, chrysalis). Comstock, J. A. Bul. S. Cal. Acad. Sci., 30 (3) : pp. 87, 88, pl. 27, fig. A, 1931 (egg). Haskin, J. R. Ent. News, 44 (3) : pp. 72-74, 1933 (life history).
Food plant: *Quercus*, *Phoradendron flavescens*.
- T. augustus* Kirby. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 844-845, 1889 (larva, chrysalis). Cook, J. H., and Cook, H. Can. Ent., 36 (5) : p. 136, 1904 (larva, chrysalis). Cook, J. H. Can. Ent., 38 (7) : pp. 214-217, pl. 3, 1906 (life history). Cook, J. H. Can. Ent., 39 (5) : pp. 145-149, pl. 3. 1907 (larva, chrysalis, food plant).
Food plant: *Vaccinium*, *Kalmia angustifolia*.
- T. iroides* Boisduval. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 32 (2) : pp. 77-79, pls. 19-22, 1933 (life history).
Food plant: *Sedum*, *Cuscuta*.

T. irus (Godart). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 838-841, pl. 65, figs. 9, 10; pl. 68, fig. 8; pl. 75, figs. 22, 23, 28; pl. 79, fig. 42; pl. 84, figs. 26, 32-34, 1889 (life history). Cook, J. H. Can. Ent., 38 (5, 6) : pp. 141-144, 181-185, pls. 1, 2, 1906 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, figs. 32-34 (chrysalis).

Food plant: *Prunus, Vaccinium corymbosum.*

T. henrici Grote and Robinson. Cook, J. H. Can. Ent., 39 (6, 7) : p. 181-187, 229-234, pls. 4, 5, 1907 (life history).

Food plant: *Prunus.*

T. polios Cook and Watson. Cook, J. H. Can. Ent., 39 (12) : pp. 405-409, pl. 5, 1907 (life history). Cook, J. H. Can. Ent., 40 (2) : pp. 37-43, pl. 2, 1908 (life history).

Food plant: *Arctostaphylos.*

T. niphon (Hübner). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 831-833, pl. 65, fig. 7; pl. 68, fig. 7; pl. 75, fig. 24; pl. 84, figs. 38, 40, 1889 (life history). Cook, J. H. Can. Ent., 39 (8, 9) : pp. 257-260, 293-295, pls. 6, 9, 1907 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, figs. 38, 40 (chrysalis).

Food plant: *Pinus.*

T. dumetorum Boisduval. Coolidge, K. R. Trans. Am. Ent. Soc., 50 : pp. 329-335, 1925 (life history).

Food plant: *Hosackia, Eriogonum, Syrmatium.*

T. m-album Boisduval and Leconte. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1825, 1826, 1889 (larva, chrysalis).

Food plant: *Quercus, Astragalus.*

T. nelsoni Boisduval. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 31 (3) : pp. 88, 89, pl. 24, 1932 (life history).

Food plant: *Thuja.*

T. loki Skinner. Coolidge, K. R. Ent. News, 35 (6) : pp. 199-204, 1924 (life history). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 31 (2) : pp. 40-42, pls. 20, 21, 1932 (life history).

Food plant: *Juniperus californica.*

T. damon (Cramer). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 864-866, pl. 65, fig. 4; pl. 17, fig. 3; pl. 75, figs. 30, 31; pl. 79, fig. 27; pl. 84, figs. 30, 31, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, figs. 30, 31 (chrysalis).

Food plant: *Juniperus virginiana, Smilax.*

T. adenostomatis Hy. Edwards. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 34 (3) : pp. 212, 213, pls. 51a, 52.

1935 (larva, chrysalis, food plant). Comstock, J. A. Bul. S. Cal. Acad. Sci., 36 (1) : pp. 19-20, pl. 6, 1937 (egg).

Food plant: *Cercocarpus betuloides*.

- T. saepium* Boisduval. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 32 (3) : pp. 105-107, pls. 46-48, 1933 (life history).

Food plant: *Ceanothus cuneatus*.

- T. auretorum spadix* Hy. Edwards. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 33 (2) : pp. 79-81, pls. 23-25, 1934 (life history).

Food plant: *Quercus*.

- T. grunus* Boisduval. Dyar, H. G. Can. Ent., 25 (4) : p. 94, 1893 (larva, chrysalis, food plant). Holland, W. J. Butterfly Book, (1), p. 238; (3), p. 234 (larva, chrysalis). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 34 (1) : pp. 81, 82, pl. 7, 1935 (larva, chrysalis).

Food plant: *Quercus chrysolepis*.

- T. edwardsi* Saunders. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 894-897, pl. 65, fig. 2; pl. 68, fig. 2; pl. 75, fig. 25; pl. 84, fig. 29; 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, fig. 29 (chrysalis).

Food plant: *Quercus*.

- T. calanus* (Hübner). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 887-890, pl. 65, fig. 3; pl. 68, fig. 1; pl. 75, figs. 20, 26; pl. 84, figs. 25, 27, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, figs. 25, 27 (chrysalis).

Food plant: *Quercus*.

- T. melinus* (Hübner). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 852-855, pl. 65, figs. 5, 6; pl. 68, fig. 3; pl. 75, fig. 21; pl. 84, fig. 39, 1889 (life history). Cockerell, T. D. A. Ent. News, 11 (8) : p. 578, 1900 (larva). Rivers, J. J. Bul. S. Cal. Acad. Sci., 1 (4) : pp. 41, 42, 1902 (larva, chrysalis, food plant). Coolidge, K. R. Bul. Brooklyn Ent. Soc., 18 (5) : pp. 160, 161, 1923 (food plant). Holland, W. J. Butterfly Book, (1), pl. 5, fig. 39 (chrysalis).

Food plant: *Humulus*, *Echinocactus intertextus*, *Lupinus*, *Malva*, *Sphaeralcea*, *Polygonum*, *Hyptis*.

- T. ontario* Edwards. Clark, A. H. Ent. News, 46 (5) : pp. 123, 124, 1935 (larva).

Food plant: *Quercus obtusiloba*.

- T. liparops* Boisduval and Leconte. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 880-883, pl. 65, fig. 17; pl. 71, fig. 2; pl.

75, figs. 27, 32; pl. 79, fig. 26; pl. 86, fig. 27; pl. 84, fig. 28, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, fig. 28 (chrysalis).

Food plant: *Quercus*, *Ericaceae*, *Crataegus*, *Vaccinium*.

T. acadica Edwards. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 900–902, pl. 65, fig. 1; pl. 75, figs. 16–18; pl. 79, fig. 25; pl. 84, fig. 35, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, fig. 35 (chrysalis).

Food plant: *Salix*.

T. californica Edwards. Comstock, J. A. Bul. S. Cal. Acad. Sci., 32 (3) : pp. 114–117, pls. 54, 55, 1933 (larva, chrysalis, food plant).

Food plant: *Quercus*.

T. sylvinus Boisduval. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 33 (3) : pp. 137, 138, pls. 40, 41, 1934 (life history).

Food plant: *Salix*.

T. laeta Edwards. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 821, 822, pl. 65, fig. 8, 1889 (egg). Mousley, H. Can. Ent., 55 (2) : pp. 26–29, 1923 (egg, larva, food plant).

Food plant: *Fagus*.

T. fuliginosa (Edwards). Comstock, J. A. Bul. S. Cal. Acad. Sci., 32 (3) : p. 114, 1933 (egg, oviposition, food plant).

Food plant: *Lupinus*.

T. columella (Fabricius). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 34 (2) : pp. 120–123, pls. 16–18, 1935 (life history).

Food plant: *Sida hederacea*.

T. leda Edwards. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 35 (1) : pp. 6–8, pls. 2, 3, 1936 (life history).

Food plant: *Prosopis juliflora v. glandulosa*.

T. avalona Wright. Coolidge, K. R. Bul. Brooklyn Ent. Soc., 18 (5) : p. 160, 1923 (egg). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 32 (3) : pp. 107–110, pls. 49, 50, 1933 (life history).

Food plant: *Lotus argophyllus v. ornithopus*.

T. behrii Edwards. Williams, F. X. Ent. News, 19 (10) : pp. 476–483, 1908 (larva, chrysalis). Comstock, J. A. Bul. S. Cal. Acad. Sci., 26 (3) : pp. 67, 68, pl. 15, 1927 (egg, food plant). Comstock, J. A. Bul. S. Cal. Acad. Sci., 27 (2) : pp. 63, 64, pl. 2, 1928 (larva, chrysalis, food plant).

Food plant: *Lotus glaber*, *Astragalus*, *Purshia glandulosa*.

T. titus (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 811–815, pl. 65, fig. 11; pl. 68, fig. 4; pl. 75, fig. 35; pl. 84, fig. 37, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, fig. 37 (chrysalis).

Food plant: *Rosaceae*.

Feniseca tarquinius Fabricius. Riley, C. V. Am. Nat., 20: pp. 556, 557, 1886 (life history). Riley, C. V. Ent. Nachr., 12 (14) : pp. 219, 229, 1886 (larva). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1019–1024, pl. 65, fig. 24; pl. 68, fig. 9; pl. 75, figs. 33, 34, 41, 43; pl. 79, figs. 43–45, pl. 84, figs. 45, 46, 1889 (life history). Scudder, S. H. Ent. News, 7 (7) : p. 193, pl. 8, 1896 (chrysalis). Scudder, S. H. Psyche, 8 (258) : p. 123, pl. 3, 1897 (food, chrysalis). Good, A. I. Can. Ent., 33 (8) : p. 228, 1901 (food). Winn, A. F. Ottawa Nat., 25 (6) : pp. 100, 101, 1911 (larva). Clark, A. H. Ann. Report Smithsonian Inst., pp. 492–505, figs. 1–5, 1925 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, figs. 45, 46; (3), pl. 76, fig. 23 (chrysalis).

Food: Aphids.

Chrysophanus arota (Boisduval). Dyar, H. G. Can. Ent., 23 (10) : pp. 204, 205, 1891 (larva, chrysalis). Comstock, J. A. Bul. S. Cal. Acad. Sci., 26 (3) : p. 67, pl. 14, 1927 (egg, food plant). Comstock, J. A. Bul. S. Cal. Acad. Sci., 27 (2) : pp. 64, 65, pls. 3, 4, 1928 (larva, chrysalis, food plant).

Food plant: *Ribes*.

C. hermes Edwards. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 34 (2) : pp. 124–126, pls. 19–21, 1935 (life history).

Food plant: *Rhamnus crocea*.

C. xanthoides (Boisduval). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 34 (3) : pp. 213–217, pls. 53–56, 1935 (life history).

Food plant: *Rumex hymenosepalus*.

C. gorgon (Boisduval). Grundel, J. G. Ent. News, 15 (3) : p. 97, 1904 (egg, larva). Coolidge, K. R. Can. Ent., 40 (10) : pp. 346, 347, 1908 (life history). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 33 (1) : pp. 25–27, pls. 3–5, 1934 (life history).

Food plant: *Eriogonum elongatum*.

C. thoë (Boisduval). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 979–981, pl. 65, fig. 19; pl. 68, fig. 13; pl. 84, fig. 50,

1889 (life history). Holland, W. J. *Butterfly Book*, (1), pl. 5, fig. 50 (chrysalis).

Food plant: *Rumex*, *Polygonum*.

C. mariposa (Reakirt). Coolidge, K. R. *Can. Ent.*, 42 (9) : p. 316, 1910 (egg). Newcomer, E. J. *Can. Ent.*, 43 (3) : pp. 83, 84, 1 fig., 1911 (life history).

C. heliooides (Boisduval). Coolidge, K. R. *Ent. News*, 35 (9) : pp. 306–312, 1924 (life history). Comstock, J. A. *Bul. S. Cal. Acad. Sci.*, 28 (3) : p. 55, pl. 29, 1929 (larva, chrysalis).

Food plant: *Polygonum*, *Rumex*, *Oxytheca sanguinolenta*, *Gayophytum diffusum*.

C. dorcus (Kirby). Newcomb, W. W. *Can. Ent.*, 41 (7, 8) : pp. 221–229, 293, 1909 (oviposition). Newcomb, W. W. *Can. Ent.*, 43 (5) : pp. 160–168, 1911 (life history).

Food plant: *Potentilla fruticosa*.

C. epixanthe (Boisduval and Leconte). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 987–989, pl. 65, figs. 16, 23; pl. 68, fig. 11; pl. 79, fig. 41, 1889 (egg, larva, food plant). Cook, J. H., and Watson, F. E. *Can. Ent.*, 40 (3) : pp. 85–88, 1908 (oviposition).

Food plant: *Vaccinium macrocarpon*.

C. hypophlaeas Boisduval. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1002–1006, pl. 65, fig. 21; pl. 68, fig. 10; pl. 71, fig. 1; pl. 75, fig. 42; pl. 79, figs. 39, 40; pl. 84, fig. 49; pl. 86, fig. 33, 1889 (life history). Holland, W. J. *Butterfly Book*, (1), p. 225, pl. 5, fig. 49; (3), p. 251 (larva, chrysalis).

Food plant: *Rumex acetosella*.

C. heteronea (Boisduval). Williams, F. X. *Ent. News*, 21 (1) : p. 37, 1910 (larva, chrysalis). Comstock, J. A. *Bul. S. Cal. Acad. Sci.*, 26 (3) : pp. 67, 68, pl. 15, 1927 (egg, food plant).

Food plant: *Eriogonum fasciculatum*, *E. microthecum*.

Lycaena pseudargiolus Boisduval and Leconte. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 934–935, 937–942, pl. 65, figs. 14, 15, 18; pl. 68, fig. 6; pl. 75, figs. 29, 39, 40, 45; pl. 79, fig. 28; pl. 87, figs. 14, 19, 1889 (life history). Fletcher, J. Can. Ent., 36 (1) : p. 4, 1904 (oviposition, food plant). Wheeler, W. M. *Ants*, pp. 352, 357–360, figs. 210, 211, 1910 (larva). Holland, W. J. *Butterfly Book*, (1), p. 268, pl. 5, figs. 36, 43, 44, pl. 4, fig. 7 (larva, chrysalis).

Food plant: *Cornus* flowers, *Actinomeris*, *Chrysanthemum leucanthemum*.

- L. violacea* Edwards. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (breeding experiment).
Food plant: *Cornus* flowers.
- L. piasus* Boisduval. Coolidge, K. R. Can. Ent., 40 (10) : pp. 347, 348, 1908 (larva, chrysalis).
Food plant: *Aceulus*, *Lupinus*.
- L. icarioides evius* Boisduval. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 34 (1) : pp. 82–84, pls. 8–10, 1935 (life history).
Food plant: *Lupinus*.
- L. fulla* Edwards. Newcomer, E. J. Can. Ent., 43 (3) : pp. 85–88, 1 fig., 1911 (life history).
Food plant: *Lupinus meionanthus*.
- L. antiacis* Boisduval. Williams, F. X. Ent. News, 19 (10) : pp. 476–483, figs. 1, 2, 1908 (life history).
Food plant: *Lotus glaber*, *Lupinus arboreus*, *L. micranthus*, *Astragalus menziesii*.
- L. couperi* Grote. Seudder, S. H. Butterflies of E. U. S. and Can., p. 955, 1889 (larva, food plant).
Food plant: *Vicia cracca*.
- L. lygdamus* Doubleday. Bower, H. M. Ent. News, 22 (8) : pp. 359–363, pl. 12, 1911 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (larva).
Food plant: *Lathyrus ochroleucus*, *L. caroliniana*.
- L. lygdamus australis* Grinnell. Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (1) : pp. 6, 11, pl. 5, 1929 (egg). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 34 (2) : pp. 127–128, pl. 22, 1935 (larva, chrysalis, food plant).
Food plant: *Lotus scorpiarius*.
- L. scudderii* Edwards. Seudder, S. H. Butterflies of E. U. S. and Can., pp. 966–969, pl. 65, figs. 12, 13; pl. 71, fig. 4; pl. 75, figs. 36, 38; pl. 79, figs. 32–35; pl. 86, figs. 14–16; pl. 84, fig. 41, 1889 (life history). Lyman, H. H. Can. Ent., 34 (5) : pp. 126–128, 1902 (egg, larva). Holland, W. J. Butterfly Book, (1), pl. 5, fig. 41 (chrysalis).
Food plant: *Lupinus perennis*.
- L. melissa* Edwards. Comstock, J. A. Bul. S. Cal. Acad. Sci., 27 (2) : p. 66, pl. 5, figs. a, b, 1928 (egg). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (2) : p. 24, pl. 9, 1929 (larva, chrysalis, food plant).
Food plant: *Astragalus*, *Aster*, *Glycyrrhiza lepidota*.
- L. emigdionis* Grinnell. Comstock, J. A. Bul. S. Cal. Acad. Sci..

29 (1) : p. 23, pl. 5, 1930 (egg, food plant). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 31 (3) : pp. 92-94, pls. 27-28, 1932 (life history).

Food plant: *Atriplex*.

- L. neurona* Skinner. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 32 (2) : pp. 79-81, pls. 23, 24, 1933 (life history).

Food plant: *Eriogonum wrightii*.

- L. battooides bernardino* Barnes and McDunnough. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 33 (1) : pp. 27-29, pls. 6, 7, 1934 (life history).

Food plant: *Eriogonum fasciculatum*.

- L. speciosa* Hy. Edwards. Comstock, J. A. Bul. S. Cal. Acad. Sci., 29 (1) : p. 23, pl. 6, 1930 (egg, food plant). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 31 (3) : pp. 90, 91, pls. 25, 26, 1932 (life history).

Food plant: *Oxytheca perfoliata*.

- L. sonorensis* Felder. Comstock, J. A., and Coolidge, C. Bul. S. Cal. Acad. Sci., 29 (1) : pp. 16-21, pl. 2, 1930 (life history).

Food Plant: *Sedum*.

- L. amyntula* Boisduval. Coquillett, D. W. J. N. Y. Ent. Soc., 7 (2) : p. 211, 1899 (larva). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 34 (3) : pp. 218-219, pls. 57, 58, 1935 (life history).

Food plant: *Astragalus crotalariae*.

- L. comyntas* (Godart). Seudder, S. H. Butterflies of E. U. S. and Can., pp. 913-917, pl. 65, fig. 20; pl. 68, figs. 5, 12; pl. 71, fig. 5; pl. 75, figs. 37, 44; pl. 79, figs. 36-38; pl. 84, figs. 42, 47, 48, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 5, figs. 42, 47, 48 (chrysalis).

Food plant: *Leguminosae*, *Lespedeza*, *Phaseolus*, *Desmodium*.

- L. hanno* (Stoll). Haskin, J. R. Ent. News, 44 (6) : pp. 155, 156, 1933 (life history).

Food plant: *Chamaecrista brachiata*, *C. aspera*, *Abrus precatorius*.

- L. gyas* Edwards. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 33 (3) : pp. 139-140, pls. 42-44, 1934 (life history).

Food plant: *Prosopis*, *Medicago*.

- L. marina* Reakirt. Coolidge, C. R. Psyche, 18 : p. 32, 1911 (egg).

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- L. theonus* Lucas. Haskin, J. R. Ent. News, 44 (6) : pp. 154, 155, 1933 (life history).
 Food plant: *Galactia pilosa*.
- L. exilis* Boisduval. Coquillett, D. W. J. N. Y. Ent. Soc., 7 (2) : p. 211, 1899 (larva). Coolidge, K. R. Ent. News, 35 (4) : pp. 115-121, 1924 (life history).
 Food plant: *Atriplex, Petunia parviflora*.
- Neophasia menapia* Felder. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Neophasia 1, cut a, 1897 (life history).
 Food plant: *Pinus ponderosa, Pseudotsuga mucronata*.
- Pieris beckerii* Edwards. Coolidge, K. R. Ent. News, 34 (8) : pp. 225-231, 1923 (life history).
 Food plant: *Cruciferae*.
- P. occidentalis* Reakirt. Cockerell, T. D. A. Ent. News, 12 (1) : p. 18, 1901 (food plant).
 Food plant: *Cleome serrulata*.
- P. protodice* Boisduval and Leconte. Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1166, 1168, 1169, pl. 65, fig. 26; pl. 76, fig. 7; pl. 79, fig. 49; pl. 84, figs. 66, 67, 1889 (life history). Keith, E. D. Bul. Brooklyn Ent. Soc., 9 (1) : p. 13, 1914 (oviposition). Holland, W. J. Butterfly Book, (1), pl. 2, fig. 7; pl. 5, figs. 66, 67 (larva, chrysalis). Querci, O. Trans. Am. Ent. Soc., 62 : pp. 37-47, 1936 (oviposition, egg).
 Food plant: *Cruciferae*.
- P. napi* (Linnaeus). Holland, W. J. Butterfly Book, (1), pl. 2, figs. 8, 9; pl. 5, figs. 57, 63, 64 (larva, chrysalis).
 Food plant: *Cruciferae*.
- P. oleracea* Harris. Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1194-1195, 1198-1203, pl. 65, fig. 27; pl. 68, fig. 15; pl. 76, figs. 8, 9; pl. 79, figs. 50-52; pl. 86, figs. 32, 44; pl. 84, figs. 57, 63, 64, 1889 (life history).
 Food plant: *Cruciferae*.
- P. virginensis* Edwards. Klots, A. B. J. N. Y. Ent. Soc., 43 (2) : pp. 139-142, figs. 1, 2, 1935 (life history).
 Food plant: *Dentaria diphylla*.
- P. rapae* (Linnaeus). Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1208-1211, pl. 65, fig. 28; pl. 68, figs. 16, 17; pl. 72, fig. 4; pl. 76, figs. 11, 12; pl. 79, fig. 53; pl. 86, figs. 31, 36, 43; pl. 84, figs. 58, 65, 1889 (life history). Schwartz, E. A. Proc. Ent. Soc. Wash., 1 : pp. 250, 251, 1899 (food plant). Forbes, W. T. M. Psyche, 16 : pp. 73, 74, 1909 (egg, larva). Coolidge, K. R. Bul. Brooklyn Ent. Soc., 18 (5) : p. 159, 1923 (food

plant). Holland, W. J. *Butterfly Book*, (1), pl. 2, figs. 11, 12; pl. 5, figs. 58, 65 (larva, chrysalis). Querci, O. *Ent. Rec.*, 44 (12) : pp. 168-176, 1932 (habits).

Food plant: *Cruciferae*.

Nathalis iole Boisduval. Comstock, J. A. *Bul. S. Cal. Acad. Sci.*, 27 (3) : pp. 86-88, pls. 14-16, 1928 (life history). Berry, L. M. *Ent. News*, 45 (9) : pp. 252, 253, 1934 (egg, larva).

Food plant: *Bidens pilosa, Stellaria media*.

Euchloe ausonides Boisduval. Holland, W. J. *Butterfly Book*, (1), p. 283; (3), p. 284 (larva). Edwards, W. H. *Butterflies of N. Amer.*, 3rd Ser., Supplementary Notes, 1897 (breeding experiment). Coolidge, K. R., and Newcomer, E. J. *Ent. News*, 19 (5) : pp. 204-210, 1 fig., 1908 (life history).

Food plant: *Cruciferae*.

E. creusa hyantis (Edwards). Coolidge, K. R. *Ent. News*, 36 (3) : pp. 65-68, 1925 (life history).

Food plant: *Cruciferae*.

E. creusa lotta Beutenmüller. Comstock, J. A., and Dammers, C. M. *Bul. S. Cal. Acad. Sci.*, 31 (2) : pp. 35-37, pls. 15, 16, 1932 (life history).

Food plant: *Sisymbrium altissimum*.

E. olympia (Edwards). Edwards, W. H. *Butterflies of N. Amer.*, 3rd Ser., Supplementary Notes, 1897 (egg, larva). Schull, C. A. *Ent. News*, 18 (3) : pp. 73-82, pl. 1, 1907 (life history).

Food plant: *Arabis lyrata*.

E. cethura (Felder). Comstock, J. A., and Dammers, C. M. *Bul. S. Cal. Acad. Sci.*, 31 (2) : pp. 33-35, pls. 13, 14, 1932 (life history).

Food plant: *Sisymbrium pinnatum, Thelypodium longirostris, Streptanthus inflatus*.

E. sara (Boisduval). Coolidge, K. R., and Newcomer, E. J. *Can. Ent.*, 41 (2) : pp. 45-47, 1909 (life history). Edwards, W. H. *Butterflies of N. Amer.*, 3rd Ser., Supplementary Notes, 1897 (breeding experiments).

Food plant: *Brassica nigra, B. campestris*.

E. sara reakirti (Edwards). Minot, G. R. *Ent. News*, 13 (5) : p. 158, 1902 (egg). Comstock, J. A., *Bul. S. Cal. Acad. Sci.*, 30 (3) : pp. 90-92, pls. 28, 29, 1931 (life history).

Food plant: *Brassica, Thysanocarpus curvipes*.

E. pima (Edwards). Coolidge, K. R. *Psyche*, 15 : p. 81, 1908 (chrysalis).

E. genutia (Fabricius). Scudder, S. H. *Butterflies of E. U. S.*

and Can., pp. 1148–1152, pl. 65, fig. 29; pl. 73, fig. 9; pl. 76, fig. 5; pl. 79, fig. 54; pl. 84, fig. 59, 1889 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Anthocaris 1, figs. a–h, 1897 (life history). Smyth, E. A. Ent. News, 11 (5) : pp. 465–468, 1900 (larva). Hornig, H. Ent. News, 14 (8) : p. 252, 1903 (egg, larval habits). Grossbeck, J. A. Ent. News, 16 (5) : pp. 131–133, 1905 (habits). Holland, W. J. Butterfly Book, (1), pl. 2, fig. 5; pl. 5, fig. 59; pl. 4, fig. 6 (larva, chrysalis).

Food plant: *Sisymbrium*, *Arabis*, *Cardamine*, *Cruciferae*.

- E. lanceolata* (Boisduval). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Anthocaris 1, fig. x, 1897 (larva, chrysalis). Coolidge, K. R. Can. Ent., 40 (4) : pp. 130, 131, 1908 (chrysalis). Coolidge, K. R. Psyche, 15 : p. 81, 1 fig., 1908 (chrysalis). Holland, W. J. Butterfly Book, (1), p. 285; (3), p. 288 (larva).

Food plant: *Turritis*.

- E. lanceolata australis* (Grinnell). Coolidge, K. R. Can. Ent., 42 (9) : p. 315, 1910 (egg, larva, food plant). Comstock, J. A. Bul. S. Cal. Acad. Sci., 29 (1) : pp. 21, 22, pl. 3, 1930 (egg).

Food plant: *Cruciferae*.

- Callidryas eubule* (Linnaeus). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1056–1059, pl. 65, fig. 30; pl. 76, figs. 2, 4; pl. 79, fig. 67; pl. 84, figs. 60–62, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 2, figs. 2, 4; pl. 5, figs. 60–62 (larva, chrysalis).

Food plant: *Cassia*.

- C. sennae* (Linnaeus). Scudder, S. H. Butterflies of E. U. S. and Can., p. 1833, 1889 (chrysalis).

- Zerene cesonia* (Stoll). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1837–1839, 1889 (life history).

Food plant: *Trifolium*, *Amorpha*.

- Z. eurydice* (Boisduval). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Colias 1, figs. a–k, 1897 (life history).

Food plant: *Amorpha californica*.

- Colias philodice* Godart. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1115–1117, 1119–1123, pl. 65, fig. 25; pl. 68, fig. 14; pl. 72, fig. 3; pl. 76, fig. 10; pl. 79, figs. 46–48; pl. 86, figs. 13, 42; pl. 84, figs. 54, 55; pl. 87, fig. 4, 1889 (life history). Holland, W. J. Butterfly Book, (1), p. 291, pl. 2, fig. 10; pl. 5, figs. 54, 55; (3), p. 293 (egg, larva).

Food plant: *Trifolium*, *Astragalus*.

C. harfordii Hy. Edwards. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Colias 2, figs. a-g, 1897 (life history). Comstock, J. A. Bul. S. Cal. Acad. Sci., 25 (2) : pp. 63, 64, figs. 8, 10, 11, 1926 (life history).

Food plant: *Astragalus*.

C. interior Scudder. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1107-1110, 1889 (egg, larva, food plant).

C. alexandra Edwards. Holland, W. J. Butterfly Book, (1), p. 292; (3), pp. 294, 295 (larva, chrysalis). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (life history).

Food plant: *Astragalus, Thermopsis, Trifolium repens*.

C. scudderri Reakirt. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (larva).

Food plant: *Populus, Vaccinium, Salix*.

C. christina Edwards. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (larva).

Food plant: *Trifolium*.

C. eurytheme Boisduval. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1129-1130, 1132, pl. 65, fig. 22; pl. 76, fig. 1, pl. 79, fig. 61; pl. 84, fig. 53, 1889 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Colias 3, 1897 (breeding experiments). Wildermuth, V. L. U. S. Dept. Agric. Ent. Circular, 133, pp. 1-14, figs. 1, 4, 5, 1911 (habits). Wildermuth, V. L. Bul. U. S. Dept. Agr., 124: pp. 1-28, figs. 2, 5-7, 13, 17, 1914 (life history). Wildermuth, V. L. U. S. Dept. Agr. Farmer's Bul., 1094: pp. 3-7, figs. 3-5, 1920 (life history). Holland, W. J. Butterfly Book, (1), pl. 2, fig. 1; pl. 5, fig. 53 (larva, chrysalis).

Food plant: *Trifolium, Melilotus alba, Astragalus, Medicago sativa*.

C. meadii Edwards. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (larva, chrysalis).

Food plant: *Trifolium*.

C. elis Strecker. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (larva, chrysalis).

C. hecla Lefevre. Sheldon, W. G. Entomologist, 47 (610) : pp. 82-85, 1914 (egg, larva). Klots, A. B. Ent. News, 46 (2) : p. 58, 1935 (ovoviparity).

Food plant: *Astragalus alpinus*.

C. nastes Boisduval. Sheldon, W. G. Entomologist, 45 (587) : pp. 122-125, 1912 (life history).

Food plant: *Astragalus alpinus, Trifolium repens*.

C. behrii Edwards. Comstock, J. A. Bul. S. Cal. Acad. Sci., 25 (2) : p. 64, 1926 (food plant).

Food Plant: *Vaccinium caespitosum*, *Gentiana newberryi*. *Eurema niceppe* (Cramer). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1069–1072, pl. 65, fig. 31; pl. 76, fig. 6; pl. 79, fig. 68; pl. 84, figs. 51, 52, 1889 (life history). Ainslie, G. C. Proc. Ent. Soc. Wash., 19 : p. 78, 1917 (chrysalis). Comstock, J. A. Bul. S. Cal. Acad. Sci., 25 (2) : pp. 64–65, figs. 9, 14, 1926 (life history). Holland, W. J. Butterfly Book, (1), pl. 2, fig. 6; pl. 5, figs. 51, 52 (larva, chrysalis).

Food plant: *Cassia*, *Leguminosae*.

E. lisa (Boisduval and Leconte). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1089–1090, 1092–1094, pl. 65, fig. 32; pl. 76, fig. 3; pl. 79, fig. 55; pl. 84, fig. 56, 1889 (life history). Skinner, H. Ent. News, 1 (1) : p. 8, 1890 (oviposition). Holland, W. J. Butterfly Book, (1), pl. 2, fig. 3; pl. 5, fig. 56 (larva, chrysalis).

Food plant: *Cassia*, *Trifolium*.

E. demoditas Hübner. Haskin, J. R. Ent. News, 44 (6) : pp. 153–154, 1933 (life history).

Food plant: *Aeschynomene viscidula*, *Stylosanthes biflora*.

Parnassius smintheus Doubleday and Hewitson. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Parnassius 1, figs. a–h, 1897 (life history). Comstock, J. A. Bul. S. Cal. Acad. Sci., 25 (2) : p. 62, figs. 6, 7, 1926 (egg, larva). Comstock, J. A. Bull. S. Cal. Acad. Sci., 29 (3) : pp. 135–136, pl. 28, 1930 (larva, chrysalis).

Food plant: *Sedum*, *Saxifraga*.

Papilio polydamas Linnaeus. Dyar, H. G. Proc. Ent. Soc. Wash., 13 : p. 227, 1911 (larva). Holland, W. J. Butterfly Book, (1), p. 316 (larva).

Food plant: *Aristolochia*.

P. polydamas lucayus Rothschild and Jordan. Comstock, J. A., and Grimshawe, F. M. Bul. S. Cal. Acad. Sci., 34 (1) : pp. 76–80, pls. 3–6, 1935 (life history).

Food plant: *Aristolochia pentandra*, *A. macrophylla*, *A. grandiflora gigas*, *A. ringens*.

P. philenor Linnaeus. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1244–1245, 1248–1250, pl. 66, figs. 4, 8; pl. 72, fig. 7; pl. 76, figs. 13, 20, 21; pl. 80, figs. 1–5; pl. 85, figs. 14–17, 20, 1889 (life history). Scudder, S. H. Psyche, 8 (265) : p. 207, pl. 5, 1898 (larva). Girault, A. A. Can. Ent., 39 (6) : pp.

209–211, 1907 (larva, chrysalis). Florsheim, C. Ent. Rec., 21 (6–8) : pp. 146–148, 157, 158, 1909 (larval habits). Holland, W. J. Butterfly Book, (1), pl. 2, figs. 13, 20, 21; pl. 6, figs. 14, 17, 20 (larva, chrysalis).

Food plant: *Aristolochia siphon*, *Aristolochia serpentaria*.

- P. polyxenes* Fabricius. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1357–1362, pl. 66, fig. 2; pl. 72, fig. 11; pl. 76, figs. 17, 24, 27; pl. 79, figs. 56–60; pl. 85, figs. 13, 18, 19, 1889 (life history). Soule, C. G. Psyche, 8 (284) : p. 435, 1899 (oviposition, larva). Chittenden, F. H. U. S. Dept. Agr. Ent. Bul., 82 (2) : pp. 20–24, figs. 5, 6, 1909 (life history).

Food plant: *Umbelliferae*.

- P. asterias* Cramer. Holland, W. J. Butterfly Book, (1), pl. 2, figs. 17, 14, 27; pl. 6, figs. 13, 18, 19 (larva, chrysalis). Meiners, E. P. Ent. News, 47 (10) : p. 269, 1936 (habits, food plant).

Food plant: *Umbelliferae*.

- P. americanus* Kollar. Meiners, E. P. Ent. News, 47 (10) : p. 269, 1936 (habits, food plant).

Food plant: *Umbelliferae*.

- P. brevicauda* Saunders. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1852–1854, 1889 (life history).

Food plant: *Umbelliferae*.

- P. brucei* Edwards. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Papilio 4, 1897.

Food plant: *Artemisia dracunculoides*.

- P. zolicaon* Boisduval. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Papilio 3, figs. a–g, 1897 (life history). Coolidge, K. R. Bul. Brooklyn Ent. Soc., 19 (2) : pp. 44, 45, 1924 (egg, food plant).

Food plant: *Umbelliferae*.

- P. indra* Reakirt. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (egg, larva).

Food plant: *Artemisia dracunculoides*.

- P. indra pergamus* Hy. Edwards. Comstock, J. A. Bul. S. Cal. Acad. Sci., 27 (3) : pp. 82–86, pls. 12, 13, 1928 (life history).

- P. thous* Linnaeus. Engelhardt, G. P. Bul. Brooklyn Ent. Soc., 13 (1) : p. 22, 1918 (food plant).

Food plant: *Ptelea*, *Xanthoxylon*, *Citrus*, *Ruta graveolens*.

- P. cresphontes* Cramer. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1337–1339, 1341–1343, pl. 66, fig. 3; pl. 68, fig. 19; pl. 73, fig. 1; pl. 76, fig. 16; pl. 79, figs. 62–66; pl. 85, figs. 8–10, 1889 (life history). Seudder, S. H. Psyche, 8 (265, 266) : pp.

210, 221–224, pl. 5, 1898 (larva). Holland, W. J. Butterfly Book, (1), pl. 2, fig. 16; pl. 6, figs. 8–10 (larva, chrysalis).

Food plant: *Ptelea*, *Xanthoxylon*, *Citrus*.

P. glaucus Linnaeus. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1291–1294, 1296–1300, pl. 66, fig. 1; pl. 68, fig. 18; pl. 76, figs. 15, 26, 28; pl. 80, figs. 7–10; pl. 85, figs. 1–4, 1889 (life history). Scudder, S. H. Psyche, 8 (265) : p. 208, pl. 5, 1898 (larva). Jeheber, E. Ent. News, 16 (4) : pp. 111, 112, 1905 (food plant). Holland, W. J. Butterfly Book, (1), p. 310, pl. 2, figs. 15, 26, 28; pl. 6, figs. 1–4; p. 4, fig. 3 (life history).

Food plant: *Prunus*, *Cerasus*, *Liriodendron*, *Populus*, *Fraxinus*.

P. daunus Boisduval. Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Supplementary Notes, 1897 (larva).

Food plant: *Rosaceae*, *Populus*.

P. eurymedon Boisduval. Comstock, J. A. Bul. S. Cal. Acad. Sci., 25 (2) : p. 65, figs. 12, 13, 1926 (larva, chrysalis). Holland, W. J. Butterfly Book, (1), p. 309; (3), p. 320 (larva).

Food plant: *Rhamnus californica*.

P. troilus Linnaeus. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1317–1325, pl. 66, fig. 13; pl. 68, fig. 20; pl. 72, figs. 8, 9; pl. 76, figs. 18, 19, 22; pl. 79, figs. 69–73; pl. 82, figs. 4–6; pl. 86, figs. 24, 25; pl. 85, figs. 5–7; pl. 86, figs. 22, 23, 34, 35, 74–80; pl. 87, figs. 6, 15, 24, 1889 (life history). Scudder, S. H. Psyche, 8 (265) : p. 209, pl. 5, 1898 (larva). Holland, W. J. Butterfly Book, (1), pl. 2, figs. 18, 19, 22; pl. 6, figs. 5–7 (larva, chrysalis).

Food plant: *Sassafras*, *Laurus*.

P. palamedes Drury. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1848–1851, 1889 (life history).

Food plant: *Magnolia*, *Lauraceae*, *Citrus*.

P. ajax Linnaeus. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1269–1278, pl. 66, fig. 5; pl. 73, fig. 12; pl. 76, fig. 14; pl. 80, figs. 13–16; pl. 85, figs. 11, 12, 1889 (life history). Edwards, W. H. Butterflies of N. Amer., 3rd Ser., Papilio 5, 1897 (breeding experiments). Scudder, S. H. Psyche, 8 (265) : p. 208, pl. 5, 1898 (life history). Rowley, R. R. Ent. News, 17 (5) : pp. 175–177, 1906 (egg). Rowley, R. R. Ent. News, 18 (7) : pp. 306–308, 1907 (habits). Florsheim, C. Ent. Rec., 21 (5) : pp. 113–115, 1909 (larva). Holland, W. J. Butterfly Book, (1), pl. 2, fig. 14; pl. 6, figs. 11, 12 (larva, chrysalis).

Food plant: *Asimina triloba*.

P. rukini Comstock. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 36 (1) : pp. 13-18, pls. 2-5, 1937 (life history).

Food plant: *Thamnosma montana*, *Foeniculum*.

Phocides batabano (Lucas). Dyar, H. G. Can. Ent., 22 (10) : pp. 211, 212, 1890 (metamorphosis).

Food plant: *Rhizophora mangle*.

Polygonus amyntas (Fabricius). Dyar, H. G. Ent. News, 8 (7) : pp. 182, 183, 1897 (egg, larva, food plant).

Food plant: *Piscidia erythrina*.

Epargyreus tityrus Fabricius. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1402-1410, pl. 73, fig. 8; pl. 76, figs. 30, 31, 33, 35; pl. 80, figs. 19-22; pl. 82, figs. 9, 11; pl. 85, figs. 22, 25, 26; pl. 86, fig. 26; pl. 87, figs. 1, 11, 12, 1889 (life history). Skinner, H. Trans. Am. Ent. Soc., 37 : pp. 192, 193, 1911 (larva, chrysalis, food plant). Girault, A. A. Ent. News, 24 (5) : pp. 195, 196, 1913 (larval habits). Holland, W. J. Butterfly Book, (1), pl. 2, figs. 30, 31, 33; pl. 6, figs. 22, 25, 26 (larva, chrysalis). Sim, R. J. J. N. Y. Ent. Soc., 44 (4) : p. 316, 1936 (food plant).

Food plant: *Wistaria*, *Robinia pseudacacia*, *Acacia*, *Amorpha*, *Lespedeza*, *Lathyrus*, *Aplos*, *Desmodium*, *Amphicarpa*, *Pueraria hirsuta*.

Eudamus proteus (Linnaeus). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1389-1392, pl. 66, fig. 6; pl. 76, fig. 34; pl. 80, figs. 11, 12; pl. 85, fig. 23, 1889 (life history). Chittenden, F. H. Bul. U. S. Dept. Agr. Ent., 33 : pp. 92-96, fig. 20, 1902 (life history). Skinner, H. Trans. Am. Ent. Soc., 37 : pp. 195, 196, 1911 (larva, chrysalis, food plant). Holland, W. J. Butterfly Book, (1), pl. 2, fig. 34; pl. 6, fig. 23. Comstock, J. A. Bul. S. Cal. Acad. Sci., 31 (1) : p. 18, pl. 12, 1932 (egg).

Food plant: *Wistaria*, *Clitoria*, *Phaseolus*, *Desmodium*.

Thorybes pylades (Seudder). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1438-1443, pl. 66, fig. 7; pl. 69, fig. 5; pl. 73, fig. 5; pl. 76, figs. 25, 29; pl. 80, figs. 25-29; pl. 86, fig. 45; pl. 85, fig. 28, 1889 (life history). Skinner, H. Trans. Am. Ent. Soc., 37 ; pp. 176, 177, 1911 (larva, chrysalis, food plant). Holland, W. J. Butterfly Book, (1), pl. 2, figs. 25, 29; pl. 6, fig. 28 (larva, chrysalis).

Food plant: *Lespedeza*, *Desmodium*, *Trifolium*.

T. bathyllus (Smith and Abbot). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1434-1436, pl. 66, fig. 9; pl. 76, fig. 32; pl.

80, fig. 6; pl. 85, fig. 24, 1889 (life history). Skinner, H. Trans. Am. Ent. Soc., 37: p. 179, 1911 (larva, chrysalis, food plant). Holland, W. J. Butterfly Book, (1), pl. 2, fig. 32; pl. 6, fig. 24 (larva, chrysalis).

Food plant: *Rhynchosia*, *Tephrosia*, *Centrosema*.

T. mexicana Herrich-Schaeffer. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 32 (3) : pp. 110-112, pls. 51-53, 1933 (life history).

Food plant: *Amorpha californica*.

Achalarus lycidas (Smith and Abbot). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1420-1422, pl. 66, fig. 16; pl. 73, fig. 6; pl. 76, fig. 23; pl. 80, figs. 17, 18, 23, 24; pl. 85, fig. 21, 1889 (life history). Skinner, H. Trans. Am. Ent. Soc., 37: pp. 188, 189, 1911 (larva, chrysalis, food plant). Holland, W. J. Butterfly Book, (1), pl. 2, fig. 23; pl. 6, fig. 21 (larva, chrysalis).

Food plant: *Desmodium*, *Indigo*, *Indigofera*, *Ipomoea*.

Rhabdooides cellus (Boisduval and Leconte). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1855, 1856, 1889 (larva, chrysalis). Skinner, H. Trans. Am. Ent. Soc., 37: p. 190, 1911 (larva, chrysalis, food plant). Clark, A. H. Science, 80 (2068) : pp. 163, 164, 1934 (life history). Clark, A. H. Smithsonian Misc. Coll., 95 (7) : pp. 1-50, 8 pls., figs. A-H, 1936 (life history).

Food plant: *Breweria aquatica*.

Hesperia scriptura (Boisduval). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (2) : p. 26, 1929 (food plant).

Food plant: *Sida hederacea*.

H. montivaga (Reakirt). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1539-1542, pl. 77, figs. 14, 17; pl. 80, fig. 45; pl. 85, fig. 35; 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 35 (chrysalis).

H. ericetorum (Boisduval). Coolidge, K. R. Ent. News, 34 (5) : pp. 140-146, 1923 (life history).

Food plant: *Sphaeralcea*, *Malva*, *Althea*.

Pholisora catullus (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1521-1522, 1524, 1526, pl. 66, fig. 21; pl. 69, fig. 2; pl. 77, figs. 16, 21, 23; pl. 80, figs. 43, 44; pl. 85, figs. 29, 36, 41, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, figs. 29, 36, 41 (chrysalis). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 33 (3) : p. 141, pl. 45, 1934 (egg).

Food plant: *Chenopodium album*, *Amaranthaceae*, *Ambrosia*.

P. libya Scudder. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 31 (3) : pp. 96, 97, pls. 31, 32, 1932 (life history).

Food plant: *Atriplex canescens*.

P. alpheus Edwards. Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (2) : pp. 25, 26, pls. 10, 11, 1929 (life history).

Food plant: *Atriplex expansa*.

P. hayhurstii Edwards. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1857, 1858, 1889 (life history).

Thanaos brizo Boisduval and Leconte. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1503-1506, pl. 66, fig. 12; pl. 69, fig. 4; pl. 77, figs. 12, 18; pl. 85, fig. 38, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 38 (chrysalis).

Food plant: *Quercus, Galactia*.

T. icelus (Scudder and Burgess). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1509-1514, pl. 77, fig. 1; pl. 85, fig. 27, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 27 (chrysalis).

Food plant: *Quercus, Populus tremuloides, Hamamelis virginiana*.

T. lucilius (Scudder and Burgess). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1461-1467, pl. 66, fig. 14; pl. 69, figs. 3, 6; pl. 73, fig. 2; pl. 77, figs. 8, 9; pl. 80, figs. 31-35; pl. 82, fig. 10; pl. 86, figs. 28-30, 46, 47; pl. 85, figs. 30-32, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, figs. 30-32 (chrysalis).

Food plant: *Aquilegia canadensis*.

T. persius (Scudder). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1471-1475, pl. 66, fig. 11; pl. 69, fig. 1; pl. 77, figs. 7, 15; pl. 80, figs. 37-41; pl. 82, fig. 7; pl. 85, fig. 34, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 34 (chrysalis).

Food plant: *Galactia, Quercus ilicifolia, Populus*.

T. persius afranius (Lintner). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 31 (3) : pp. 94, 95, pls. 29, 30, 1932 (life history).

Food plant: *Lotus americanus, Ceanothus divaricatus*.

T. martialis (Scudder). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1496-1498, pl. 66, fig. 16; pl. 69, fig. 9; pl. 77, fig. 13; pl. 85, fig. 37, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 37 (chrysalis).

Food plant: *Indigofera, Amaranthus*.

T. juvenalis (Fabricius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1480–1485, pl. 77, figs. 2–6, 10, 11; pl. 80, figs. 30, 36, 42; pl. 82, figs. 1, 2; pl. 86, figs. 48–51; pl. 85, fig. 33, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 33 (chrysalis).

Food plant: *Leguminosae, Quercus.*

T. horatius (Seudder and Burgess). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1488, 1489, 1889 (larva, chrysalis).

Food plant: *Wistaria frutescens.*

T. tristis Boisduval. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 31 (2) : pp. 42–45, pls. 22, 23, 1932 (life history).

Food plant: *Quercus.*

T. funeralis (Seudder and Burgess). Coquillett, D. W. J. N. Y. Ent. Soc., 7 (2) : pp. 211, 212, 1899 (larva). Coolidge, K. R. J. N. Y. Ent. Soc., 31 (4) : pp. 175–181, 1923 (life history). Comstock, J. A. Bul. S. Cal. Acad. Sci., 29 (1) : p. 24, pls. 7, 8, 1930 (life history).

Food plant: *Nemophila, Hosackia glabra, Medicago sativa.*

Pamphila mandan Edwards. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1571–1574, 1889 (egg, larva). Fletcher, J. Can. Ent., 21 (6) : pp. 113–116, 1889 (egg, larva).

Food plant: Grasses.

Oarisma garita (Reakirt). Gibson, A. Can. Ent., 42 (4) : pp. 145–147, 1910 (egg, larva, food plant).

Food plant: *Poa pratensis.*

Amblyscirtes vialis (Edwards). Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1583–1587, pl. 66, fig. 17; pl. 69, fig. 7; pl. 77, fig. 24; pl. 80, figs. 46–50, 53; pl. 85, fig. 40, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 40 (chrysalis).

Food plant: Grasses.

A. samoset (Scudder). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1590–1592, pl. 77, fig. 29; pl. 85, fig. 45, 1889 (larva, chrysalis). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 45 (chrysalis).

Food plant: Grasses, *Sorghum.*

A. bellus (Edwards). Coolidge, K. R. Can. Ent., 43 (1) : pp. 7, 8, 1911 (egg, larva).

Food plant: Grasses.

Anclyoxypha numitor Fabricius. Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1560–1562, pl. 66, figs. 22, 25; pl. 69, fig.

8; pl. 73, fig. 4; pl. 80, fig. 51, 1889 (life history). Beutemüller, W. Can. Ent., 21 (8), p. 160, 1889 (egg).

Food plant: Grasses.

Copaeodes aurantiaca (Hewitson). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (2) : pp. 28, 29, pl. 14, 1929 (life history).

Food plant: *Capriola dactylon*.

Pseudocopaeodes eunus (Edwards). Comstock, J. A. Bul. S. Cal. Acad. Sci., 30 (3) : pp. 87, 88, pl. 27, fig. b, 1931 (egg).

Erynnis juba (Seudder). Lindsey, A. W. J. Sci. Lab. Denison Univ., 20 : pp. 121-125, pl. 16, 1923 (egg, larva).

E. sassacus (Harris). Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1643-1645, pl. 66, figs. 19, 23 ; pl. 69, fig. 12 ; pl. 73, fig. 7, 1889 (egg, larva).

Food plant: Grasses.

E. metea (Seudder). Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1652-1653, pl. 66, fig. 30 ; pl. 80, fig. 52, 1889 (egg, larva).

Food plant: Grasses.

E. leonardus (Harris). Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1675-1677, pl. 66, fig. 33 ; pl. 69, fig. 11 ; pl. 73, fig. 10 ; pl. 77, figs. 32, 33 ; pl. 80, figs. 66, 67, 1889 (egg, larva).

Food plant: Grasses.

Hylephila phylaeus (Drury). Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1633-1634, pl. 85, fig. 39 ; pl. 77, fig. 19, 1889 (larva, chrysalis). Coquillett, D. W. J. N. Y. Ent. Soc., 7 (2) : p. 211, 1899 (larva). Coolidge, K. R. Trans. Am. Ent. Soc., 50 : pp. 319-324, 1925 (life history). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 32 (2) : p. 82, pl. 25, 1933 (life history).

Food plant: Grasses.

Augiaades sylvanoides (Esper). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (2) : p. 27, pl. 13, 1929 (larva, chrysalis). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (3) : p. 55, 1929 (egg).

Food plant: Grasses.

A. nemorum (Boisduval). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (3) : p. 56, pl. 30, 1929 (egg).

A. agricola (Boisduval). Comstock, J. A. Bul. S. Cal. Acad. Sci., 26 (3) : pp. 68, 70, pl. 18, 1927 (egg, larva).

Polites verna (Edwards). Seudder, S. H. Butterflies of E. U. S. and Can., pp. 1744-1745, pl. 66, fig. 35 ; pl. 77, figs. 25, 26 ; pl. 80, fig. 65, 1889 (egg, larva).

Food plant: Grasses.

P. manataaqua (Scudder). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1722–1724, pl. 66, fig. 26; pl. 69, fig. 14; pl. 73, fig. 3; pl. 80, figs. 63, 64; pl. 86, fig. 52, 1889 (egg, larva).

Food plant: Grasses.

P. taumas (Fabreius). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1727–1730, pl. 66, fig. 29; pl. 77, figs. 27, 35; pl. 80, figs. 60–62; pl. 86, fig. 53; pl. 85, fig. 44, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 44 (chrysalis).

Food plant: Grasses.

P. peckius (Kirby). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1686–1688, pl. 66, fig. 28; pl. 80, fig. 57, 1889 (egg, larva).

Food plant: Grasses.

P. sabuleti comstocki (Boisduval). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (2) : p. 26, pl. 12, 1929 (egg, larva, food plant).

Food plant: *Capriola dactylon*.

P. mystic (Scudder). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1707–1710, pl. 66, figs. 20, 24; pl. 69, fig. 13; pl. 80, figs. 58, 59, 1889 (egg, larva).

Food plant: Grasses.

P. brettus (Boisduval and Leconte). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1703–1704; 1889 (life history).

Food plant: Grasses.

Atalopedes huron (Edwards). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1664–1666, pl. 66, fig. 31; pl. 77, figs. 28, 30, 31; pl. 80, figs. 68–71; pl. 85, figs. 43, 47, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, figs. 43, 47 (chrysalis).

Food plant: Grasses.

A. campestris (Boisduval). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (2) : pp. 30, 31, pls. 16, 17, 1929 (life history).

Food plant: Grasses, *Capriola dactylon*.

Catia aetna Scudder. Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1698–1700, pl. 66, fig. 27; pl. 73, fig. 11; pl. 77, fig. 34; pl. 85, fig. 42, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 42 (chrysalis).

Food plant: Grasses.

Atrytone logan (Edwards). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1615–1616, 1889 (larva, chrysalis).

Food plant: *Erianthus alopecuroides*.

A. metacomet (Harris). Scudder, S. H. Butterflies of E. U. S. and Can., p. 1741, 1889 (egg).

Poanes zabulon (Boisduval and Leconte). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1620–1624, pl. 66, fig. 18; pl. 69, fig. 10; pl. 77, fig. 22; pl. 80, figs. 54–56, 1889 (life history).

Food plant: Grasses.

P. melane (Edwards). Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 30 (1) : pp. 20–22, pl. 8, 1931 (life history).

Food plant: Grasses, *Capriola dactylon*.

Lerema accius (Smith and Abbot). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1769–1771, pl. 66, fig. 36; pl. 77, fig. 36; pl. 85, fig. 46, 1889 (life history). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 46 (chrysalis).

Food plant: *Zea mays*, *Erianthus*.

Lerodea eupala Edwards. Coolidge, K. R. Ent. News, 33 (10) : pp. 305–309, 1922 (life history). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (2) : pp. 29, 30, pl. 15, 1929 (larva, chrysalis). Comstock, J. A. Bul. S. Cal. Acad. Sci., 28 (3) : p. 56, pl. 31, 1929 (egg).

Food plant: Grasses.

Oligoria maculata (Edwards). Scudder, S. H. Butterflies of E. U. S. and Can., p. 1763, 1889 (larva, chrysalis).

Prenes panoquin (Scudder). Skinner, H. Ent. News, 1 (1) : pp. 8, 9, 1890 (egg).

P. errans (Skinner). Comstock, J. A. Bul. S. Cal. Acad. Sci., 29 (3) : pp. 139–141, 1930 (life history).

Food plant: *Capriola dactylon*.

Calpodes ethlius (Cramer). Scudder, S. H. Butterflies of E. U. S. and Can., pp. 1752–1756, pl. 66, fig. 34; pl. 69, fig. 15; pl. 77, fig. 20; pl. 80, figs. 72–74; pl. 85, fig. 48, 1889 (life history). Chittenden, F. H. Bul. U. S. Dept. Agr. Ent., 54 : pp. 54–58, fig. 18, 1905 (metamorphosis). Holland, W. J. Butterfly Book, (1), pl. 6, fig. 48 (chrysalis).

Food plant: *Canna*.

Megathymus yuccae (Boisduval and Leconte). Holland, W. J. Butterfly Book, (1), fig. 182; (3), figs. 196–198 (life history).

Food plant: *Yucca*.

M. yuccae navajo Skinner. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 33 (2) : pp. 87–92, pls. 31–35, 1934 (life history).

Food plant: *Yucca brevifolia*.

M. streckeri Skinner. Leussler, R. A. Ent. News, 41 (1) : pp. 7–9, 1930 (oviposition, egg, larva, food plant).

Food plant: *Yucca*.

M. mariae Barnes and Benjamin. Bonniwell, J. C. Ann. Carn. Mus., 20 (2) : pp. 264, 265, 1931 (metamorphosis).

M. stephensi Skinner. Comstock, J. A., and Dammers, C. M. Bul. S. Cal. Acad. Sci., 33 (2) : pp. 79-86, pls. 26-30, 1934 (life history).

Food plant: *Agave deserti*.

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THE GENERA LASIOPOGON LOEW AND ALEXIOPOGON CURRAN IN NORTH AMERICA (DIPTERA-ASILIDAE)

BY F. R. COLE, REDLANDS, CALIF., AND J. WILCOX,

DIVISION OF TRUCK CROP AND GARDEN INSECT INVESTIGATIONS, BUREAU
OF ENTOMOLOGY AND PLANT QUARANTINE, UNITED STATES
DEPARTMENT OF AGRICULTURE

The robber flies now included in the genera *Lasiopogon* Loew and *Alexiopogon* Curran were all formerly included in the genus *Lasiopogon*. In this paper keys and descriptions to all the known North American species are given and 21 species are described as new. Since Back's monograph of 1909 (1),¹ in which descriptions of the 6 species then known were given, 10 species have been described, namely: *drabicolum* Cole (3); *cinereus* Cole (4, p. 229); *actius*, *aldrichii*, *delicatulus*, *fumipennis*, *monticola*, *ripicola*, and *trivittatus* Melander (9); and *littoris* Cole (5). Schaeffer (11) described *arizonensis* in *Lasiopogon*, but the writers were informed by the late Dr. J. M. Aldrich, of the United States National Museum, where the type is now on deposit, that the specimen has a distinct curved tibial spur and runs to *Cophura* in the keys. Melander's key (9) has been of great help in establishing most of the species described up to 1923. The Palearctic species were treated by Bezzi (2) in 1916, 16 species being listed together with descriptions and keys.

Loans of material and assistance have been received from several sources.² From the limited quantity of material in most collections,

¹ Numbers in italics in parentheses refer to Bibliography at end.

² The writers are especially indebted to Nathan Banks and Rich-

one would judge that the species are rare. In the West this is certainly not the case, as the writers and Charles H. Martin have collected several thousand specimens in the past few years, and friends, especially S. E. Crumb, Wm. W. Baker, M. W. Stone, R. E. Dimick, and the late F. S. Carr, have contributed hundreds of additional specimens.

The species for the most part are usually taken near water; thus *arenicola* (Osten Sacken), *actius* Melander, *bivittatus* Loew, *dimicki* and *pacificus*, new species, and probably *littoris* Cole, are taken on the dry sands of the sea beach and in open spots in the woods near the ocean; *cinereus* Cole, *drabicola* Cole, *ripicola* Melander, *willametti* and *pugeti*, new species, and sometimes *aldrichii* Melander, are taken resting on sand, rocks, or logs along streams and rivers and in open places in the woods adjacent thereto; *monticola* Melander, *aldrichii* Melander, and *fumipennis* Melander are usually taken at higher elevations in open spots in the forest not necessarily adjacent

ard Dow for making comparisons with the Loew types in the Museum of Comparative Zoology, Harvard University, and to the late Dr. J. M. Aldrich for examining the type of *Lasiopogon arizonensis* Schaeffer in the United States National Museum.

For generous loans of material they are greatly indebted to the following: Edward S. Thomas and C. F. Walker, Ohio State Museum; J. McDunnough and G. S. Walley, Canadian National Collection; C. H. Curran, American Museum of Natural History; Vasco M. Tanner, Brigham Young University; Ezra T. Cresson, Jr., Academy of Natural Sciences of Philadelphia; C. S. Brimley, North Carolina Department of Agriculture; Franklin Sherman, Clemson Agricultural College; Richard Dow, Boston Society of Natural History; J. C. Bradley, Cornell University; H. B. Hungerford and R. H. Beamer, University of Kansas; the late J. M. Aldrich, United States National Museum; Maurice T. James and Charles Hicks, University of Colorado; Nathan Banks, Museum of Comparative Zoology; E. P. Van Duzee, California Academy of Sciences; G. Allen Mail and J. H. Pepper, Montana State College; R. H. Painter, Kansas State College; R. E. Dimick, Oregon State College; the late F. S. Carr, Medicine Hat, Alberta; C. H. Martin and Randall Latta, Sumner, Wash.; S. E. Crumb, Wm. W. Baker, and C. W. Getzendaner, Puyallup, Wash.; M. C. Lane, Walla Walla, Wash.; F. H. Shirck, Parma, Idaho; M. W. Stone and R. Sloop, Alhambra, Calif.; H. H. Kiefer, Sacramento, Calif.; S. W. Bromley, Stamford, Conn.; Hugh B. Leech, Salmon Arm, British Columbia; G. P. Engelhardt, Hartsdale, N. Y.; F. S. Blanton, Babylon, N. Y.; A. Earl Pritchard, Oklahoma A. and M. College; and Owen Bryant, Tucson, Ariz.

to water, resting on rocks, logs, and twigs, frequently on the ground, and occasionally on foliage; *delicatulus* Melander was taken in an open alpine meadow on bare spots between the low-growing plants, while and shortly after the snow was melting; *chaetosus* and *albidus*, new species, were taken in the dry sagebrush country resting on the ground, *albidus* in an especially sandy location. Frequently two or three species can be taken in the same habitat at the same time.

The immature stages of *Lasiopogon* and *Alexiopogon* apparently have not been studied in this country. Lundbeck (8, p. 39) says: "The larvae live in the ground on sandy localities, and the pupae are found in the same places. The larvae hibernate, and the trans-

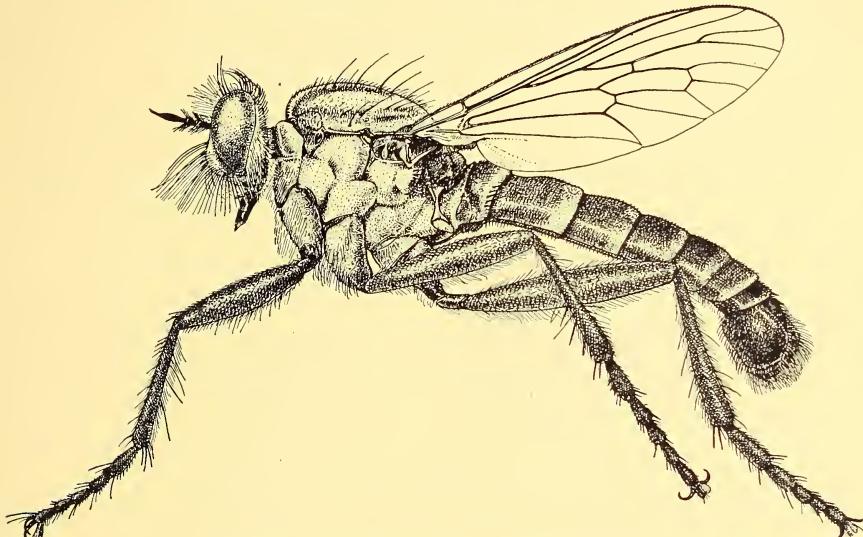


FIGURE 1. *Lasiopogon pugeti*, new species.

formation to pupa and the development of the imago take place in the following spring." Additional information on the immature stages of the robber flies will be found in the papers by Melin (10, p. 115-166) and Séguay (12).

The male hypopygium is especially valuable in the identification of the species. The two parts that are heavily sclerotic and exposed so that they can readily be seen without dissection or preparation are the surstyli and the hypandrium. The surstyli have been defined by Cole (6, p. 404-405) as follows: "The lateral portions of the ninth segment may be prolonged and form accessory clasping organs, which may be known as *surstyli*. The dististylia and surstyli often have spines or ridges on the surface to aid in holding the females

more securely." Melander (9) refers to the surstyli as the "lower valves," and Lundbeck calls them the "upper or large forceps." According to Cole (6, p. 401), "the term *hypandrium* for the plate or sternite below the genitalia is a useful term proposed by Cramp-ton. . ." Melander (9) refers to the hypandrium as the "dorsal side" and the posterior margin of the hypandrium as the "dorsal notch" and "dorsal incision."

In *Lasiopogon* the hypopygium is inverted and the hypandrium, which in most genera is ventral in position, is dorsal in position in this genus and bears a prominent posterior fringe of hairs; and the surstyli occupy the entire lower sides and ventral surface. The epandrium is absent. Lundbeck (8, p. 36-37) calls attention to this inversion of the hypopygium and says that in an examination of a mature pupa he found the large forceps lying dorsally. In this paper, therefore, the hypandrium (ninth sternite) will be described and figured as it appears on the species, i. e., dorsally; and the surstyli will be referred to as the parts are found in position on the specimen.

Figures have been drawn illustrating the two general types of hypopygium found. *Lasiopogon pacificus*, new species (fig. 2) is

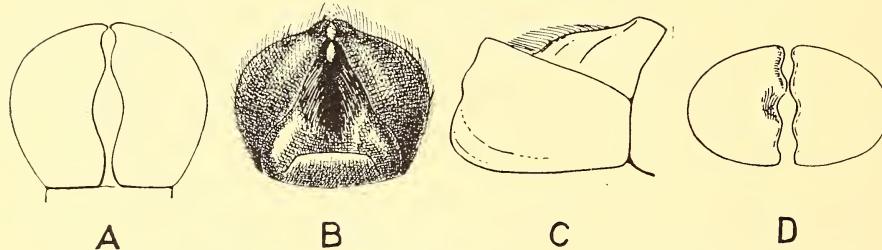


FIGURE 2. *Lasiopogon pacificus*, new species, male genitalia: A, Ventral view of the surstyli; B, Dorsal view of the hypandrium and surstyli; C, Lateral view of the hypandrium and surstyli; D, Apical view of the surstyli.

an example of a species that has the hypandrium bulging, not much wider than long, and with the posterior margin deeply emarginate or V shaped; and with the surstyli in lateral view not much longer than wide and ventrally with a basal umbo or swelling. *Lasiopogon gabrieli*, new species (plate III, fig. 33) is an example of a species that has the hypandrium transverse, much wider than long, and with the posterior margin shallowly and widely emarginate; and with the surstyli in lateral view more than twice as long as wide and ventrally deeply emarginate but without a basal umbo.

The female ovipositor also offers some characters of value in the differentiation of the species. This organ has not been studied sufficiently to show the true relationship of the parts; so a figure

(fig. 3) of the ovipositor of *Lasiopogon pacificus*, new species, has

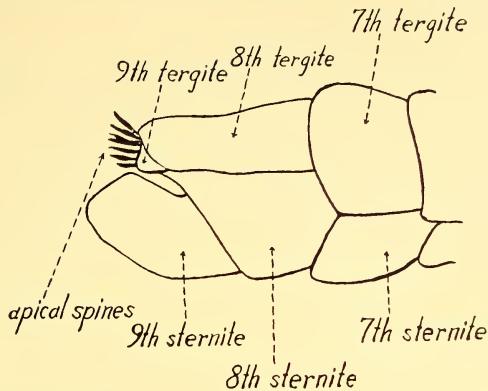


FIGURE 3. *Lasiopogon pacificus*, new species, lateral view of the ovipositor.

been prepared showing the parts referred to in the present descriptions and keys.

Apparently there has been some confusion in the literature with reference to the areas of the mesonotum, so a figure (fig. 4) has been

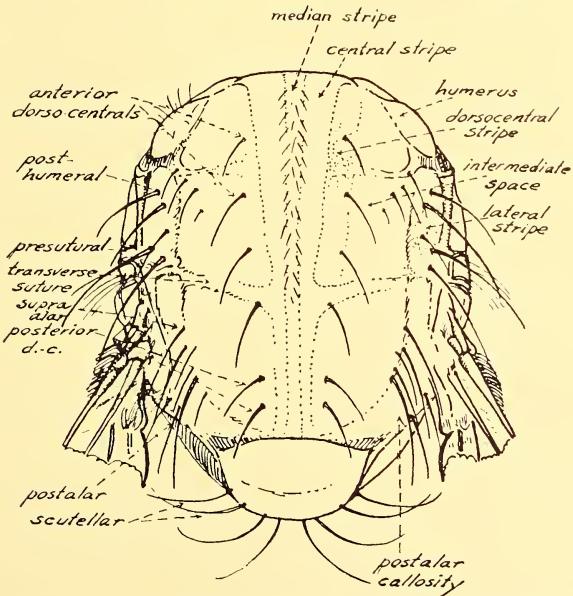


FIGURE 4. *Lasiopogon pugeti*, new species, dorsal view of the mesonotum.

prepared showing the definitions of the areas and bristles used in this paper.

KEY TO GENERA

- Dorsocentral bristles present, usually well defined but in some species inconspicuous; long marginal scutellar bristles or hairs present; abdomen pollinose, at least narrowly, on the posterior margins of most segments *Lasiopogon* Loew, p. 6.
 Dorsocentral bristles absent; scutellum bare, at most with a few short, fine, apical hairs, abdomen pollinose only on the posterior corners of most segments *Alexiopogo* Curran, p. 82.

Lasiopogon Loew

Lasiopogon Loew, Linn. Ent., v. 2, p. 508, 1847.

Daulopogon Loew, Berlin Ent. Ztschr., 18, p. 377, 1874.

Lasiopogon Lundbeck, Diptera Danica, v. 2, p. 35-40, 1908.

Lasiopogon Back, Trans. Amer. Ent. Soc., v. 35, p. 296, 1909.

Lasiopogon Bezzi, Bot. Lab. Zool. Gen. e Agr. R. Scuola Super. Agr. Portici, v. 11, p. 250-281, 1916.

Lasiopogon Melander, Psyche, v. 30, p. 135-145, 1923.

Black or brown species of small to medium size, of comparatively long body structure, and only moderately haired; ground color more or less obscured by grayish or brownish pollen, which on the posterior portions of the abdominal segments is often grayish white. Head of moderate width, obviously broader than high; face broad, but clearly narrowed above, on the lower half with a large protuberance which is wholly covered with a long and moderately thick haired mystax. Antennae approximate, first two joints short, about equal or the second shorter than the first, both with stout hair; third joint elongate oval, of medium length; style distinct, from less than one-half to nearly as long as the third joint and terminated by a fine bristle. Front much broader at the vertex than at the antennae, saddle-shaped. Front, ocellar tubercle, and upper occiput with hair and bristles varying in number and stoutness. Palpi with fine hair. Thorax but little arched, moderately hairy, and with well-developed lateral and dorsocentral bristles; scutellum with marginal bristles; pleura usually without pile, but with a well-developed row of hypopleural bristles. Abdomen cylindrical, flattened, moderately bare, with well-developed lateral bristles on the

first segment. Legs rather slender; hind femora not much longer than front ones. The first tarsal segment longer than the following ones but still, properly speaking, not long; the stout bristles of the tibiae and tarsi of medium length, those on the femora very short and situated chiefly on the upper side toward the tip. Front tibia without terminal clawlike spur; pulvilli normal. Wings usually grayish hyaline, with all the submarginal and posterior cells wide open (fourth posterior cell sometimes narrowed or closed); anal cell closed at the margin or slightly petiolate.

The above is taken from Back's (1) description with slight amendments.

Genotype: *Dasypogon pilosellus* Loew; see Coquillett (7, p. 558). Melander (9), in commenting on *Lasiopogon*, says:

"The species of *Lasiopogon* and *Cyrtopogon* have the face strongly gibbose, thus forming a natural group in the Dasypogoninae. At first sight they appear to intergrade, but the two genera are quite distinct in several characters. The species of *Lasiopogon* are browner in general color, and have the abdomen nearly parallel-sided. They possess a vertical row of setae on the hypopleura, lack the short first segment of the arista, and have the anal cell closed just within the margin. *Cyrtopogon* presents a more tapering abdomen, usually more pilose, the hypopleura with patch of fine pile, the trichostichal hairs, in place of bristles, the basal joint of the arista usually distinct, and the anal cell usually narrowly open. The male genitalia are different in the two genera; in *Lasiopogon* the lateral valves [*surstyli*] are most prominent, the lower valves being undeveloped, the dorsal side [*hypandrium*] is deeply emarginate and furnished with a distinctive fringe; in *Cyrtopogon* the lower valves [*epandrium*] are usually large and there is no dorsal fringe of setae."

Back (1, p. 297) says: "After establishing the generic name *Lasiopogon*, Loew discovered that it was already used as such in botany, and so changed the name to *Daulopogon*, which was adopted by Osten Sacken in his Catalogue (1878). As there is no rule demanding such a change, Dr. Williston was justified in restoring the older name in his Manual of N. Am. Diptera (1896)."

KEY TO THE SPECIES OF LASIOPOGON*

1. Scutellar bristles white; at least some bristles of legs and

* Includes all species but is especially applicable to the males; see the supplementary key to the females, page 13.

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- | | |
|---|---------------------------------|
| thorax white; mystax and hypopleural bristles always white | 2 |
| Scutellar bristles black; bristles of legs and thorax black; mystax and hypopleural bristles variable | 7 |
| 2. Thorax quadriovittate, the central and dorsocentral stripes making four vittae (Intermountain species) | 3 |
| Thorax bivittate on the dorsocentral rows or evittate (Pacific Coast species) | 4 |
| 3. Three anterior dorsocentral bristles present; apex of surstyli triangular in side view; bristles except on tarsi all white; length 9–11 mm. (Nebraska, Alberta, Montana, North Dakota) | <i>quadriovittatus</i> Jones |
| No anterior dorsocentral bristles present; apex of surstyli truncate; only a few of leg and thoracic bristles white, mostly black; length 12 mm. (New Mexico) | <i>aridus</i> , n. sp. |
| 4. Arista longer than short third antennal joint; no vitta on mesonotum; length 5.5 mm. (California) (only male known). | <i>littoris</i> Cole |
| Arista shorter than third antennal joint; thorax bivittate on dorsocentral rows | 5 |
| 5. Lateral bristles of thorax and leg bristles mostly black; upper angle of surstyli obtuse, apical margin evenly rounded, convex; arista two-thirds length of third antennal joint; length 7–12 mm. (Washington, Oregon) | <i>actius</i> Melander |
| Bristles of thorax and legs all white or whitish | 6 |
| 6. Apical margin of surstyli slightly emarginate, upper angle rectangular; first two antennal joints together about two-thirds as long as third joint; length 7–8 mm. (California). | <i>arenicola</i> (Osten Sacken) |
| Apical margin of surstyli convex, evenly rounded, with a small triangular projection above apical angle; first two antennal joints together subequal in length to third joint; length 8–10 mm. (Washington) | <i>albidus</i> , n. sp. |
| 7. Mystax mostly white | 8 |
| Mystax mostly black | 13 |
| 8. With at least eight strong anterior dorsocentral bristles; hairs below on the first antennal joint, and sometimes on the second, white; most of frontal hairs white; hypopygium yellowish red with yellowish hairs except for posterior fringe, which is mostly black; tibiae and tarsi yellowish red, sometimes tibiae darker; length 10–12 mm. (Washington). | <i>chaetosus</i> , n. sp. |

- With not more than 3-4 anterior dorsocentral bristles 9
9. Large species, 12 mm. or more in length 10
- Smaller species, 9 mm. or less in length 11
10. Without anterior dorsocentral bristles; hypopleural and lateral bristles on first abdominal segment white; length 12 mm. (New Mexico) *aridus*, n. sp.
- With three anterior dorsocentral bristles; hypopleural and lateral bristles on first abdominal segment black; length 12 mm. (Washington, Oregon, Idaho, Alberta).
- ripicola* Melander
11. Thorax evittate; third antennal joint broad, little more than twice as long as wide; basal half of abdominal segments shining black, apically grayish pollinose; mystax of males white, of females black on upper half; length 6 mm. (Washington) *delicatulus* Melander
- Thorax definitely vittate, especially on dorsocentral rows 12
12. Thorax trivittate, median stripe undivided; abdominal segments with narrow white pruinose fasciae along hind margins; hypopleural bristles black; nearly bare species; length 7 mm. (Montana) (only female known) *trivittatus* Melander
- Thorax quadrivittate, median stripe plainly divided; sides and posterior half of abdominal segments grayish pollinose; hypopleural bristles usually white; pilose species; length 8-9 mm. (Oklahoma) *oklahomensis*, n. sp.
13. Knob of halteres with dorsum distinctly blackish 14
- Knob of halteres white or yellowish, sometimes brownish 16
14. Basal three-fourths of third antennal joint yellowish red; hairs of surstyli entirely yellow; dorsocentral bristles well developed; length 8 mm. (New Hampshire, North Carolina, Connecticut, Georgia, Maine, Massachusetts).
- currani*, n. sp.
- Third antennal joint black; most of hairs of surstyli black; dorsocentral bristles short, poorly defined 15
15. Fringe on hypandrium black; legs black, at most middle and hind tibiae dark reddish; length 7-9 mm. (Washington, Oregon, British Columbia, California, Idaho, Colorado).
- fumipennis* Melander
- Fringe on hypandrium mostly golden yellow; all tibiae more or less reddish; length 7-9 mm. (Washington, British Columbia) *fumipennis olympia*, n. subsp.
16. Eight or more strong anterior dorsocentral bristles; humeri with short bristles; tibiae and tarsi more or less reddish; length 10-12 mm. (Washington) *chaetosus*, n. sp.

- Usually only 3-4 weak anterior dorsocentral bristles; humeri without bristles 17
17. At least basal one-half and usually basal two-thirds of tibiae reddish; male genitalia entirely reddish 18
Legs black; at least surstyli of male genitalia black 19
18. Posterior fringe of hypandrium black; only basal one-half to two-thirds of tibiae reddish; style two-thirds length of third antennal joint; surstyli without basal umbo; length 8.5-11 mm. (South Carolina, North Carolina) *shermani*, n. sp.
Posterior fringe of hypandrium, in part at least, golden yellow; tibiae and tarsi entirely reddish; style less than one-half length of third antennal joint; surstyli with a well-developed basal umbo; length 8 mm. (California) *testaceus*, n. sp.
19. Eastern species 20
Western species, including Alaska and Yukon Territory 23
20. Style four-fifths length of third antennal joint 21
Style about one-half length of third antennal joint 22
21. In lateral view surstyli about three times as long as wide and sharply bent down apically; hairs of tibiae and tarsi black; length 10 mm. (New Hampshire, New Jersey, Virginia).
slossonae, n. sp.
In lateral view surstyli not more than twice as long as broad and evenly rounded above and below apically; hairs of tibiae and tarsi mostly white; length 8-10 mm. (North Carolina, South Carolina) *carolinensis*, n. sp.
22. Thorax quadriovittate; hypopleural and lateral bristles on first abdominal segment mostly black; upper apical angle of surstyli acute; length 8-10 mm. (Canada, Connecticut, New Hampshire, Massachusetts, New York).
tetragrammus Loew
Thorax indistinctly bivittate on dorsocentral rows; hypopleural and lateral bristles on first abdominal segment mostly white; apex of surstyli above with a small emargination; length 8 mm. (Illinois, Ohio, Maryland, North Carolina, Virginia).
opaculus Loew
23. Not more than posterior one-fourth of abdominal segments pollinose, remainder polished black (Alaskan and northern species) 24
At least posterior one-third of abdominal segments pollinose, remainder usually subshining brownish 26
24. Lateral bristles on first abdominal segment black; knob of halteres white; hypandrium bulging, shining black 25

- Lateral bristles on first abdominal segment white; knob of halteres brownish; hypandrium transverse, more or less reddish; surstyli evenly rounded apically, heart-shaped between margins in ventral view; length 8–10 mm. (Alaska) *hinei*, n. sp.
25. Upper apical angle of surstyli produced into a cone-shaped tubercle, apical margin concave, ventral angle slightly flanged, rounded apically in ventral view; apical one-fourth of abdominal segments pollinose; legs shining black; length 11 mm. (Yukon Territory, Canada) (only male known).
yukonensis, n. sp.
 Upper angle of surstyli not forming tubercle, apical margin slightly convex and with a complete narrow flange, in ventral view broad, nearly square; apical one-fifth of abdominal segments pollinose; legs, especially femora, pollinose; length 9–10 mm. (Alaska) *canus*, n. sp.
26. Surstyli with a strong umbo below at base and in side view not more than $1\frac{1}{3}$ times as long as wide; genitalia from dorsal view wider than abdomen 27
 Surstyli without basal umbo and in side view at least twice as long as wide; genitalia from dorsal view not noticeably wider than abdomen 29
27. Hind coxae with a sharp spur on anterior side; surstyli with a prominent broad flange on lower half at apex; hypandrium less bulging, posterior margin U-shaped; surstyli thinly pollinose; length 10 mm. (Washington, Oregon).
pugeti, n. sp.
 Hind coxae without spur; surstyli without apical flange 28
28. From side view surstyli club-shaped, much wider at apex than at base; mesonotum golden brown pollinose, all stripes prominent; style about one-third length of third antennal joint; short hairs above and most of longer hairs below on hind femora black; length 10–11 mm. (Oregon, Washington, British Columbia) *pacificus*, n. sp.
 From side view surstyli not greatly wider at apex than at base; mesonotum mostly gray pollinose, lateral stripes only vaguely indicated; style one-half length of third antennal joint; hairs of hind femora mostly white or yellowish; length 8 mm. (Idaho, Washington, Oregon, Alberta, Colorado) *aldrichii* Melander
29. Surstyli from lateral view about three times as long as broad. 30
 Surstyli from lateral view about twice as long as broad 31

30. Surstyli shining black and with a shallow emargination above at apex; wings uniformly deep brown; style three-fourths length of third antennal joint, third joint only slightly more than twice as long as broad; length 9–11 mm. (Oregon).
atripennis, n. sp.
 Surstyli gray pollinose with but a slight emargination above at apex; wings hyaline; style one-half length of third antennal joint, third joint at least three times as long as broad; length 8–12 mm. (Oregon, Washington, Alberta, Wyoming, Montana, Utah, California) *cinereus* Cole
31. Style of antennae at least two-thirds length of third joint 32
 Style of antennae one-half length of third antennal joint 34
32. Surstyli shining black with a broad semicircular emargination above at apex; anterior cross vein at or beyond middle of discal cell; style two-thirds length of slender third antennal joint; length 10–12 mm. (California, Oregon, Washington).
bivittatus Loew
 Surstyli densely pollinose and without broad apical emargination 33
33. Surstyli from ventral view deeply rounded; style subequal in length to third antennal joint; at least posterior half of abdominal segments pollinose; length 6–7 mm. (California).
gabrieli, n. sp.
 Surstyli from ventral view not at all rounded; style two-thirds length of third antennal joint; only about posterior one-fourth of abdominal segments pollinose; length 8–9 mm. (California) *zonatus*, n. sp.
34. Surstyli with a prominent tooth on ventral margin before base, upper apical angle rectangular; anterior cross vein at two-fifths length of discal cell; nearly posterior half of abdominal segments pollinose; length 8–9 mm. (Washington, Idaho, Oregon, British Columbia, Utah).
monticola Melander
 Surstyli without tooth below near base 35
35. Posterior half of abdominal segments 2 to 5 pollinose, pollen extending forward on dorsum to or nearly to anterior margin and to anterior margin on sides, so that these segments appear marked with two anterior semicircular subshining brown spots 36
 Only sides and posterior margins of abdominal segments pollinose 39
36. Large, robust species, 10–12 mm. in length; antennal hairs mostly black (Northwestern species) 37

- Smaller species, 7–9 mm. in length; hairs below on first two antennal joints white; mystax black, white, or mixed (California) *drabicola* Cole
37. Lower margin of surstyli in side view nearly semicircular, and in ventral view the two parts but slightly separated, nearly parallel; hairs below on first antennal joint white; length 10–11 mm. (Washington) *martinensis*, n. sp.
- Lower margin of surstyli in side view only slightly curved, and in ventral view the margins rounded on about apical half; antennal hairs black 38
38. Mystax black; longer hairs on abdomen mostly white and not contrasting in color with beard; normally 5 lateral bristles on the first abdominal segment; length 9–12 mm. (Oregon, Washington) *willametti*, n. sp.
- Lower hairs of mystax yellowish or with yellowish tips; longer hairs on abdomen mostly yellow and strongly contrasting in color with hairs of beard; normally at least 10 lateral bristles on first abdominal segment; length 10–11 mm. (Oregon) *dimicki*, n. sp.
39. Hairs on first antennal joint, humeri, and middle anterior part of mesonotum white; surstyli evenly rounded apically above and below; length 9–11 mm. (California).
..... *californicus*, n. sp.
- Hairs mentioned above black; surstyli emarginate above apically 40
40. Normally 5 lateral bristles on first abdominal segment; longer hairs of abdomen mostly white; length 10–12 mm. (Washington, British Columbia) *willametti puyallupi*, n. sp.
- Normally 10 lateral bristles on first abdominal segment; longer hairs of abdomen yellow; length 10–11 mm. (Oregon).
..... *dimicki*, n. sp.

SUPPLEMENTARY KEY TO THE FEMALES*

1. Scutellar bristles white; at least part of bristles of legs and thorax white; mystax and hypopleural bristles always white 2
- Scutellar bristles black; bristles of legs and thorax entirely black; mystax and hypopleural bristles variable 6
2. Thorax quadrivittate, the 2 dorsocentral stripes and the divided

* Does not include *litoris* Cole or *yukonensis*, new species, which are known only from a single male specimen each.

- central stripe making the 4 vittae (Intermountain species) 3
- Thorax bivittate on dorsocentral rows (Pacific Coast species) ... 4
3. Bristles of thorax, legs, and scutellum all white except for a few of the tarsal bristles; anterior dorsocentral bristles well developed; second joint of antennae longer than first; wings hyaline; white hairs on sides of abdomen long and abundant; length 9–11 mm. (Nebraska, Alberta, North Dakota, Montana) *quadrivittata* Jones
Usually only a few of the thoracic and leg bristles white; anterior dorsocentral bristles absent; first and second antennal joints subequal in length; wings tinged with red; white hairs on sides of abdomen very short and inconspicuous; length 12 mm. (New Mexico) *aridus*, n. sp.
4. Most of leg bristles and those on lateral margins of thorax black; some of hairs below on second antennal joint black; style of antennae about one-half length of third joint; length 7–12 mm. (Washington, Oregon) *actius* Melander
Bristles of legs and thorax entirely white; hairs of body entirely white 5
5. Hairs on sides of abdominal segments 2 to 3 about as long as lateral bristles on first segment; face and front gray pollinose; ninth sternite black, at most with a small brownish spot at base; third antennal joint one and one-half times length of first two joints together; tarsi entirely black; length 7–9 mm. (California) *arenicola* (Osten Sacken)
Hairs on sides of abdominal segments 2 to 3 less than half as long as lateral bristles on first segment; face and front with a golden tinge; ninth sternite mostly amber colored; third antennal joint but slightly longer than first two joints together; tarsal joints narrowly yellowish basally and apically; length 8–10 mm. (Washington) *albidus*, n. sp.
6. Posterior half of abdominal segments 2 to 5 pollinose, pollen extending triangularly forward on dorsum to or nearly to anterior margins and to anterior margins on sides, so that these segments appear marked with two anterior semicircular subshining brown spots 7
Usually only narrow posterior margins pollinose, at least pollen not extending forward on dorsum 13
7. Large robust species, 10–12 mm. in length 8
Smaller species, 7–9 mm. in length 12
8. Eight or more strong anterior dorsocentral bristles; humeri with

short bristles; hairs below on first antennal joint and sometimes on second white; length 10–12 mm. (Washington).

chaetosus, n. sp.

Only 3–4 anterior dorsocentral bristles; humeri without bristles 9

9. *Mystax* largely white; length 12 mm. (Washington, Oregon, Alberta, Idaho) *ripicola* Melander

Mystax largely black 10

10. Hairs on first antennal joint, humeri, and anterior discal portion of mesonotum white; some of hairs on last two ventral segments of abdomen black; length 9–11 mm. (California).

californicus, n. sp.

Antennal, humeral, and thoracic hairs all black; hairs on venter of abdomen white 11

11. Normally 7 or less black lateral bristles on first abdominal segment; long hairs on abdominal segments 1 to 3 white and not contrasting in color with beard; color yellowish gray pollinose; length 10–12 mm. (Oregon, Washington, British Columbia) *willametti*, n. sp.

Normally 10 or more black lateral bristles on first abdominal segment; long hairs on sides of abdominal segments 1–3 yellow, contrasting in color with beard; color brown subshining; length 10–11 mm. (Oregon) *dimicki*, n. sp.

12. Hairs below on first two antennal joints white; hypopleural and lateral bristles on first abdominal segment mostly black; length 7–9 mm. (California) *drabicola* Cole

All antennal hairs black; hypopleural and lateral bristles on first abdominal segment mostly white; length 8 mm. (Illinois, Ohio, Maryland, North Carolina) *opaculus* Loew

13. *Mystax* largely white 14

Mystax largely black 17

14. Large species; thorax quadriovittate; anterior dorsocentral bristles absent; length 12 mm. (New Mexico) *aridus*, n. sp.

Smaller species, 9 mm. or less in length 15

15. Thorax evittate; legs only thinly pollinose; at least basal half of abdominal segments shining dark brown; upper hairs of *mystax* black; length 6 mm. (Washington).

delicatulus Melander

Thorax plainly vittate 16

16. Thorax trivittate with brown; legs densely coated with gray pollen; abdominal segments 2 to 7 fulvous over greater portion; length 7 mm. (Montana) (only female known).

trivittatus Melander

- Thorax quadriovittate; legs only thinly pollinose; at most basal half of abdominal segments subshining brown; length 8-9 mm. (Oklahoma) *oklahomensis*, n. sp.
17. Eastern species 18
 Western species, including Alaska 22
18. Eighth sternite entirely or entire ventral portion of ovipositor reddish; tibiae and tarsi usually more or less reddish 19
 Ovipositor black, at most somewhat brownish basally on eighth sternite; legs black 20
19. Knob of halteres with dorsum distinctly black; style of antennae not more than one-half length of third joint, basal two-thirds of third joint yellowish red; entire ventral part of ovipositor reddish; length 7-9 mm. (New Hampshire, North Carolina, Georgia, Massachusetts, Connecticut, Maine).
currani, n. sp.
 Knob of halteres yellowish red; style of antennae two-thirds length of third joint, only basal one-fifth of third joint reddish; only eighth sternite of ovipositor reddish; length 11 mm. (North Carolina, South Carolina) *shermani*, n. sp.
20. Hypopleural and lateral bristles on first abdominal segment usually entirely white; style of antennae four-fifths length of third joint; hairs on ovipositor and seventh sternite black 21
 Hypopleural and lateral bristles on first abdominal segment usually entirely black; style of antennae about one-half length of third joint; hairs on ovipositor and seventh sternite white; length 10-11 mm. (Canada, New York, New Hampshire, Connecticut, Massachusetts).
tetragrammus Loew
21. Thorax broadly bivittate on dorsocentral rows; hairs on tibiae and tarsi mostly white; ovipositor in lateral view of even width; length 8-10 mm. (North Carolina, South Carolina).
carolinensis, n. sp.
 Thorax indistinctly bivittate on dorsocentral rows; hairs on tibiae and tarsi mostly black; ovipositor in lateral view extremely wide basally and narrowed apically; length 10 mm. (New Hampshire, New Jersey, Virginia).
slossonae, n. sp.
22. Alaskan species 23
 Other western species 24
23. Knob of halteres white; lateral bristles on first abdominal segment black; abdomen shining black, posterior margins

- densely gray pollinose; ventral portion of ovipositor more or less reddish; dorsum with long yellow hairs; length 10 mm.
 (Alaska) *canus*, n. sp.
- Knob of halteres brown; lateral bristles on first abdominal segment white; abdomen shining dark brown, its very narrow posterior margin yellow and posterior half of segments obscured by a thin layer of gray pollen; only ninth sternite reddish; dorsum of ovipositor almost devoid of hair; length 10 mm. (Alaska) *hinei*, n. sp.
24. At least ninth sternite reddish or amber colored 25
 Ovipositor entirely black 32
25. Knob of halteres distinctly black on dorsum 26
 Knob of halteres white or yellowish 27
26. Basal one-fourth of dorsum of ovipositor reddish; all tibiae and tarsi more or less reddish; length 8 mm. (Washington, British Columbia) *fumipennis olympia*, n. subsp.
 Only ventral part of ovipositor red; legs usually entirely black; length 8 mm. (Washington, Oregon, British Columbia, California) *fumipennis* Melander
27. Thorax evittate, only indistinctly brown vittate on dorsocentral rows; third antennal joint short and broad; lower hairs of mystax white; length 6 mm. (Washington).
delicatulus Melander
 Thorax distinctly vittate, at least on dorsocentral rows; larger species, 8–10 mm. in length 28
28. Basal two-thirds of dorsum of ovipositor red; venter entirely reddish; wings evenly tinged with red; tibiae and tarsi entirely reddish; style of antennae short, one-third length of third joint; length 8 mm. (California) *testaceus*, n. sp.
 Dorsum of ovipositor dark brown or black and only ninth sternite reddish or amber colored; legs black 29
29. Hairs on lateral margins of last three abdominal segments white; ninth sternite amber colored; style of antennae two-thirds length of third joint; length 9 mm. (California).
zonatus, n. sp.
 Hairs on lateral margins of last three abdominal segments black; ninth sternite reddish; style of antennae not more than one-half length of third joint 30
30. Hind coxae with a sharp spur on anterior side; ninth sternite shorter than eighth in ventral view; length 10 mm. (Washington, Oregon) *pugeti*, n. sp.
 No spur anteriorly on hind coxae; ninth sternite longer than eighth in ventral view 31

31. Median line of thorax narrow and of even width; dorsocentral stripes narrow, usually light brown; most of hairs on hind femora white; hairs on the seventh sternite short and yellowish, usually with a few black hairs; usually only six hairs posteriorly on mesopleura, and six scutellar and five hypopleural bristles; length 8 mm. (Washington, Idaho, British Columbia, Oregon) *aldrichii* Melander
 Median line of thorax broad, somewhat narrowed anteriorly; dorsocentral stripes broad and usually dark shining brown; most of hairs on hind femora black; hairs on seventh sternite long and golden; usually 12 hairs posteriorly on mesopleura, and 8 to 10 scutellar and 7 hypopleural bristles; length 10 mm. (Oregon, Washington, British Columbia).
pacificus, n. sp.
32. Cinereous species; face, thorax, and legs densely so 33
 Golden to brown pollinose species 34
33. Knob of halteres brown; thorax uniformly cinereous pollinose except light-brown dorsocentral stripes; front cinereous; style of antennae about one-half length of third joint; length 8–12 mm. (Oregon, Washington, Alberta, Wyoming, Montana, Utah) *cinereus* Cole
 Knob of halteres white; central stripe of thorax black, obscured by a thin coating of gray pollen and bisected by a broad gray line; front with some golden pollen; style of antennae subequal in length to third joint; length 6–7 mm. (California).
gabrieli, n. sp.
34. Style three-fourths length of third antennal joint 35
 Style about one-half length of third antennal joint 36
35. Wings deep brown all over; only narrow posterior margins of abdominal segments pollinose; anterior cross vein well before middle of discal cell; length 9–11 mm. (Oregon).
atripennis, n. sp.
 Wings clear hyaline; posterior margins of abdominal segments broadly pollinose; anterior cross vein at or beyond middle of discal cell; length 10–12 mm. (California, Oregon, Washington).
bivittatus Loew
36. Long white lateral hairs of abdomen continuing on to fourth abdominal segment, hairs on venter all white; numerous long, slender, black bristles on scutellar margin; length 9–12 mm. (Washington, British Columbia).
willametti puyallupi, n. sp.
 Long white lateral hairs of abdomen extending only on to base

of third segment, hairs on venter of segments 4 to 7 mostly short black; usually not more than 8 to 10 black marginal bristles on scutellum; length 9 mm. (Washington, Oregon, Idaho, British Columbia, Utah) *monticola* Melander

In the list of localities following each species, the museums or collections in which the specimens are located are abbreviated as shown below. Where no abbreviation is given, the specimens are in the writers' collections.

- A.E.P.—A. Earl Pritchard.
A.M.N.H.—American Museum of Natural History.
A.N.S.P.—Academy of Natural Sciences of Philadelphia.
B.S.N.H.—Boston Society of Natural History.
B.Y.U.—Brigham Young University.
C.A.C.—Clemson Agricultural College.
C.A.S.—California Academy of Sciences.
C.H.M.—Charles H. Martin.
C.N.C.—Canadian National Collection.
C.U.—Cornell University.
F.S.B.—F. S. Blanton.
M.C.Z.—Museum of Comparative Zoology.
M.T.J.—M. T. James.
N.C.D.A.—North Carolina Department of Agriculture.
O.S.C.—Oregon State College.
O.S.M.—Ohio State Museum.
R.H.P.—R. H. Painter.
R.L.—Randall Latta.
S.W.B.—S. W. Bromley.
U. K.—University of Kansas.
U.S.N.M.—United States National Museum.

Lasiopogon actius Melander

(Plate I, Figure 4)

Lasiopogon actius Melander, Psyche, v. 30, p. 138–139, 1923.

Lasiopogon actius Cole, Pan-Pacific Ent., v. 1, p. 7, 1924.

“Male.—Length 7–9 mm. Front and upper occiput dusted with brownish, face with white, hairs of upper part of head and of antennae with yellowish tinge; style three-fifths as long as third antennal joint. Notum rather closely pollinose, changing in color according to incidence of light, dorsocentral vittae distinct, dark brown, curved, the broad undivided middle stripe yellowish brown, sides fulvous brown, connecting with the dorso-

central vittae behind the gray humeri; scutellum, postalar callosities and a vitta extending forward from each callosity cinereous; hairs and bristles of mesonotal disk and of scutellar margin yellowish, lateral bristles stout and black; pleura cinereous, the mesopleura brownish, hairs of meso-, sterno- and hypopleura pale. Abdomen quite dull, first segment gray, 2-7 segments marked with paired basal semicircular brown spots and apical gray band, vestiture abundant and whitish; hypopygium slightly wider than abdomen, dorsal piece centrally polished, not emarginate, fringe fulvous becoming almost golden laterally, valves lightly dusted and with abundant yellowish hair, curved, over twice as long as wide and parallel-sided as seen obliquely from above, their apex rounded and furnished with short blackish hairs, base below strongly widening and then narrowed at attachment; venter cinereous, the coating thinner posteriorly. Legs gray dusted, hairs and femoral bristles whitish, bristles of tibiae black and whitish mixed, of tarsi black, claws reddish, tipped with black. Halteres with pale yellow knob, wings hyaline veins blackish, crossvein a little before middle of discal cell.

“Female.—Third antennal joint even shorter, the style two-thirds or three-fourths the length of the third joint; ovipositor shining black, the terminal rosette consisting of long black hooks.

“Types.—Sixteen specimens, collected on the dry sands of the seabeach near Seaview and Naheotta, Washington, May to July. (Melander.) The species is closely related to *L. arenicola*, but that species has a less patterned thorax, subshining scutellum and abdomen, wholly pale bristles, yellow rosette on ovipositor and a different construction of the hypopygium. The lateral valves of *arenicola* are squared off at the end or even emarginate, the dorsal fringe is golden, and the dorsal piece is polished.”

The above is a copy of Melander's description and remarks. Cole records the species from Rockaway, Oreg., Aug. 19, 1919. (M. M. Reeher.)

Specimens are on hand from the following localities:

OREGON: Canon Beach, VI-9 '27 (E. C. Van Dyke), C.A.S.; De Lake, IX-2 '32 (Wm. W. Baker); Rockaway, VIII-19 '19 (M. M. Reeher); Seaside, V-29 '33 (Wm. W. Baker); Waldport, VI-5 '25 (H. A. Scullen), O.S.M.; Waldport, VI-6 '25 (E. P. Van Duzee), C.A.S.; Waldport, VII-6 '25 (J. E. Davis).

WASHINGTON: Naheotta, V-27 '17 (A. L. Melander), U.K.; West-

port, V-5 to IX-8 '32 to '35 (Wm. W. Baker, G. P. Engelhardt, S. E. Crumb, C. W. Getzendaner, C. H. and D. Martin, Itol J. and J. Wilcox).

Lasiopogon albidus, n. sp.

(Plate I, Figure 6)

Male: Length 9 mm. Head black; palpi, proboscis, and lower cheeks shining; face, front, and upper occiput densely golden-gray pollinose; lower occiput densely gray pollinose. Mystax and hairs and bristles on front, ocellar tubercle, upper occiput, and antennae yellowish white; beard and sparse hairs of palpi and proboscis white. Antennae dull black, thinly golden pollinose; first and second joints subequal in length, third $1\frac{1}{2}$ times length of first two joints together; style one-half length of third joint.

Thorax brown in ground color; scutellum, humeri, lateral stripes, dorsocentral stripes, and area immediately behind humeri connecting lateral and dorsocentral stripes, golden pollinose; central stripe and intermediate area gray pollinose; central stripe indistinctly bisected, and dorsocentral stripes at most angles plainly brown. Hairs and bristles all yellowish white; 4 or 5 anterior and 3 or 4 posterior dorsocentral, 1 posthumeral, 3 presutural, 4 supra-alar, 3 postalar, and about 12 marginal scutellar bristles. Pleura golden gray pollinose, becoming more gray on lower pleura and coxae; hairs and bristles yellowish white, about 7 hypopleurals.

Abdomen gray pollinose, anterior angles golden-brown pollinose, giving a rather faint appearance of two anterior semicircular spots on each segment. Hairs whitish, about 8 yellowish-white bristles on each side of first segment. Hypandrium transverse, brown, shining, very thinly golden pollinose; hairs white, posterior fringe yellowish white. Surstyli brown, thinly covered with golden pollen; hairs yellowish white; from side view about twice as long as wide; lower and upper apical angles evenly rounded but with a small triangular projection above before apex; ventrally but slightly curved from base to apex.

Legs black except a trace of yellowish red at base of tibiae and all tarsal joints at base and apex; densely covered with gray pollen; hairs white; bristles yellowish white; claws black at tip, reddish basally; empodium black; pulvilli whitish with streaks of brown.

Halteres yellowish white, basal portion of stem brown. Wings faintly tinged with brown; veins dark brown, first vein and basal portion of second light brown; anterior crossvein at one-third distance from base to apex of discal cell; fourth posterior cell slightly narrowed.

Female: Length 10 mm. Similar to male. Dorsum of ovipositor and eighth sternite shining black, ninth sternite mostly light brown or amber colored; hairs white; apical spines amber colored. Third antennal joint but slightly longer than first two joints together; style nearly as long as third joint.

Holotype: Male, 8 miles east of Kiona, Wash., IV-23 '33 (J. Wilcox); deposited in the California Academy of Sciences.

Allotype: Female, same data (Itol Josephine Wilcox); deposited in the California Academy of Sciences.

Paratypes: About 80 specimens, both sexes, same data and collectors.

This wholly white or yellowish-white-haired and bristled species was taken in a sandy part of the sagebrush country. In habitat it is more closely related to *quadrivittatus*, but structurally it is closer to *arenicola*. The form of the surstyli of the male and the amber-colored ninth sternite of the female ovipositor, as well as the reddish bases and apices of the tarsal joints, distinguish it from the closely related species.

Lasiopogon aldrichii Melander

(Plate II, Figure 23)

Lasiopogon aldrichii Melander, Psyche, v. 30, p. 139-140, 1923.

Lasiopogon aldrichii Cole, Pan-Pacific Ent., v. 1, p. 7, 1924.

“*Male*.—Length 8 mm. Entirely black, the halteres yellow, calypteres yellowish, front brownish-gray pollinose, the pollen of face slightly more yellowish, mystax black, hairs of face and lower occiput cinereous pollinose with long silky white pile; style thick, one-half as long as third joint of antenna. The usual pair of anteriorly diverging stripes of mesonotum distinct and blackish, the immediate brownish stripe medially bisected by a distinct blackish line, lateral stripes vaguely represented by darkenings above root of wings; bristles and sparse hairs black; scutellum dusted at base, its hairs and bristles black; pleura dull gray pollinose; the hypopleural fringe consisting of a single row of long black bristles. Major portion of abdomen

polished black, the hind margins of the individual segments grayish-pollinose, lateral hairs whitish, becoming black on posterior segments; genitalia large, forming a club-like globular termination to the abdomen, hairs rather short and black, the lateral valves strongly convex, nearly quadrate, the apical edge crenulate-truncate, lower basal angle not toothed but with an umbo, dorsal incision deep and U-shaped, the marginal fringes black, the hairs obliquely crossed; venter uniformly dark grayish-pollinose, subshining, the short sparse hairs pale. Legs entirely black, the coxae pollinose and concolorous with pleura, remainder of legs shining, very lightly dusted, the hairs and bristles black except the fine pile at base of femora beneath, pulvilli fuscous. Wings lightly infumated, veins black, anterior crossvein slightly before middle of discal cell.

"*Female*.—Pile of lower occiput more sordid white; lateral whitish hairs of abdomen shorter and confined to basal segment, ovipositor highly polished, short-conical, the ventral keel brown.

"*Types*.—Male and female, Moscow Mountains, Idaho, June 29, 1918 (Melander). Sixty paratypes from same locality (Melander) and from the Blue Mountains of southwestern Washington (Piper and Melander) and Naheotta, Washington (Melander). The two specimens from Naheotta, male and female, are indistinguishable from the others, notwithstanding their totally different provenience. These specimens have been taken on almost every visit to Moscow Mountain. They occur along the trails and frequent rocks on the summit. It is a pleasure to dedicate this species in honor of Dr. J. M. Aldrich, and in memory of the many trips we have made together to this interesting collecting ground. The species is evidently very closely related to *L. bivittatus* Lw. but is constant in showing the bisected median stripe of the thorax."

The above is a copy of Melander's description and remarks for this species. Cole records taking 18 specimens of this species on Moscow Mount, Idaho, June 23, 1919, in company with Dr. Aldrich and Dr. Melander. Many specimens are on hand from the following localities:

ALBERTA : Banff, VII-5 '22 (C. B. D. Garrett), C.N.C.

COLORADO : Veta Pass, VI-21 (J. M. Aldrich), U.S.N.M.

IDAHO : Long Valley, Alpha, VI-24 '34 (C. H. and D. Martin), C.H.M.; Moscow, VI-25 '95, U.K.; Moscow Mt., VI-29 '18 (A. L. Melander), U.K., VI-4 '10 and VII-1 '32 (J. M. Aldrich), U.S.N.M., VI-26 (F. M. Hull), R.H.P., and VI-23 '19 (Cole).

OREGON: Anthony Lake, VII-11 '31 (R. H. Beamer, J. Nottingham), U.K.; Blue Mountains, Tollgate, 5,000 feet, VIII-4 '29 (M. C. Lane); Fish Lake, Steins Mountains, 7,000 feet, VII-11 '27 (H. A. Scullen); Haines, VII-10 '31 (L. D. Anderson), U.K.; Mount Hood, 3,000-6,000 feet, VI-22 '25 (E. C. Van Dyke), C.A.S.; Mount Hood National Forest, Sherwood Forest Camp, VI-29 '30, VI-26 '32, VI-22 '35 (S. E. Crumb, Wilcox); Strawberry Mountain, Grant County, 8,600 feet, VIII-23 to IX-2 '32 (D. K. Frewing); Sumpter, VI-9 '34 (C. H. Martin), C.H.M.; Wallowa Lake, Aneroid Lake Trail, 6,200 feet, VII-22 '29 (H. A. Scullen).

UTAH: Beaver Creek, VI-23 '31 (Joe Schuh), O.S.C.

WASHINGTON: Blue Mountains, VII-15 '96 (C. V. Piper), O.S.M.; Signal Peak, VII-16 '33 (S. E. Crumb, Wilcox), VII-20 '33 (P. M. Eide); White Rock Springs, Stevens Pass, Cascade Mountains, VII-13 '30 (E. C. Van Dyke), C.A.S.

Lasiopogon arenicola (Osten Sacken)

(Plate I, Figure 3)

Daulopogon arenicola Osten Sacken, West. Dipt., p. 310, 1877.

Lasiopogon arenicola Back, Trans. Amer. Ent. Soc., v. 35, p. 297-298, 1909.

Lasiopogon arenicola Melander, Psyche, v. 30, p. 136, 1923.

Lasiopogon arenicola Cole, Pan-Pacific Ent., v. 1, p. 8, 1924.

“♂ ♀.—Length 7-8 mm.—Brownish-gray; abdominal segments 2-6 each with a pair of semi-circular spots at the base.

“Brownish-gray, sometimes with a tinge of yellowish; the mystax and the few hairs on the vertex and on the upper part of the occiput yellowish-white; those on the lower part of the occiput pure white; antennae black. Thorax with two, rather distant, brown stripes, expanded and somewhat diverging anteriorly; the hairs and bristles on the dorsum whitish; scutellum with a quantity of long, erect, whitish hairs on its edge; a semi-circular impressed line parallel to this edge is very distinct. Abdominal segments 2-6 at the base each with a pair of semi-circular brown spots, gradually diminishing in size on each subsequent segment; a vestige of such spots is also visible on the seventh segment. Hypopygium of the male black, beset with whitish pile and with an appressed tuft of yellow hairs above the forceps. In the female, the eighth segment is black polished. Legs yellowish-gray, with short appressed whitish pile and yellowish-white bristles. Wings with a slight brownish

tinge; the small cross vein before the middle of the discal cell; second posterior cell sometimes very narrow, in some specimens even petiolate; the fourth posterior in some specimens, coarctate toward the end, even closed; these characters are very inconsistent.

"*Type*.—M.C.Z. Four males and four females; two pairs of which are in coitus.

"*Habitat*.—San Francisco, Cal., on the sands about Lone Mountain, April 6, and again June 29. (Osten Sacken).

"This species and *opaculus* are similar in size and in spots of the abdomen, but *arenicola* possess more pile and bristles than *opaculus*, and they are wholly pale, while the bristles of *opaculus* are chiefly black."

The above is Osten Sacken's description as given by Back; the remarks are Back's. Fairly large series of specimens at hand from the following localities:

CALIFORNIA: Pacific Grove, Monterey County, IX-20 (F. E. Blaisdell), C.A.S.; San Francisco, IV-9 to VI-6 (M. C. Van Duzee, E. P. Van Duzee, E. C. Van Dyke, and C. L. Fox), C.A.C.; San Francisco, IV-10 '07 (E. C. Van Dyke), V-12 '15 (M. C. Van Duzee), sand dunes, VI-12 '23 (Carl D. Duncan), O.S.M.; San Francisco, sand dunes (Cole) and one male cotype (Osten Sacken); San Francisco, III-29 and IV-4 '20 (A. J. Basinger), C.H.M.; Santa Cruz, V-2 to 29 (R. Latta), R.L.; Santa Cruz, XI-3 '19 (E. P. Van Duzee), C.A.S.

Most closely related to *actius* Mel. and *albidus*, n. sp.; see notes under these species.

Lasiopogon aridus, n. sp.

(Plate I, Figure 1)

Male: Length 12 mm. Head black, lower cheeks, upper part of palpi, and middle of proboscis shining black; sides of oral margin, base of palpi and proboscis, and tip of proboscis yellowish red. Face densely white pollinose; front, vertex, and upper occiput densely yellowish brown pollinose; lower occiput gray pollinose. Mystax, hairs of front, and most of hairs of ocellar tubercle, vertex, and occiput yellowish white; 2 long black hairs on the ocellar tubercle, and from 3 to 5 short, stout, blackish bristles on each side of upper occiput; beard and sparse hairs of palpi and proboscis white. Antennae black, thinly gray pollinose; first and second joints somewhat reddish, subequal in length and black-haired; third joint about twice as long as first two joints together; style less than one-half length of third joint.

Thorax black in ground color, thickly gray, golden, and brown pollinose. Central bisecting stripe, humeri, inner part of intermediate area, and posterior area before scutellum gray pollinose; median stripes and outer half of intermediate area dark brown; dorsocentral stripes light brown; lateral stripes golden pollinose. Very short hairs of humeri white; anterior three-fourths of dorsum with numerous very short recumbent black hairs. Bristles black; no anterior and 2 posterior dorsocentral, 2 presutural, 2 supra-alar, and 1 or 2 postalar bristles. Scutellum densely gray pollinose, with 1 strong black bristle and 2 moderately long black hairs on each side. Pleura and coxae black, densely gray pollinose with a slight yellow tinge on mesopleura, hairs yellowish white except 2 or 3 short black hairs on posterior margin of mesopleura; 5 long yellowish white hypopleural bristles.

Abdomen black; narrow posterior margins reddish; densely gray pollinose on posterior half and sides of all segments, anteriorly brown pollinose. Hairs entirely white and, except for a few longer appressed ones on lateral margin of all segments and on sides of first two segments, very short, appressed. Venter uniformly gray pollinose, with short, sparse, white hairs; margins reddish. Hypandrium transverse, shining dark reddish brown, subshining on sides through the gray pollen; short hairs black; posterior fringe black. Surstyli in side view about twice as long as wide, upper apical angle about rectangular, with a shallow emargination on lower half of apex; in ventral view one small rounded emargination; no basal umbo; densely grayish yellow pollinose and mostly black pilose, some yellow hairs on lower half.

Legs black; tarsi more or less dark reddish; claws red with black tips; empodium slender, black, nearly as long as claws; pulvilli light brown. Hairs on femora white, on tibiae mostly golden, and on underside of tarsi golden, otherwise black. Most of the bristles black, but some of those on each femur and tibia partly or entirely yellowish white.

Base of halteres brown; stem and knob yellowish red. Wings slightly but evenly infumated with reddish brown; veins dark brown; anterior crossvein at two-fifths distance from base to apex of discal cell.

Female: Length 12 mm. Similar to male. Most of short hairs on front black, and most of stout hairs and bristles on upper occiput black or blackish; hairs on first antennal joint

yellowish white. Thorax densely gray pollinose, central stripes blackish, dorsocentral stripes brown. Bristles and hairs as in male; 2 black scutellars on each side, and 4 yellowish hypopleurals. Hairs of abdomen all short, recumbent, yellowish white; 4 strong lateral yellowish white bristles on first abdominal segment. Ovipositor dark brownish black, with touches of red above at apex, and below at apex and base, of eighth sternite; sparse hairs yellowish; terminal spines black. Legs with yellowish white bristles only on femora, otherwise bristles black. Wings like those of male; fourth posterior cell somewhat narrowed.

Holotype: Male, Jemez Springs Mountains, N. Mex., VI-17; in the Ohio State Museum.

Allotype: Female, same data, in the Ohio State Museum.

Paratypes: Male and female, same data except that the male is labeled "May." The female paratype is the same as the allotype except that some of the tibial bristles are white. The male paratype shows considerable variation from the holotype; the hairs and bristles on the front, ocellar tubercle, and occiput are entirely yellowish white, and the hairs on the first antennal joint are white. Some of the thoracic bristles are yellowish white or have whitish tips, and the scutellar bristles are entirely yellowish; the hairs of the hypopygium are all yellowish and the posterior fringe of the hypandrium is yellow; most of the bristles of the femora and tibiae are yellow, and also some of those on the tarsi. In spite of these variations, the absence of any long hairs on the dorsum of the thorax and the complete absence of anterior dorsocentral bristles are constant in the material at hand, and are characters not found in any of the closely related species.

Lasiopogon atripennis, n. sp.

(Plate III, Figure 27)

Male: Length 8 mm. Head black; palpi, proboscis, and lower cheeks shining; face thickly covered with gray pollen, obscuring the ground color; front thinly gray pollinose; vertex and upper occiput golden pollinose; lower occiput yellowish-gray pollinose. Mystax and hairs of front, vertex, and occiput, all black; beard and hairs of palpi and proboscis white, a tuft of 6 or 7 prominent erect hairs on the ocellar tubercle; black hairs long except on the upper occiput; no definite bristles. Antennae black, thinly gray pollinose; first joint slightly longer than second, both black-

haired; the third but very slightly longer than the first two together, and only slightly longer than twice its own width; style three-fourths length of third joint.

Thorax shining brown, more or less obscured by golden, brown, and gray pollen. Humeri gray pollinose; central stripe mixed golden brown and gray and bisected by a narrow yet distinct brown line; dorsocentral stripes brown; narrow area just outside of dorsocentral stripes gray, abbreviated before and behind; broad lateral margins golden brown. Numerous short black hairs on humeri and anterior half of dorsum; bristles black, 3 anterior and 3 posterior dorsocentral, 2 presutural, 2 supralar, and 2 postalar. Scutellum densely golden gray pollinose, at most angles the disk appearing gray and the margin golden; 4 strong black marginal bristles and a few shorter bristle-like hairs. Pleura mixed gray and golden pollinose, the gray more intense anteriorly and ventrally and on coxae; hairs of prothorax, coxae, and sternopleura long, abundant, and white; 6 or 7 long black hairs and several shorter ones on posterior and dorsal margins of mesopleura; 7 to 9 long black hypopleurals.

Abdomen shining dark brown; first segment almost entirely, anterior margin of second and narrow hind and lateral margins of second and remaining segments silvery-golden pollinose. Hairs on lateral margins yellowish white, inside of these on each segment some long blackish brown hairs, making a cluster on broader sides of the first three segments; five long black bristles on sides of first segment. Venter uniformly grayish-golden pollinose and long yellowish-white pilose. Hypandrium transverse, polished black with black hairs; fringe black. Surstyli polished black with a very thin layer of golden pollen and covered with numerous long black hairs; in side view more than three times as long as wide, above at apex with a long, shallow emargination ventrally only gently curved from base to apex; no basal umbo.

Legs shining black, covered with a very thin layer of grayish golden pollen; claws brown with black tips. Long hairs below on femora golden and black mixed, some short golden pile on underside of tibiae, and some short whitish pile on underside of tarsi, otherwise hairs and bristles black.

Halteres with base and lower stem brown, knob and upper stem mostly light reddish brown mixed with white. Wings uniformly dark brown; veins black; anterior crossvein at two-fifths distance from base to apex of discal cell.

Female: Length 9 mm. Similar to male. Dorsocentral stripes a little more prominent, mesonotal bristles the same; 8 hypopleurals, 5 scutellar, and 3 or 4 lateral bristles on first abdominal segment. Hairs on sides of abdomen yellowish white only on first three segments; longer black hairs on these segments the same as in male; segments 4 to 7 and dorsum of first three covered with short black hairs. Ovipositor shining black; eighth tergite slightly longer than seventh, covered with short, sparse yellow hairs, the usual spines at apex black, a tuft of yellow hairs at tip below spines, and a tuft of rather black stout hairs below on each side near apex. Wings somewhat lighter than in male, but still definitely brown.

Holotype: Male, Smith River, Douglas County, Oreg., IX-14 '32 (D. K. Frewing); deposited in the California Academy of Sciences.

Allotype: Female, same data; deposited in the California Academy of Sciences.

Paratypes: 26 specimens, both sexes, same data and from Scotsburg, Douglas County, Oreg., IX-19 '32 (D. K. Frewing).

This species at first appeared to be a melanic form of *cinereus* Cole, but besides the different coloration of the body and wings, structurally the surstyli are slightly more emarginate at the apex above and the third antennal joint is only two-thirds as long as the third joint of *cinereus*, and broader.

Lasiopogon bivittatus Loew

(Plate III, Figure 29)

Lasiopogon bivittatus Loew, Dipt. Amer. septentrionalis (II), p. 93, 1865-72.

Lasiopogon bivittatus Loew, Berlin Ent. Ztschr., v. 18, p. 370, 1874.

Daulopogon bivittatus Osten Sacken, West. Dipt., p. 310, 1877.

Lasiopogon bivittatus Back, Trans. Amer. Ent. Soc., v. 35, p. 298-299, 1909.

Lasiopogon bivittatus Melander, Psyche, v. 30, p. 138, 1923.

“♂ ♀.—Length 8 mm.—Translation. Black; brownish-gray pruinose, the two narrow thoracic stripes black, separated by a broad interval, the median transverse vein of the vein [wing?] projecting beyond the middle of the discal cell. Length of body 4 lin; of wing 3-7-12 lin.

“Wholly black; mystax, pile of palpi, antennae, front and

vertex, black; beard whitish. Thoracic dorsum covered with brownish bloom, black pilose, and marked with two narrow black stripes, separated by a broad interval, diverging anteriorly and subabbreviated; scutellum of the same color, black pilose, with the same depressed line as Osten Sacken mentions in his description of *arenicola*; pleura more grayish pruinose, with a little white pile; pile in front of the wings and the trichostical bristles black. Abdomen black, polished; the first segment almost wholly, the posterior margin and sides of the remaining segments, broadly grayish-white pruinose. Pile of the abdomen rather longer, sordid whitish; the posterior margin of the first segment toward the sides with a few black bristles. Venter grayish pruinose with whitish pile. Hypopygium large, black, polished, with black pile. Legs wholly black, all the bristles and pile of the tibiae and tarsi and of the apical third of the femora black; the pile of the rest of the femora sordid white; femora slightly grayish pruinose. Wings grayish hyaline, veins blackish, the transverse median vein a little further removed from the base of the discal cell than from the apex.

"*Type*.—M.C.Z. A single female in the Loew collection is probably the type. There are, in addition, four male and three female specimens in Osten Sacken's collection, which are probably those which he mentions in Western Diptera.

"*Habitat*.—California (type); near San Francisco, March 28 (Osten Sacken); Los Angeles County, Cal. (Coquillett); Mount Hood, Oregon (June 9).

"This species and *tetragrammus* are similar in the coloration of the abdomen but markedly different in the stripes of the dorsum of the thorax."

The above is copied from Back. Specimens on hand from the following localities:

CALIFORNIA: Carmel, III-26 '30 (L. S. Slevin), C.A.S.; San Francisco, Lake Merced, IV-9 '16 (E. C. Van Dyke), O.S.M.; San Francisco, III-20 to V-29 (C. L. Fox, E. P. Van Duzee, E. C. Van Dyke, and M. C. Van Duzee), C.A.S.; San Francisco, III-29 to V-2 (Basinger).

OREGON: Newport, VI-8 '25 (E. P. Van Duzee and E. C. Van Dyke), C.A.S.; Newport, V-24 '31, V-22 '32, V-12 '35 and VI-5 '32 (R. E. Dimick, S. E. Crumb and J. Wilcox); Waldport, VI-5 '25 (E. P. Van Duzee), C.A.S.

WASHINGTON: Westport, V-28 '33 (C. H. Martin), C.H.M.

See note under *aldrichi*.

Lasiopogon californicus, new species

(Plate III, Figure 34)

Male: Length 9 mm. Head black, lower cheeks, palpi, and proboscis shining; face densely golden gray pollinose; front, vertex, and upper occiput heavily golden-brown pollinose; lower occiput gray pollinose. Mystax and hairs of front black, excepting a few fine white ones along the orbits, ocellar tubercle, vertex, and upper occiput; beard and sparse hairs of palpi and proboscis white. Antennae black, golden-brown pollinose; first and second joints subequal in length, the first white-haired, the second black-haired; third about $1\frac{1}{2}$ times length of first two; style one-half length of third.

Thorax and humeri densely golden-brown pollinose except central and dorsocentral stripes and outer two-thirds of intermediate area, which are brown, subshining. Fine hairs of humeri and those on anterior part of dorsum in middle white, otherwise black; bristles black, 3 anterior and 3 posterior dorsocentral, 1 posthumeral, 3 presutural, 3 supra-alar, and 3 postalar. Scutellum densely golden pollinose with some black hairs and about 12 black marginal bristles. Coxae gray, pleura golden excepting mesopleura golden brown pollinose, hairs white except 8 to 10 black ones on posterior margin of mesopleura, 10 black hypopleural bristles.

Abdomen shining brown; narrow posterior margins yellowish; sides and posterior two-fifths of each segment densely gray pollinose. Hairs on sides and lateral margins on the dorsum shorter, appressed black; 3 strong black bristles on each side of first segment. Venter densely golden brown pollinose and white pilose. Hypandrium transverse, somewhat bulging in side view; dorsum shining dark brown; sides golden brown pollinose; hairs and posterior fringe black. Surstyli golden-brown pollinose, subshining; hairs black; in side view twice as long as wide, evenly rounded at apex above and below, the apical fourth wider than at middle; ventrally gently curved from base to apex; no basal umbo.

Legs brown, golden-brown pollinose, outer fifth of tarsal joints reddish; claws dark reddish brown with black tips; empodium dark brown, about as long as claws; pulvilli brown. Hairs on femora and tibiae white except golden pile on anterior side of fore tibiae; most of tarsal hairs black; bristles black.

Base and lower stem of halteres brown, upper stem yellow, knob yellowish red. Wings uniformly lightly tinged with

brown; veins dark brown; anterior crossvein at one-third distance from base to apex of discal cell; fourth posterior cell slightly narrowed.

Female: Length 11 mm. Similar to male. Hairs of front entirely black; 14 to 16 scutellar bristles; 8 or 9 hypopleurals. Pollinose bands of abdomen extending forward in middle so that brown area appears as two anterior semicircular spots on each segment; hairs on lateral margins and sides of first four segments white, otherwise black; 4 or 5 black bristles on sides of first segment; venter white pilose, except a few black hairs on posterior margin of sixth and most of those on seventh segment, which are black. Ovipositor dark shining brown; lower basal part of ninth sternite reddish brown; hairs white; apical spines black. Brown of wings a little more intense along veins.

Holotype: Male, Stanford University, Calif., V-12 '21 (F. R. Cole); deposited in the California Academy of Sciences.

Allotype: Female, same data, V-20 '21; deposited in the California Academy of Sciences.

Paratypes: 2 males, 1 female, same data, IV-30 to V-5 '20 and '21; 1 male, Sunol, Calif., V-15 '22 (Cole); 4 specimens, Cloverdale, Calif., V-9 '26 (M. C. Van Duzee Coll.), C.A.S.; 1 specimen, Lagunitas, Calif., III-21 '25 (H. H. Keifer), C.A.S.; Hopland, Calif., V-9 '26 (M. C. Van Duzee Coll.); Bradley, Calif., V-23 '20 (E. P. Van Duzee), C.A.S. Two specimens, Mesa Grande, Sonoma County, V- '08 (J. P. Baumberger), A.N.S.P., are doubtfully referred here. Kern County (H. K. Morrison), U.S.N.M.; Palo Alto, '06 (J. M. Aldrich), U.S.N.M.; and Santa Rosa, V-4 '25, S.W.B.; Yosemite, V-13 to V-29 (E. C. Van Dyke); Oroville, IV-30 (Keifer); Guerneville, V-31 (Van Dyke); Sacramento, VI-4 (M. C. Van Duzee); Reno, Nevada, VI-27 (E. P. Van Duzee), C.A.S.

Lasiopogon canus, n. sp.

(Plate III, Figure 25)

Male: Length 9 mm. Head black; lower cheeks, palpi, and proboscis shining. Face gray pollinose; front and upper occiput along orbits golden pollinose; front very thinly gray pollinose; vertex and occiput gray pollinose. Mystax entirely black; front, vertex ocellar tubercle, and upper occiput with long black hairs; beard and sparse hairs on palpi and proboscis gray. Antennae black, gray pollinose except style, which is dark reddish brown; first and second joints subequal in length, both with black hairs;

third joint wider in middle and narrowed at both ends, about one and one-half times length of first two together, and on dorsum at two-thirds distance from base to apex with two short black hairs; style less than one-half length of third joint.

Thorax black, uniformly gray pollinose; median bisecting line and dorsocentral stripes light brown, lateral stripes with a brownish tinge. A number of short and long black hairs on humeri and anterior part of dorsum; bristles black, 2 anterior and 3 posterior dorsocentral, 1 posthumeral, 2 or 3 presutural, 2 supra-alar, and 3 postalar. Scutellum shining black, thinly gray pollinose; 8 black marginal bristles and some black hairs on margin and disk. Pleura and coxae densely grayish-golden pollinose, shining black in ground color; hairs white except some black ones on posterior margin of mesopleura; 10 long black hypopleural bristles.

Abdomen polished black, narrow posterior margins yellowish; posterior half of first segment and about posterior one-fifth of remaining segments gray pollinose, not extending along sides of segments, 4 to 6 black lateral bristles on first abdominal segment. Hairs on lateral margins of all segments and on sides of first and second segments yellowish white; beginning with third segment, hairs on sides brownish black; hairs on dorsum of all segments short and black. Venter shining black; all margins more or less yellowish red; sparse long hairs white. Hypopygium shining black, with short, sparse black pilosity, except on apical margin of surstyli, which has short golden-brown hairs. Hypandrium bulging in side view; posterior margin U-shaped, posterior fringe black. Surstyli in side view about twice as long as wide; lower margin evenly curved; a narrow flange around complete apex; upper margin emarginate; ventrally with a small basal umbo.

Legs shining black except tarsi, which are more or less yellowish, anterior ones more so; femora and tibiae thinly gray pollinose; claws and empodium reddish, claws with black tips; empodium less than one-half length of claws; pulvilli brownish. Hairs on the femora and on anterior side of fore tibiae yellowish; otherwise hairs and bristles black.

Halteres with base and stem brown, knob yellow. Wings nearly hyaline with a slight reddish tinge; veins dark brown, anterior crossvein at two-fifths distance from base to apex of discal cell; fourth posterior cell somewhat narrowed.

Female: Length 10 mm. Similar to male. Venter of abdomen with a coating of gray pollen; ovipositor shining black

and short yellow pilose; ninth sternite yellowish red, apical spines black. Wings lightly infumated and clouded on cross-veins; fourth posterior cell closed in margin of wings.

Holotype: Male, Savonoski, Naknek Lake, Alaska, July 1919 (J. S. Hine); in the Ohio State Museum.

Allotype: Female, same data; in the Ohio State Museum.

Paratypes: 1 female, same data, O.S.M.; and 1 female, Healy, Alaska, VI-26 '21 (J. M. Aldrich), 3 females, Fairbanks, Alaska, VII-1 (Aldrich), and 1 female, Camp 334, Alaska Eng. Comm., VII-4 (Aldrich), U.S.N.M.

This species and *hinei*, new species, were received from the Ohio State Museum labeled "*Lasiopogon canus*," apparently a manuscript name of the late Prof. James S. Hine. In general appearance these Alaskan species resemble the European forms rather than the North American species.

Lasiopogon carolinensis, n. sp.

(Plate II, Figure 18)

Male: Length 8 mm. Head shining dark brown; lower cheeks, palpi, and proboscis this color; face covered with a fairly dense coating of grayish golden pollen; front, vertex, and upper occiput fairly densely golden-brown pollinose; lower occiput densely gray pollinose. *Mystax* black; hairs of front, vertex, ocellar tubercle, and upper occiput abundantly long, black; beard and sparse hairs of palpi and proboscis white. Antennae dark brown; first joint shining, the remainder grayish-golden pollinose; first two joints black haired; third joint about $1\frac{1}{4}$ times length of first two joints together; style four-fifths length of third joint.

Thorax shining dark brown, uniformly covered with golden-brown pollen. Dorsocentral stripes and intermediate area appearing shining brown in certain lights, dorsocentrals widened anteriorly; broad central stripe not definitely bisected and dull brown in color with golden next to dorsocentrals; lateral stripes lighter golden-brown pollinose with a touch of gray below supra-alar, also a grayish spot on dorsocentrals at transverse suture; humeri grayish-golden pollinose. Hairs on humeri yellowish white; a number of short and long black hairs on anterior part of thorax; bristles black, 3 anterior and 2 posterior dorsocentral, 1 posthumeral, 3 presutural, 2 supra-alar, and 2 postalar. Scutellum densely grayish golden pollinose, with 6 strong black

bristles and some shorter black hairs on posterior margin. Pleura and coxae grayish golden pollinose, the golden more intense above; hairs all white except about 5 black ones on posterior margin of mesopleura; 6 long white hypopleural bristles.

Abdomen shining dark brown, hind margins yellowish, and about the posterior one-sixth of each segment gray pollinose with a slight golden color anteriorly, lateral margins golden pollinose. Hairs on lateral margins of all segments white, longer on first four segments and extending on sides; hairs on dorsum of first four segments and on dorsum and sides of remaining segments short, appressed, black; 4 yellowish-white bristles on each side of first abdominal segment. Venter uniformly grayish-golden pollinose; hind margins yellowish; hairs white. Hypandrium transverse, dark brown, dorsum gray pollinose except posterior margin, which is shining, sides grayish-golden pollinose, hairs and posterior fringe black. Surstyli shining dark brown, coated with grayish golden pollen, and with dense, long, black hairs; in side view more than twice as long as wide and evenly rounded apically above and below; ventrally but slightly curved from base to apex; no basal umbo.

Legs shining black, somewhat dulled by a thin coating of yellowish-gray pollen; claws dark red with black tips; empodium slender, black, nearly as long as claws; pulvilli light dull brown. Hairs on femora, on anterior side of fore tibiae, and below on fore and middle tarsi yellowish white, otherwise black; bristles black.

Base of halteres brown, stem light reddish brown, knob yellowish white with a tinge of reddish brown in some lights. Wings lightly infumated, veins dark brown, anterior crossvein at two-fifths distance from base to apex of discal cell.

Female: Length 9 mm. Similar to male. Hypopleural and lateral bristles on first abdominal segment yellowish white, otherwise bristles all black. White hairs of abdomen confined to lateral margins and sides of first three segments; otherwise short, black; posterior margins gray pollinose in some lights, otherwise abdominal segments entirely covered with a thin layer of golden-brown pollen; ovipositor entirely shining brown, except apex of eighth sternite and base and ventral margin of ninth sternite, which are yellowish red; hairs entirely brownish; apical spines black. Hairs on all legs mostly yellowish white. Fourth posterior cell of wing considerably narrowed. Knob and upper stem of halteres reddish.

Holotype: Male, Raleigh, N. C., late in April, 1908 (F. Sherman); in the Ohio State Museum.

Allotype: Female, same data; in the Ohio State Museum.

Paratypes: 1 male, same data, O.S.M.; 19 specimens, both sexes, type locality, IV-5 to V-17 (C. S. Brimley and M. R. Smith), N.C.D.A.; 1 male labeled "N. Carolina, C.U. Lot 35, 275, Cornell U., lot 60, Sub. 275, C.U."; Little River, Salem, S. Carolina, IV-21 '29 (O. L. Cartwright), C.A.C.; Chesterton, Ind., VI-2 '16 (J. M. Aldrich), U.S.N.M. A male labeled "Ohio" and a female with no data, A.N.S.P., are doubtfully referred to this species.

Lasiopogon chaetosus, n. sp.

(Plate I, Figure 9)

Male: Length 11 mm. Head black; lower cheeks, palpi, and proboscis shining; outer half of proboscis reddish brown; face, front, vertex, and upper occiput densely grayish-golden pollinose; lower occiput gray pollinose. *Mystax* white and amber color, upper three-fourths with bases of hairs brownish; numerous fine white hairs on front, 2 or 3 stronger black or brownish hairs near orbits and slightly in front of ocellar tubercle; about 8 to 10 strong, black, curved bristles on vertex and upper occiput, shorter on sides of upper occiput; hairs of ocellar tubercle black, at least 2 of which are longer than others; beard and fine hairs of palpi and proboscis white. First and second antennal joints and inner basal one-fifth of third reddish brown, remainder of third and style black; first and second joints about equal in length, third $1\frac{1}{4}$ times length of first 2 joints together, and style slightly more than one-half length of third; hairs below on first two joints mostly yellowish white, above black.

Thorax black, densely pollinose, the broad dorsocentral stripes golden brown; median bisecting line, humeri, area in back of humeri, narrow inner margin of intermediate area broadening at transverse suture, and lateral stripes grayish-golden pollinose; central stripes and intermediate area thinly gray pollinose, subshining, appearing blackish. Very short fine hairs of humeri and dorsum white; bristles black, 4 or 5 short humeral, 13 anterior and 4 posterior dorsocentral, 2 posthumeral, 3-4 presutural, 3 supra-alar, and 4-5 postalar. Scutellum densely grayish-golden pollinose with about 8 strong black marginal bristles and some short, fine, white hairs. Pleura and coxae densely grayish-golden pollinose and white pilose, except

1-2 short bristle-like black hairs posteriorly on mesopleura; 7-8 hypopleural bristles, mostly yellowish, 1-2 on one side brownish and some of the others with brownish bases.

Abdomen densely gray pollinose, narrow posterior margins yellowish; segments 2 to 5 with anterior semicircular golden-brown spots. Hairs all white, longer on lateral margins of all segments and on sides of segments 1 to 3; 6 or 7 bristles on each side of first segment, 4 on each side brown or black and the others white. Venter uniformly gray pollinose and white pilose. Hypandrium transverse, entirely shining yellowish red; hairs yellowish white; posterior fringe mostly black with some yellowish hairs on sides. Surstyli yellowish red except narrow apical margin and apical half of ventral margin, which are black; sides thinly gray pollinose; in lateral view about twice as long as wide; apical margin rounded below, upper angle obtuse; ventral margin considerably cupped to basal one-third; no basal umbo; hairs long, numerous, yellowish white.

Femora dark brown, pollinose; tibiae and tarsi yellowish red, the fore and middle ones darker; basal two-thirds of claws yellowish red, tip black; empodium about as long as claws, reddish brown; pulvilli light brown. Hairs all white; numerous bristles black.

Base and lower stem of halteres brown, upper stem and knob white. Wings hyaline with a very slight reddish-brown tinge; veins brown; anterior crossvein at two-fifths distance from base to apex of discal cell; fourth posterior cell slightly narrowed.

Female: Length 12 mm. Similar to male. Face and front densely grayish pollinose with only a slight yellowish tinge on front. First and second antennal joints black and only hairs below on first joint white. Ovipositor black except eighth sternite and basal part of ninth sternite, which are reddish brown; short fine hairs white; spines black. Femora and tibiae somewhat darker than in male. Wings tinged with brown, especially along veins; anterior crossvein at one-third distance from base to apex of discal cell.

Holotype: Male, Lind, Wash., IV-26 '19 (Cole); deposited in the California Academy of Sciences.

Allotype: Female, Adrian, Wash., IV-29 '19 (M. M. Reeher); deposited in the California Academy of Sciences.

Paratypes: More than 100 specimens of both sexes, Moses Coulee, Wash., IV-22 '33, IV- '35 (Itol J. and J. Wilcox). As many of the

specimens have the mystax entirely black, the species has been included in the key twice. The extreme development of bristles, especially on the thorax, should at once separate this species from the remainder of the North American species.

Lasiopogon cinereus Cole

(Plate III, Figure 26)

Lasiopogon cinereus Cole, Proc. Calif. Acad. Sci., Ser. 4, v. 9, p. 229, 1919.

Lasiopogon cinereus Melander, Psyche, v. 30, p. 137, 1923.

“Male: Length 8 mm. Head black, gray pollinose, except a faint yellowish tinge on upper occiput; mystax, and hairs of frons, antennae and upper occiput black; a few white hairs on side of mouth opening; pile of lower occiput and proboscis white; antennae black, the third joint slightly longer than first two; pointed style about as long as first joint.

“Thorax black, gray pollinose, with a faint yellowish, narrow median stripe and a heavy brown stripe on either side, diverging anteriorly and expanded at the end; scutellum with black upcurved hairs; pile and bristles of thoracic dorsum black; bristles in front of wings and halteres black; pile of pleura white; halteres yellowish, the knob brown.

“Abdomen black, densely gray-pollinose, except on the genitalia; a large blackish brown, semi-shining spot on base of each segment, leaving only the lateral and posterior margins gray-pollinose; these spots rounded posteriorly; first four segments with rather long white pile; the pile of the other segments black and shorter, that on the genitalia black and heavier; a conspicuous tuft of black hair on the dorsum of the genitalia just behind the seventh segment (Fig. 11a).

“Legs black, gray-pollinose, with black bristles; coxae and femora with white pile; wings very faintly infuscated; anterior cross-vein slightly before the middle of the discal cell.

“Female: Very similar to the male. There is a faint brown line above the dorsocentral suture and some black pile on the posterior margin of the second, third and fourth abdominal segments; eighth segment black with some red on the genitalia; the circlet of blunt bristles black. Genitalia peculiar in shape (Fig. 11b).

“Holotype (No. 476), male, collected at Hood River, Ore., Sept. 24, 1918 (F. R. Cole), and allotype (No. 477), female, taken at Hood

River, Oregon, July 28, 1917 (F. R. Cole), in the Museum of the California Academy of Sciences.

"Paratypes from Corvallis and Parkdale, Oregon, in the author's collection.

"This species is very near *opaculus* but differs in having distinct thoracic stripes and also in the abdominal markings."

The above is a copy of Cole's description of the species. Melander records it also from Washington. Specimens are on hand from the following localities:

ALBERTA: Banff (N. B. Sanson), and Frank, VIII-18 '26 (F. H. Strickland), C.N.C.

CALIFORNIA: Tuolumne Meadows, Yosemite Park, VII-4 '27 (J. M. Aldrich), U.S.N.M.

MONTANA: edge of Musselshell River, Winnecock, VIII-15 '24 (S. S. Berry).

OREGON: Hood River, IX-24 '17 (L. Childs); Joseph; Lebanon, V-27 '31 (Wilcox); Mehama, VI-19 '32 (Wilcox); Mt. Hood, O.S.M.; Mt. Hood National Forest, Sherwood Forest Camp, VI-26 '32 (Wilcox); Wallowa Lake, IX-9 '32 (Itol J. Wilcox).

WASHINGTON: Blewett, VI-12 '32 (C. H. Martin and Wilcox); Buckley, VI-15 '32 (Wilcox); Cle Elum, VI-12 '32 and VIII-19, '35 (Martin, S. E. Crumb, Jr., and Wilcox); VII-4 '32 (Wm. W. Baker); Gaynor, IX-3 '33 (Martin), C.H.M.; Goldendale, VI-23 '35 (S. E. Crumb and Wilcox); Kalama River, VII-21 '31 (J. Nottingham), U.K.; Lake Cushman, Mason County, VIII-6 '19 (F. M. Gaige), O.S.M.; Mt. Rainier, Ipsut Creek Camp, VIII-14 '32 (Baker); Mt. Rainier, Old White River Entrance, VIII-14 '31 and VII-31 '32 (Martin and Wilcox); Mt. Rainier, White River Camp, IX-3 '32 (Wilcox); Naches, VII-10 '32 (Wilcox); Rainier National Forest, Indian Flat Camp, VII-10 '32 (Martin and Wilcox); Rainier National Forest, Lodgepole Camp, VIII-16 '32 (S. E. Crumb and Baker); Satus Creek, VI-23 '35 (Crumb and Wilcox); Virden, VII-4 and IX-5 '32 (Martin and Wilcox); Virden, IX-4 '33 (Martin), C.H.M.; Walla Walla, VIII-18 '23 (A. L. Melander), U.K.

UTAH: Uinta Mountains, VI-26 (Truman Swallow); Duchesne Mountain, No. 2037, VII-'26 (Vasco M. Tanner); Sheep Creek, Duchesne County, VI-5 '26 (Clarence Cottan); B.Y.U.

WYOMING: near Lander, 5,000-8,000 feet, VII (Roy Moodie), O.S.M.; Thumb Station, Yellowstone National Park (Vasco M. Tanner), B.Y.U.

One specimen from Hood River, Oreg., has the mystax almost entirely white. See note under *atripennis*.

Lasiopogon currani, n. sp.

(Plate II, Figure 15)

Male: Length 7 mm. Head brown; lower cheeks, palpi, and proboscis shining; face densely grayish-golden pollinose; front very thinly golden-brown pollinose; vertex and occiput gray pollinose. Mystax, hairs of front, vertex, ocellar tubercle, and upper occiput black; beard and hairs of palpi and proboscis white. First and second antennal joints brown, the first shining, $1\frac{1}{4}$ times length of second, hairs of both joints black; third joint $1\frac{1}{4}$ times length of first two joints together, brown apically, basal four-fifths yellowish, a short hair on upper side at two-thirds length from base to apex; style dark brown, about one-half length of third joint.

Thorax black, densely gray pollinose, dorsocentral, lateral stripes, and a broad area behind humeri nearly connecting dorsocentral and lateral stripes, light brown; humeri gray, brownish at some angles; inner half of intermediate area also showing a brownish tinge at some angles. Short hairs of humeri and most of those on anterior part of notum yellowish white, otherwise black; bristles black, 3 anterior and 2 posterior dorsocentral, 1 presutural, 1 supra-alar, and 1 long and 1 short postalar. Scutellum gray pollinose, with 4 black marginal bristles and some shorter yellowish white hairs. Pleura and coxae gray pollinose with a tinge of golden on mesopleura; hairs white except 3 or 4 short blackish ones on mesopleura; 5 black hypopleural bristles on each side plus a shorter black one on one side and a white one on the other.

Abdomen black; narrow posterior margins yellowish red, apical half of most segments, greater portion of segments 1, 6, and 7, and sides of all segments gray pollinose; otherwise light brown pollinose, subshining. Hairs and lateral bristles on first segment yellowish white, longer on sides of first three segments, shorter and appressed otherwise. Venter with reddish margins, densely gray pollinose and with long yellowish white hairs. Hypopygium shining dark reddish brown, sides of hypandrium and basal half of surstyli thinly gray pollinose, hairs entirely yellowish white. Hypandrium somewhat bulging, posterior margin broad V-shaped, posterior fringe deep golden yellow. Surstyli in side view nearly twice as long as wide, ventrally with a small emargination near apex, evenly curved to base, and with a good-sized basal umbo.

(Continued)

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THE GENERA LASIOPOGON LOEW AND ALEXIOPOGON CURRAN IN NORTH AMERICA (DIPTERA-ASILIDAE)

BY F. R. COLE, REDLANDS, CALIF., AND J. WILCOX

DIVISION OF TRUCK CROP AND GARDEN INSECT INVESTIGATIONS, BUREAU

OF ENTOMOLOGY AND PLANT QUARANTINE, UNITED STATES

DEPARTMENT OF AGRICULTURE

(Continued from January Issue)

Legs thinly dusted with gray pollen; femora black; tibiae and tarsi dark reddish brown, fore ones nearly black; base of claws reddish, tips black; empodium black; pulvilli brown. Hairs on femora, on underside of all tibiae, on anterior side of fore tibiae, and on underside of fore and middle tarsi yellowish white; otherwise black; bristles black.

Base, stem, and underside of halteres and narrow basal margin of knob from brown to light brown, dorsum of knob distinctly black. Wings lightly infumated with reddish; veins brown, anterior crossvein at one-third distance from base to apex of discal cell; fourth posterior cell slightly narrowed.

Female: Length 9 mm. Similar to male. One or two hairs of mystax at sides at oral margin white. Golden pollen of front extending on vertex and narrowing on upper occiput. Antennae grayish-golden pollinose; first two joints brown; third joint and style as in male. Short hairs on anterior part of thorax black; only humeri, central stripes, postalar calli, and scutellum gray pollinose; remainder mostly brown pollinose, central stripe plainly bisected by a narrow brown line. Abdomen as in male,

gray posterior bands not quite so wide, hairs entirely yellowish white, longer on first three segments. Ovipositor shining brown on dorsum, ventrally entirely yellowish red, sparse short hairs yellowish, apical spines black. Legs black, only a slight tinge of brown on tibiae and tarsi. Halteres brown, except black dorsum of knob. Wings as in male.

Holotype: Male, Melrose Highlands, Mass., V-22 '18 in the museum of the Boston Society of Natural History.

Allotype: Female, Newton, Mass., VI-7 '14; in the museum of the Boston Society of Natural History.

Paratypes: More than 50 specimens from the following localities:
CONNECTICUT: New Haven, VI-11 '14 (C. W. Johnson and B. H. Walden), B.S.N.H.

GEORGIA: Burton, 1,800 feet, V-21 '11 (J. C. Bradley), O.S.M.

MAINE: Monmouth, VI-16 (C. A. Frost), B.S.N.H.

MASSACHUSETTS: Auburndale, V-22, V-24 '08 and VI-16 '08 (C. W. Johnson), B.S.N.H., VI-26 '04 and VI-29 '07, R.H.P.; Chester, V-21 and 28 '12 (C. W. Johnson), B.S.N.H.; Douglas Woods, V-24 '30 and V-25 '32, S.W.B.; Riverside, V-22 '04, S.W.B.; Sherborn, VI-11 '16 (C. A. Frost), C.A.S.

NORTH CAROLINA: Lake Toxaway (Mrs. A. T. Slosson), Ac. 23226, A.M.N.H.; "N. C." (Coquillett), U.S.N.M.

NEW HAMPSHIRE: Franconia (Mrs. A. T. Slosson), Ac. 26226, A.M.N.H., B.S.N.H., U.S.N.M.; Jaffrey, VI-16 '24 (C. W. Johnson), B.S.N.H.

NEW YORK: Dix Hills, L. I., V-18-19 '35, Half Way Hollow Hills, L. I., V-18 '35 and West Hills, L. I., VI-1 '35 (Blanton and Borders), F.S.B.

Named in honor of C. H. Curran, who had planned to describe this species but on learning of the writers' projected paper kindly sent the specimens to them for description.

Apparently this is the most common of the eastern species and the species that has been going under the name *opaculus* Loew. The writers have received it from several sources named *opaculus*, and it would run to *opaculus* in Melander's key. Charles Dow and Nathan Banks have examined the Loew types and agree with the present writers' designation of that species, from which it is quite different, being closely related to the Pacific Coast forms *fumipennis* Melander and *testaceus*, new species. This species and *fumipennis* are the only North American forms that have the dorsum of the knob of the halteres distinctly black (*immaculatum* from Europe has

the halteres so marked and is very close to *currani*). It differs from *fumipennis* in having well-developed dorsocentral bristles, in the yellowish-red third antennal joint, and in having all the hairs of the male genitalia and the female abdomen yellow (only the first two segments of the female abdomen of *fumipennis* have yellowish hairs).

Lasiopogon delicatulus Melander

(Plate I, Figure 10)

Lasiopogon delicatulus Melander, Psyche, v. 30, pp. 140–141, 1923.

“Male.—Length 6 mm. Ground color entirely black, halteres yellow, the root of wing and the calypteres light brownish. Vertex dusted with dull yellowish-gray, face almost silvery, mystax and rather sparse facial hairs white, upper occiput brownish dusted, lower occiput becoming whitish, the lower hairs short silky and white, hairs and bristles of upper part of head short and black, style scarcely one-half the length of the broad third joint of antenna. Thorax brownish-pollinose, the dorsocentral stripes only vaguely indicated, middle stripe not divided, bristles black, scutellum completely dusted, bare except for the few marginal hairs; lower pleura becoming grayish-blue, hypopleural fringe consisting of about five black setae. Abdomen slender, mostly shining, the hind margin of the segments narrowly whitish and with thinner cinereous pollen extending across the posterior two-fifths of each segment and also triangularly filling the extreme sides, first segment entirely cinereous pollinose, hairs very sparse, short and whitish; hypopygium of same diameter as abdomen, the lateral valves curved, two and one-half times as long as the width of the apical half, abruptly broader on basal half so as to form rectangular projection at middle beneath, apex of valves rounded, hairs rather sparse long and black, dorsal notch broad and deep, fringe of each side with black hairs; venter uniformly grayish dusted, its hairs fine, short, sparse and whitish. Legs entirely black, lightly dusted, the coxae cinereous, the hairs of femora and coxae white, of tibiae and tarsi black, bristles strong and black, pulvilli piceous. Wings hyaline, veins black, anterior crossvein a little before middle of discal cell.

“Female.—Hairs of face in large part black, the polished ovipositor as long as sixth segment, blunt, ventral keel castaneous.

"*Types*.—Mount Rainier, Washington. Six specimens from Alta Vista, Crystal Mountain, and Van Trump Park, July and August, 1922 (Melander).

"The collection of these specimens was largely made possible through a grant from the Elizabeth Thompson Science Fund for a study of the alpine insect fauna of Mt. Rainier."

The above is a copy of Melander's description and remarks.

A large number of specimens of this unique little species are at hand from the following localities: Mt. Rainier, Paradise, Wash., VIII-15 '33 (C. H. and D. Martin), C.H.M.; Mt. Rainier, Sunrise, 6,500 feet, VII-17 to VIII-14 '32 to '35 (Wm. W. Baker, C. H. and D. Martin, Itol J. and J. Wilcox). The last-named specimens were collected largely on the slopes of Burroughs Mountain, on bare gravelly spots in an open flower meadow.

Lasiopogon dimicki, n. sp.

(Plate III, Figure 35)

Male.—Length 10 mm. Head black; lower cheeks, palpi and proboscis shining; face densely, front and vertex thinly, and upper occiput densely, golden-brown pollinose; lower half of occiput gray pollinose. Mystax black, lower hairs on sides yellow, those along oral margin black with yellow tips; numerous hairs of front, vertex, ocellar tubercle and upper occiput black, about 4 long, curved, black bristles on each side of upper occiput, beard white; sparse hairs of palpi and proboscis yellow. Antennae black, golden pollinose; first and second joints with black hairs; third about $1\frac{1}{2}$ times length of first two together; style rather broad basally, one-half length of third joint.

Thorax dark brown, shining, thinly golden-brown pollinose, in some lights dorsocentral stripes showing distinctly shining brown and central stripe and intermediate area, except their margins, more shining brown than remainder; humeri and lateral stripes more densely pollinose. Hairs of humeri and numerous short and long hairs of dorsum black; bristles black, 4 strong anterior and 4 strong posterior dorsocentral and numerous stout hairs, 2 or 3 posthumeral, 3 presutural, 3 or 4 supra-alar, and 3 or 4 postalar. Scutellum shining brown, disk densely golden-brown pollinose, about 20 long black bristle-like hairs and numerous shorter ones on margin. Pleura and coxae golden-gray pollinose, golden color more intense above; hairs yellow except about 10 black hairs above on posterior margin of mesopleura, and 8 to 10 long black hypopleural bristles.

Abdomen brown, shining; the sides, posterior margins, and dorsum with golden-gray pollinosity, the dorsum thinly pollinose, so that the shining spots occupy two semicircular areas on anterior edge of each segment. Hairs on lateral margins and sides of all segments long and yellow, on dorsum short, black, appressed, 10 black bristles on sides of first segment. Venter uniformly golden-gray pollinose and long yellow haired. Hypandrium transverse, shining black with numerous black hairs and black posterior fringe. Surstyli shining black with a thin layer of pollen on basal half; in side view about twice as long as wide; apex emarginate on upper half; upper angle obtuse and lower corner evenly rounded; in ventral view only slightly rounded from base to apex, no basal umbo; hairs long, abundant, black.

Legs black, densely golden-gray pollinose; claws reddish brown with black tips; pulvilli light brown; empodium reddish brown and about as long as claws. Hairs on femora and tibiae yellow, on tarsi black; numerous bristles, black.

Base and stem of halteres brown, knob white. Wings hyaline, veins dark brown, anterior crossvein at one-third distance from base to apex of discal cell; fourth posterior cell nearly closed.

Female.—Length 11 mm. Similar to male. Central stripe of thorax faintly bisected by a narrow pollinose line. Long yellow hairs on lateral margins and sides of abdomen confined to first three segments, on second and third segments not extending far up on sides, being replaced by shorter and stouter black hairs; some short yellowish hairs on lateral margins of all segments; otherwise hairs entirely short, black. Ovipositor polished black, with short yellowish hairs except apical spines and a tuft of hairs above on sides of ninth sternite, which are black. Wings faintly infumated, especially on crossveins; anterior crossvein at two-fifths distance from base to apex of discal cell, fourth posterior cell closed at margin on one side and narrowly open in the other.

Holotype: Male, Newport, Oreg., V-24 '31 (Wilcox); deposited in the California Academy of Sciences.

Allotype: Female, same data, V-3 '31; deposited in the California Academy of Sciences.

Paratypes: More than 200 specimens, both sexes, taken in the type locality in May and June, 1930, 1931, 1932, and 1935 (R. E. Dimick, S. E. Crumb, Itol J. and J. Wilcox); Waldport, Oreg., (J.

E. Davis); Devils Lake, Oreg., V-17 '31 (S. C. Jones); Newport, VI-8, 9 '25 (E. C. Van Dyke, E. P. Van Duzee), Waldport, VI-7 '25 (E. P. Van Duzee), C.A.S.

Named in honor of R. E. Dimick, who collected the first specimens of this species seen by the writers and a number of other species in Oregon.

Closely related to *willametti*, new species, and it may be the coastal form of that species. Differs in the characters given in the key; is more bristly all over and has the pile of the abdomen and thorax strongly contrasting with that of the beard, while in *willametti* there is no such contrast; much less pollinose all over; fourth posterior cell usually narrowed or closed; and in the females the hairs on the sides of the second abdominal segment are partly black while those in *willametti* are entirely white.

Lasiopogon drabicola Cole

(Plate I, Figure 8)

Lasiopogon drabicolum Cole, Psyche, v. 23, p. 65, 1916.

Lasiopogon drabicola Melander, Psyche, v. 30, p. 137, 1923.

"♂, ♀. Length, 8-9 mm. Ground color black. Densely gray pollinose. The pollen of head and thorax with a yellowish tinge. A great deal of white pile on the body. Ocellar bristles black and white mixed and very slender. Occipito orbitals black. One black bristle above on second joint of antenna. The rest of the antennal bristles fine and white in color. Two very faint brown stripes on thoracic dorsum of ♀. Two dark brown widely separated stripes on thorax of ♂, wide at the shoulders and narrowing toward the center of the dorsum where it disappears. Pile of palpi white. In both ♂ and ♀ the pile of front is white and black mixed. Short white pile on thorax. Abdomen covered with short whitish oppressed pile, longer at lateral margins. The mystax black and white and quite heavy. Eighth abdominal segment of ♀ polished black. A circlet of black bristles on genitalia. Scutellum flat, with a semi-circular impressed line as in *arenicola*. Several spines on margin of scutellum, the stronger ones long, black and up-curving. Hypopygium black, slightly pollinose, and covered with white pile and black hair. Legs black, gray pollinose, with white pile and slender black bristles. Tarsi of ♂ dark reddish brown almost black in front. Tarsi of ♀ blackish. Wings grayish hyaline with brownish black veins. Venation normal, the

anal cell closed. Anterior crossvein not much before middle of discal cell. In these specimens all the posterior cells wide open.

"*Type*.—U.S.N.M., Cat. No. 20183. One male and one female specimen.

"*Habitat*.—Redlands, Cal., 1913.

"These small robberflies were collected on wild flowers, and one of them was observed capturing a small cecidomyiid."

The above is a copy of the original description. Numerous specimens are on hand from the following localities:

CALIFORNIA: Artesia, II-10 '35 and III-27 '34 (M. W. Stone); Burbank, III-23 '33 (Charles H. Hicks), M.T.J.; El Monte, San Gabriel River Wash, II-17 to III-31 '33 to '35 (R. Sloop and Stone); Griffith Park, Los Angeles, V-26 '32 (Stone); Los Cerritos, III-21 to IV-9 '15 (M. C. Van Duzee), O.S.M. and C.A.S.; Rio Hondo, Los Angeles County, III-31 '30 (C. H. Martin), C.H.M.; Santa Ana Canyon, III-21 '34 (Stone); Whittier, III-25 '30 (Cole).

Typical specimens have the frontal, thoracic and abdominal hairs mostly white; several specimens have been seen which have the frontal and thoracic hairs mostly black as well as most of those on the last four abdominal segments of the females. All specimens seen, however, have the hairs below on the first two antennal joints white.

Lasiopogon fumipennis Melander

(Plate II, Figure 16)

Lasiopogon fumipennis Melander, Psyche, v. 30, p. 141-142, 1923.

Lasiopogon fumipennis Cole, Pan-Pacific Ent., v. 1, p. 7, 1924.

"*Female*.—Length 8 mm. Black in ground-color, heavily dusted. Upper part of head brownish, hairs short, sparse, fine and black, face cinereous, pile long, abundant and black, pile of lower occiput fine dense and white; style one-third the length of the third joint of antenna. Mesonotum thickly brown-polillose, dorsocentral vittae widely separated, moderately narrow and brown, median stripe not divided; humeri and pleura cinereous, no pile, four black setae in hypopleural row, no dorsocentral bristles; two prealar black bristles, anterior part of notum with scattered minute appressed black setulae, no

hairs; scutellum brownish gray pollinose, its sparse marginal hairs black. Posterior two-fifths of abdominal segments cinereous pollinose, anterior portion nearly black and subshining, first segment alone with outstanding hairs which on the hind margin are setiform and black and white mixed, remainder of abdomen with minute black setulae; ovipositor polished black, nearly as long as sixth and seventh segments combined, the ventral keel castaneous. Legs black, very lightly dusted, the posterior tibiae with brownish tinge, hairs of femora very short, sparse and whitish, of tibiae black, bristles black, two pre-apical extensor bristles on front femur, one on anterior face of middle femur, an imperfect row along upper front face of hind femur, under side of femora with about three straggling long white setiform hairs. Pulvilli alutaceous; wings infumated, veins black, anterior crossvein at middle of discal cell; halteres yellow, the upper side of knob with distinct black center, calypteres yellow.

“*Types*.—Paradise Park, Mount Rainier, Washington, Aug. 1921 (Melander). Two paratypes, same locality and south slope of Mount Adams, Washington (Melander).”

The above is a copy of Melander’s description of the female. Cole described the male as follows:

“*Lasiopogon fumipennis* Melander. Among the specimens studied there are two females from Horse Lake, Oregon, altitude 6000 feet, taken by J. C. Bridwell, July 25, 1909; one female, taken by the writer at Hood River, Oregon, July 2, 1917. Melander had only females, and as the male is worthy of description some notes are given below and one specimen is made a neallotype.

“Male. Length 5–6 mm. Very nearly like the female, but differs in the generally lighter color of pollen and the paler wings. Head more gray pollinose than brown. The male genitalia are remarkable, being broader than the abdomen and shining, dark red in color, with the usual patch of pile on the ninth sternite black in color; the genital styles are rounded and bulging (see fig. 1).

“Neallotype, male, No. 1574, in collection of California Academy of Sciences, taken July 1, 1919, by C. L. Fox.

“The specimen designated was taken in the type locality, Paradise Valley, Mt. Rainier, Washington, 8,000 feet elevation.”

More than 300 specimens on hand from the following localities:

CALIFORNIA: Fallen Leaf Lake, elevation 6,300 feet, VI-21 '30 (Arthur T. McClay), C.H.M.

COLORADO: near Ward, VI-2 to 9 '33 (H. G. and H. E. Rodeck); So. St. Vrain, Lyons, VI-9 '33 (H. I. Gibbons), M.T.J.

BRITISH COLUMBIA: Agassizi, V-7 and 10 '26 (R. Glendenning), C.N.C.

OREGON: Hood River, V-14 (A. L. Lovett), and VII-2 (Cole); Horse Lake, VII-25 (J. C. Bridwell); Mt. Hood National Forest, Sherwood Forest Camp, VI-29 '30 and VI-26 '32 (Wilcox).

IDAHO: Long Valley, Alpha, VI-10 '34 (C. H. and D. Martin), C.H.M.

WASHINGTON: Easton, V-30 '32 (Wm. W. Baker); Mount Rainier, Sunrise, elevation 6,400 feet, VII-23 to IX-14 '32 (S. E. Crumb, Wm. W. Baker, C. H. and D. Martin, C. W. Getzendaner, Itol J. and J. Wilcox); Mt. Rainier, White River Camp, IX-14 '32 (Baker); Olympia, V-14 to VI-4 '32 (Martin and Wilcox); Paradise Park (R. Latta); Preston, VI-5 '32 (Martin); Roy, IV-29 '32 (R. Latta), R.L.; Seattle, V-20 '13, O.S.M.; Tenino, V-15 '32 (Martin); Tipsoo Lake, VII-28 '32 (Martin and Wilcox).

This species, although distinct, is variable. The specimens from the lower elevations taken earlier in the season at Olympia, Tenino, Seattle, Roy, Wash., and Agassizi, B. C., are designated as variety *olympia*. They have the tibiae of all the legs more or less reddish, the posterior fringe of the hypandrium of the males partly golden yellow, and the eighth tergite of the female with some red near the base.

The specimens from Colorado are designated as variety *coloradensis*. They have the legs entirely black, well-developed anterior and posterior dorsocentral bristles, male genitalia entirely black, and only the ninth sternite of the female genitalia reddish.

See notes under *currani* and *testaceus*, new species.

Lasiopogon gabrieli, n. sp.

(Plate III, Figure 33)

Male: Length 6 mm. Head black; lower cheeks, palpi, and proboscis shining; face densely gray pollinose; front, vertex, and upper occiput densely grayish-golden pollinose; lower occiput gray pollinose. Mystax black except for a few yellowish-white hairs on oral margin; front, vertex and occiput densely long, black pilose; beard and sparse hairs of palpi and probos-

cis white. Antennae black, densely light golden pollinose; first two joints subequal in length, the first with pale hairs below, above, and the second joint entirely with black hairs; the third $1\frac{1}{2}$ times length of the first two joints together; style subequal in length to third joint.

Thorax black in ground color, densely gray pollinose with touches of golden; dorsocentral stripes brown; central stripe blackish and divided by a gray line; lateral margins grayish golden; intermediate space between central stripe and lateral margins thinly gray, subshining; humeri gray pollinose. Hairs on humeri white; sparse short and long hairs on anterior part of notum black; bristles black, 3 strong and 2 or 3 weak anterior and 3 strong and 1 weak posterior dorsocentral, 1 posthumeral, 2 presutural, 2 supra-alar, and 2 or 3 postalar. Scutellum densely gray pollinose, margin subshining; 8 strong black marginal bristles and a number of long black hairs, and on the sides several short yellowish hairs. Pleura densely gray pollinose with a touch of golden above; hairs of prothorax, sternopleura, and coxae yellowish white, about 5 long black hairs and several shorter yellowish ones below on posterior margin of mesopleura, 5 long black hypopleurals, 1 shorter black one on one side and 1 shorter white one on the other.

Abdomen polished brown, the posterior borders yellowish; sides and apical half of each segment except the first, which is almost entirely so, gray pollinose. Numerous long yellowish white hairs on lateral margins and extending onto sides of first four segments, shorter hairs on dorsum of these segments and on remainder anteriorly, appressed, yellowish white; beginning on posterior margin of fourth and increasing in extent on following segments, short, appressed, black; 4 long bristle-like hairs on sides of first segment, 2 of which on one side are black, the remainder yellowish white. Venter uniformly gray pollinose, posterior margins yellowish, long yellowish-white pilose. Hypandrium transverse, polished black centrally, densely gray pollinose on sides; hairs and fringe black. Surstyli densely gray pollinose and sparsely black pilose; in side view slightly more than twice as long as wide and evenly curved apically; ventrally the margins run at a sharp angle to about two-thirds distance to base, thence mesally nearly to middle, and then evenly curved to base; no basal umbo.

Legs black, densely gray pollinose; claws and empodium black, of equal length; pulvilli brownish. Hairs everywhere on

femora and tibiae yellowish white, except short heavy pile on apical posterior surface of hind tibiae, which is black; dense hairs below on anterior tarsi yellowish white, above and on the sides black; hairs on middle and hind tarsi mostly black; bristles black.

Base and lower stem of halteres brown; knob and upper stem yellowish. Wings hyaline, veins dark brown, anterior crossvein at one-fourth distance from base to apex of discal cell.

Female: Length 6 mm. Similar to male. Pollen all over appearing more yellowish, but with gray predominating; 2 or 3 anterior and 3 posterior dorsocentral, 1 posthumeral, 2 presutural, 2 supra-alar, 2 postalar, 8 strong scutellar, 6 hypopleural, 1 white on each side; and 4 lateral bristles on first abdominal segment, 3 on one side being black. Long white hairs of abdomen confined to lateral margins and sides of first three segments, hairs on remainder and on dorsum of first three short, somewhat recumbent, black. Ovipositor polished dark brown and short, sparsely yellow pilose; apical spines black, tuft of hairs below these yellowish; longer hairs on posterior margin of eighth sternite yellow. Most of hairs on fore tarsi yellowish, and some yellowish hairs above on middle and hind tarsi.

Holotype: Male, San Gabriel River Wash, near Whittier, Calif., II-27 '32 (C. H. Martin); deposited in the California Academy of Sciences.

Allotype: Female, same data; deposited in the California Academy of Sciences.

Paratypes: More than 50 specimens, both sexes, same data, II-22 to III-5 '32 (C. H. and D. Martin and F. R. Cole); Azusa, III-1 '25, S.W.B.; San Gabriel Canyon, II-16 '30 (R. Latta); slope north of San Bernardino, Calif., II-22 (Cole); Redlands, Calif., II-19 (Cole); Riverside, I-27 '35 (M. W. Stone); La Quinta, near Redlands, Calif., III-28 (Cole); Alpine, Calif., IV-8 '15 (M. C. Van Duzee), O.S.M.; San Gabriel River Wash, near El Monte, Calif., I, II and III, '34 and '35 (M. W. Stone), and XII-31 '34 (Wilcox).

This species is closest to *opaculus* Loew and *drabicola* Cole, but its smaller size, markings of the abdomen, structure of the antennae, and male genitalia separate it definitely.

Lasiopogon hinei, n. sp.

(Plate II, Figure 22)

Male: Length 9 mm. Head shining black; face and occiput

densely gray pollinose, the ground color plainly evident at certain angles; front and vertex thinly gray pollinose. Lower one-fourth of mystax yellowish white; remainder of mystax and numerous long hairs on front, vertex and occiput black; beard, hairs of palpi and proboscis white. Antennae black, gray pollinose, apex of the second joint and basal one-fifth of third yellowish; first two joints subequal in length, the first with 2 short black hairs below and the second with 4 below and 1 above; the third $1\frac{1}{4}$ times length of first two together; style one-half length of third, pointed apically.

Thorax in ground color shining dark brown, thinly gray pollinose, dorsocentral stripes light brown, and indistinct bisected median stripe and indistinct lateral stripes above supralars brown. Long hairs, black, numerous on fore part of notum; humeral hairs golden. Bristles black, 3 rather weak anterior and 4 posterior dorsocentral, 2 presutural, 2 supralar, and 3 postalar. Scutellum densely gray pollinose, margin thinly so, appearing shining brown; disk transversely impressed shortly before margin; about 8 long bristle-like and a number of shorter black marginal hairs. Pleura and coxae gray pollinose, more golden and shining above; hairs long, abundant, white; about 7 long black hairs and some shorter golden ones posteriorly on mesopleura; 6 or 7 long black hypopleurals.

Abdomen shining brown, the narrow posterior margins yellow, the slightly wider posterior margins and the sides, and the first segment entirely, gray pollinose. Numerous long white hairs on first three segments, merging into slightly shorter and heavier, golden brown hairs on fourth segment, and continuing so on the following segments; five long white bristlelike hairs on sides of first segment. Venter shining brown, hind margins yellowish red, thinly gray pollinose; hairs on segments 1 to 5 long and white, on segments 6 and 7 golden brown, and on segment 7 a posterior row of black hairs. Hypandrium transverse, shining reddish brown, gray pollinose on sides; short black hairs on dorsum, the rather sparse posterior fringe black. Surstyli darker shining reddish brown, gray pollinose and long black pilose; in side view slightly longer than twice its width, evenly rounded at apex below, upper apical angle acute; ventrally the inner area heart-shaped, with wider part toward base.

Legs shining black, tarsi dark reddish brown; claws reddish brown with black tips. Hairs and bristles black; long hairs below on femora white; a few short ones on anterior-dorsal surface of femora and below on tibiae and tarsi golden.

Base of stem and knob of halteres brown, intermediate portion yellow. Wings hyaline, veins dark brown, anterior cross-vein at two-fifths distance from base to apex of discal cell.

Female: Length 10 mm. Similar to male. Posterior half of abdominal segments obscured by a thin coating of gray pollen; hairs white on segments 1 to 4, short, sparse, black on remaining segments. Ovipositor on posterior margin above, and on apex, sides and base below, yellowish red; otherwise shining brownish black; hairs short, golden-brown to black; spines black. Tibiae as well as tarsi more or less reddish brown. Wings infumated all over.

Holotype: Male, Katmai, Alaska, July 1917 (J. S. Hine); in the Ohio State Museum.

Allotype: Female, same data; in the Ohio State Museum.

Paratypes: 3 males, 4 females, same data, O.S.M.

Named in honor of the late Prof. James S. Hine, the collector.

See note under *canus*.

Lasiopogon littoris Cole

(Plate I, Figure 5)

Lasiopogon littoris Cole, Pan-Pacific Ent., v. 1, p. 8, 1924.

"Male. Length 5.5 mm. A small, black, silvery gray pollinose species, with pile and bristles all white. Antennae black, rather unusual in shape (see fig. 2), the arista slightly longer than the third joint, pile beneath the first and second joints white. Facial convexity reaching almost to the antennae, the mystax long and white. Head whitish gray pollinose, the frons, occiput, and beard white pilose. Palpi very small, black, without long pile.

"Thorax and scutellum silvery white pollinose, with scant white pile and white bristles. No vittae on mesonotum. Disc of scutellum flattened. Halteres yellowish white, the base of stem brownish.

"Abdomen silvery gray pollinose and sparsely white pilose, the bases of second to fifth tergites semishining black, appearing more definite from certain angles. Genitalia black, gray pollinose and white pilose, with a characteristic fringe of dense white

pile on the hypandrium; the tergal style (surstyli) very large, rounded at the ends, but with a sharp angle below (see fig. 3). Legs black, gray pollinose, with white pile and bristles.

"Holotype, male, No. 1575, in collection of California Academy of Sciences, taken April 25, 1919, by E. P. Van Duzee.

"Type locality, Pismo, California.

"The species is described from an unique male. It is a very distinct form. In a recent table of species published by Melander (*Psyche*, Oct., 1923) it would run to couplet 4, but is quite different from *actius* and *arenicola*. The antennal structure is suggestive of the genus *Lissoteles*, but the face and genitalia are typical of *Lasiopogon*."

The above is a copy of the original description; no other specimens have been seen.

Lasiopogon martinensis, n. sp.

(Plate III, Figure 30)

Male: Length 10 mm. Head densely grayish pollinose with a yellowish tinge on front and vertex; cheeks, palpi, and proboscis shining black. Mystax, hairs of front, of ocellar tubercle, of vertex, those above on first antennal joint, and those on second, and the occipital bristles, black; beard, hairs of palpi, of proboscis, a few on sides of oral margin, and below on first antennal joint white. Antennae black, grayish pollinose, first two joints subequal in length, third $1\frac{1}{2}$ times length of first two joints together, style one-half length of third joint.

Mesonotum densely grayish pollinose, central stripes and the intermediate area appearing blackish, and narrow dorsocentral stripes light brown. Hairs black; bristles black, 4 or 5 very short fine anterior and 3 or 4 strong posterior dorsocentral, 2 presutural, 2 supra-alar, and 3 postalar. Scutellum gray pollinose with a few white hairs on disk and 6 black bristles and some black hairs on posterior margin. Pleura and coxae grayish pollinose and white pilose except some short black hairs above and a few strong black hairs posteriorly on mesopleura; 5–6 black hypopleural bristles.

Abdomen densely grayish pollinose and segments 2 to 5 with anterior semicircular subshining brownish spot on each side. Hairs entirely white, longer on sides of segments 1 to 4; 4 or 5 black lateral bristles on first segment. Hypandrium transverse, shining brown, laterally yellowish gray pollinose, hairs and

fringe black except a few on sides basally which are white. Surstyli densely yellowish gray pollinose, in side view not quite twice as long as wide, lower margin nearly semicircular, upper apical angle obtuse, ventrally the two sides but slightly separated and nearly parallel; no basal umbo.

Legs black, densely gray pollinose, narrow apices of tarsal joints yellowish; hairs of femora and of tibiae largely white, of tarsi black; bristles black; claws dark reddish, tips black; empodium black; pulvilli brown.

Halteres light brown, basal part of stem darker brown. Wings hyaline, veins dark brown, anterior crossvein at one-third distance from base to apex of discal cell.

Female: Length 10 mm. Similar to male. Hairs on dorsum of the second abdominal segment, on sides and dorsum of third, and on remaining segments all black. Ovipositor, shining black, white pilose, apical spines black. Anterior crossvein at two-sevenths distance from base to apex of discal cell.

Holotype: Male, Pasco, Wash., IV-17 '34 (C. H. Martin), deposited in the California Academy of Sciences.

Allotype: Female, same data (Dorothy Martin), deposited in the California Academy of Sciences.

Paratypes: 12 specimens both sexes, same data, in collections of C. H. Martin and the writers.

Named in honor of Mr. and Mrs. C. H. Martin, who by their diligent collecting have contributed much to the completeness of this paper.

Lasiopogon monticola Melander

(Plate III, Figure 31)

Lasiopogon monticola Melander, Psyche, v. 30, p. 142-143, 1923.

Lasiopogon monticola Cole, Pan-Pacific Ent., v. 1, p. 8, 1924.

“*Male*.—Length 9 mm. General color brownish-gray due to heavy coat of pollen, vertex and upper occiput dusted with brown, face cinereous brown, mystax entirely black, hairs of lower occiput fine silky and white, of upper occiput black; style two-fifths the length of third antennal joint, thorax marked only with the narrow dorsocentral brown stripes which diverge anteriorly, median space not divided, bristles black, two lateral bristles in front of suture, above five on postalar callus,

about five presutural dorsocentrals; scutellum margined with about eight black bristles in addition to interspaced black hairs, bare on disc; six bristles in hypopleural row, mostly black, four black hairs at posterior margin of mesopleura. Anterior half of abdominal segments piceous, posterior half cinereous brown, hairs white, becoming black at apex, five black bristles in lateral row of first segment; hypopygium globose black shining, somewhat wider than termination of abdomen, the dorsal incision very broad, its fringe black, lateral valves very broad, less than twice as long as wide, truncate at apex, the lower margin with very strong tooth, hairs coarse and black, venter concolorous with posterior portions of tergites, its hairs fine and whitish. Hairs of femora white in large part, the outer half of femora with about five extensor setae, the upper front face of hind femora setose; tarsi concolorous with remainder of legs, claws piceous with black apex, pulvilli alutaceous. Halteres and calypteres yellowish; wings lightly cinereous, veins black, anterior crossvein slightly before middle of discal cell.

“Female.—Ovipositor short, ventral keel black, hairs of abdomen short and mostly black.

“*Types.*—Mount Adams, Washington, July 24, 1921 (Melander). Other localities, Moscow Mountain, Idaho, and Mount Rainier, Washington. Thirty specimens.”

The above is a copy of Melander’s description of the species. Cole in addition records it from Horse Lake, Oreg., July 25, 1909 (J. C. Bridwell). Large series of specimens are on hand from the following localities:

BRITISH COLUMBIA: Creston, VII-12 '20 (W. B. Anderson), C.N.C.; Hope Mts., VII-19 '06 (R. V. Harvey), O.S.M.

IDAHO: Long Valley, Alpha, V-20 to VI-17 '34 (C. H. and D. Martin), C.H.M.; Moscow Mt., VI-10 '30 (J. M. Aldrich), U.S.N.M., VI-23 '19 (Cole), and VII-9 '11, paratype, U.K.

OREGON: Aneroid Lake, Blue Mts., 7,500 feet, VII-24 '29 (H. A. Scullen); Frog Meadows, Lane County, 4,300 feet, VII-18, '32 (D. K. Frewing); Haines, VII-10 '31 (R. H. Beamer), U.K.; Horse Lake, VII-25 (J. C. Bridwell); Horseshoe Lake, Blue Mts., VII-26 '29 (H. A. Scullen), O.S.M.; Mt. Hood, 3,000-6,000 feet, VIII-5 '25 (C. L. Fox), C.A.S.; Sumpter, VI-9 '34 (C. H. Martin), C.H.M.

UTAH: Park City, VII-3, '22 (E. P. Van Duzee), C.A.S.

WASHINGTON: Mt. Adams, 6,000 feet, VII-3 '25 (M. C. Lane); Mt. Rainier, Ohanepecosh, VII-14 '35 (Wm. W. Baker); Mt. Rai-

nier, Paradise, VII-1 '19 (C. L. Fox) and VII-17 and 25 '20 (E. C. Van Dyke), C.A.S.; Mt. Rainier, Sunrise, VII-25 to VIII-28 '32 to '35 (C. H. and D. Martin, Wm. W. Baker, S. E. Crumb, Itol J. and J. Wilcox); Mt. Rainier, White River Camp, VII-20 to IX-4 '32 to '35 (C. H. and D. Martin, Itol J. and J. Wilcox).

The prominent tooth on the ventral margin of the surstyli readily separates the males of this species from all the other forms.

Lasiopogon oklahomensis, n. sp.

(Plate I, Figure 12)

Male: Length 8 mm. Black; palpi, proboscis, and cheeks shining; face densely grayish pollinose with a yellowish tinge; front, vertex, ocellar tubercle, and upper occiput densely golden-brown pollinose; lower occiput gray pollinose. Mystax, beard, and hairs on palpi, proboscis, a few on vertex, and part of those below on first antennal joint white; hairs of front, ocellar tubercle, and remainder of hairs on first two antennal joints and occipital bristles black. Antennae black, first two joints subequal in length, third but slightly longer than first two joints together, and style two-thirds length of third joint.

Mesonotum densely pollinose, central stripes, dorsocentral stripes, and outer half of intermediate area brown; median line and narrow area between central and dorsocentral stripes slightly lighter brown; humeri, inner half of intermediate area, and lateral margins yellowish brown. Humeral hairs white, remainder black; bristles fine black, 3 or 4 anterior and 2 or 3 posterior dorsocentral, 2 presutural, 1 supraalar, and 1 postalar. Disk of scutellum brown and posterior margin gray pollinose; hairs white; 6 black marginal bristles. Pleura and coxae grayish-golden pollinose and white pilose except 2 or 3 black hairs posteriorly on the mesopleura; 6 or 7 white hypopleural bristles.

Abdomen densely grayish pollinose with brown semicircular subshining spots basally on each side of segments 2 to 7; hairs white, longer on sides of segments 1 to 3; 3 or 4 white lateral bristles on first segment. Hypandrium transverse, shining dark brown, grayish pollinose laterally; hairs and posterior fringe black. Surstyli black, densely grayish pollinose; hairs black; in side view not quite twice as long as wide, apical margin evenly rounded, ventral margins deeply cupped; no basal umbo.

Legs black, thinly gray pollinose, apices of tibiae and the tarsal joints reddish; hairs of femora and a few of those basally on middle and hind tibiae white, otherwise hairs and bristles black; claws reddish brown, tip black; empodium black; pulvilli brown.

Halteres dull yellowish, basal part of stem and outer half of dorsum of knob brown. Wings hyaline, veins brown, anterior crossvein at two-fifths distance from base to apex of discal cell.

Female: Length 9 mm. Similar to male. Central stripes of mesonotum very much lighter than dorsocentral stripes, and central stripe and inner half of intermediate area gray pollinose. Very short sparse hairs on sides of abdominal segments 5 to 7 black; only about posterior half of segments plainly grayish pollinose; ovipositor shining black, white pilose, eighth sternite reddish brown, and apical spines black. Hairs posteriorly on fore tibiae, mostly on middle tibiae, and all those on hind tibiae white.

Holotype: Male, Ripley, Okla., IV-21 '34 (A. E. Pritchard); deposited in the U. S. National Museum.

Allotype: Female, same data (apparently in copula with holotype); deposited in the U. S. National Museum.

Paratypes: 23 specimens representing both sexes, same data as types; Norman, Okla., V-4 '30 (Dennis), Payne County, IV-16 '33 (C. Sooter), and Stillwater, IV-21 to 23 '35 (C. Sooter and A. E. Pritchard), in A. E. Pritchard's and the writers' collections.

Some of the paratypes have a few of the upper hairs in the mystax and the hypopleural bristles in part or largely black. Some of the females have the eighth sternite largely black.

Lasiopogon opaculus Loew

(Plate II, Figure 17)

Lasiopogon opaculus Loew, Berlin Ent. Ztsch., v. 18, p. 367, 1874.

Lasiopogon opaculus Back, Trans. Amer. Ent. Soc., v. 35, p. 299-300, 1909.

Lasiopogon opaculus Melander, Psyche, v. 30, p. 137, 1923.

"♀.—Length 8-9 mm.—Black; thoracic stripes obsolete; terminal segment of abdomen polished black and black pilose; rest of the body wholly obscured by a grayish-brown bloom, but the anterior angles of the several abdominal segments broadly brownish.

"Translation. Ground color of body is without exception, black; head, thorax and abdomen with a denser dull bloom, but the last abdominal segment wholly without bloom and polished black. The bloom of the head and thorax yellowish-gray, almost brownish-gray; distinct thoracic stripes are not perceptible on the specimen described, yet the space between the middle and the lateral stripes appears darker than the surrounding color usually is. The abdomen, excepting the last segment, is covered with a grayer bloom and entirely dull; from the second segment on, the anterior angles of the several segments are broadly brownish, which color is first on the fifth segment less in degree, on the sixth segment somewhat broadened on the fore part, likewise not very dense and gradually shades off into the gray, so that it is indistinctly defined, whereas it has a sharp distinctive limit on the preceding segments, which one distinctly notices when one looks at the abdomen from behind. Halteres yellowish. Wings grayish, venation normal; veins brownish-black; the anterior crossvein is considerably before the middle of the discal cell. The hair and bristles are as usual in this genus; mystax, hair of the first two antennae segments, of the front and of the upper part of the occiput black; the hair on the large lower half of the occiput, on the mentum and on the under side of the proboscis white; that on the lateral borders of the mouth opening pale yellowish. Prothorax with more whitish hair, thoracic dorsum and scutellum with more blackish hair. Hair on the pleura whitish only in front of the mesopleural suture; beneath the base of the wing there is some stouter black hair. The hair on the first three abdominal segments is whitish, almost yellowish-white; on the gray pruinose area of the second segment there are numerous black hairs which also extend over onto the third segment; the short hair on the following segments, not excepting the last, is exclusively black. The prevailing black hair and the small amount of white hair of legs is arranged as usual; all the bristles of the legs black, as in the other species.

"*Type*.—M.C.Z. Single female type.

"*Habitat*.—Illinois (type); N. J. (Am. Ent. Soc.); Veta Pass, Col. (June 21)."

The above is copied from Back; the male is described below:

Male: Length 9 mm. Mystax black; front narrow, with black hairs; beard white. Antennae black with a touch of red

on inner sides of second joint and at base of third; hairs on first two joints black, first joint slightly longer than second; third $1\frac{1}{2}$ times length of first two joints together; style one-half length of third joint.

Humeri with a touch of reddish yellow below; mesonotum grayish brown, dorsocentral stripes and intermediate area brown, but not prominent. Hairs black; bristles black, 2 or 3 anterior and 3 posterior dorsocentrals, 2 presuturals, 2 or 3 supra-alars, 2 postalars, 8 scutellars, and 7 or 8 black or brownish hypopleurals.

Abdomen light brown, subshining; each segment with two anterior semicircular spots at base this color; sides, posterior margins, and dorsum of segments densely yellowish gray pollinose; hairs entirely white or yellowish, longer on sides of first three segments, very short on dorsum and sides of remainder; 5 yellowish bristles on each side of first segment. Hypandrium transverse, dark reddish brown, in middle shining, sides pollinose; posterior fringe and hairs black. Surstyli yellowish pollinose, in side view about twice as long as wide with a slight emargination at upper apical angle, evenly rounded below; ventrally deeply cupped in middle; no basal umbo, hairs entirely black.

Legs black, femora white or yellow haired, rest of legs black or brown haired except pile on anterior side of fore tibiae, which is golden.

Stem and base of halteres light brown, knob yellowish white. Wings hyaline with a slight reddish tinge; veins brown, anterior crossvein at two-fifths distance from base to apex of discal cell; fourth posterior cell slightly narrowed.

Described from the Maryland specimen listed below. Specimens on hand from the following localities:

MARYLAND: near Plummers Island, V-6 '16 (J. C. Crawford), N.C.D.A.

NORTH CAROLINA: Blantyre, early May '08 (F. Sherman), O.S.M.

OHIO: Columbus (J. S. Hine), Cincinnati, V-22 (Dury), VI-9 to 16 '01; Sugar Grove, VI-10 '28; Ira, Summit County, VII-1 '20 (Hine); Londonville, VI-6 '15; all in O.S.M.

The specimen from North Carolina is in rather poor condition, as the thorax is crushed, but shows the following differences: Mystalix entirely white and basal half of tibiae reddish.

This species, and *currani* and *slossonae*, new species, were all received from different sources labeled *opaculus*. Nathan Banks

and Richard Dow have examined the type and compared specimens for the writers.

See note under *currani*.

Lasiopogon pacificus, n. sp.

(Text Figures 2 and 3)

Male: Length 9 mm. Head black; broad lower cheeks, palpi, and proboscis shining; tip of proboscis reddish; face gray pollinose with a golden tinge in some lights; front, vertex, and upper occiput thinly golden-brown pollinose; lower occiput densely gray pollinose. Mystax and dense hairs of front and upper occiput black; beard and sparse hairs of palpi and proboscis white. Antennae black, golden pollinose; first two joints subequal in length, black haired; the third $1\frac{1}{2}$ times length of first two together, on upper side at two-thirds distance from base to apex with two short black hairs; style less than one-third length of third joint.

Thorax shining brown; broad dorsocentral stripes, lateral stripes, and broad median bisecting line brown; central stripes anteriorly, humeri and a narrow area behind humeri, and intermediate area and transverse suture cutting into dorsocentral stripes, gray pollinose, humeri more densely so; posterior two-thirds of central stripes and inner margins of intermediate area golden-brown pollinose. Hairs on humeri and numerous short hairs on anterior part of notum black; bristles black, 3 or 4 anterior and 3 or 4 posterior dorsocentral, 1 posthumeral, 3 presutural, 1 strong and 1 weak supra-alar, and 1 strong and 2 weak postalar. Scutellum shining brown, disk densely golden-brown pollinose, some short and long black hairs on disk and margin, 8 black marginal bristles. Pleura and coxae gray pollinose with a light golden tinge; hairs golden except 15 to 20 short black hairs on mesopleura and 9 black hypopleural bristles.

Abdomen shining brown, narrow posterior margins dull golden, sides and posterior margins gray pollinose. Hairs on lateral margins and sides mostly long golden yellow, some black hairs on sides of segments 4 to 7; hairs on dorsum short, appressed, black. Venter uniformly gray pollinose with golden margins and long yellow hairs. Hypandrium bulging, shining black, dorsum brownish, hairs black; posterior margin V-shaped, posterior fringe black, oblique; hairs slightly crossing at middle. Surstyli shining black with only a trace of brown pollen on

sides near base; in side view but slightly longer than wide, apically with three emarginations; ventrally with a basal umbo; hairs black, sparse hairs on ventral-apical margin golden.

Legs dark brown, shining, with hairs and bristles black except on underside and base of femora and anterior side of fore tibiae, where they are yellow; femora lightly dusted with golden pollen; claws reddish brown with black tips; pulvilli brown; empodium black, about two-thirds length of claws.

Base and lower stem of halteres brown, knob and upper stem white. Wings lightly and evenly infumated, a little more intense on crossveins; anterior crossvein at two-fifths distance from base to apex of discal cell; fourth posterior cell nearly wide open.

Female: Length 10 mm. Similar to male. Face more golden; bristles as in male except that there are 4 scutellar and 8 hypopleural bristles. Hairs on lateral margins of first four segments and on sides of first three of abdomen, golden yellow, otherwise black; 4 or 5 black bristles on sides of first segment; ovipositor shining dark brown, ninth sternite reddish, sparse hairs yellow, apical spines black. Wings more deeply infumated than in male, fourth posterior cell slightly narrowed but still quite broadly open.

Holotype: Male, Newport, Oreg., V-24 '31 (J. Wilcox); deposited in the California Academy of Sciences.

Allotype: Female, same data; deposited in the California Academy of Sciences.

Paratypes: More than 30 specimens as follows: Type locality, V-3 '31 (Wilcox), V-22 and VI-5 '32 (R. E. Dimick and Wilcox), and V-12 '35 (S. E. Crumb and Wilcox); Newport, Oreg., VI-9 '25 (E. P. Van Duzee), C.A.S.; Waldport, Oreg., VI-5 '25 (Don C. Mote), O.S.M.; Forks, Wash., VII-5 '20 (E. C. Van Dyke); Olympia, Wash., V-15 to VI-4 '32 (C. H. Martin and Wilcox), VI-10 '33 (R. Latta), R.L.; Westport, Wash., V-15 '32 (Wilcox); Steelhead, B. C., V-31 to VI-20 '33 (Hugh B. Leech), C.N.C.

This species is very close to *aldrichii* Melander and very likely the same as the specimens he had from Naheotta, Wash.

Lasiopogon pugeti, n. sp.

(Plate II, Figure 24 and Text Figures 1 and 4)

Male: Length 10 mm. Head black in ground color; lower cheeks, palpi, and proboscis shining; tip of proboscis red; face

densely light golden pollinose; front, vertex, and upper occiput thinly golden-brown pollinose; lower occiput grayish-golden pollinose. *Mystax* black, 2 or 3 weak white hairs on sides at oral margin; front, vertex, and upper occiput densely long black pilose; beard and hairs of palpi and proboscis gray. Antennae black, golden pollinose; first and second joints subequal in length, black haired; third $1\frac{1}{4}$ times length of first two together, with a short black hair above at three-fourths its length; style slightly less than one-half length of third joint, polished black.

Thorax shining dark brown, dorsocentral stripes, median broad bisecting line, and lateral margins this color; central stripes grayish-golden pollinose, golden color more intense on sides and anteriorly; area between dorsocentral and lateral brown stripes mainly grayish golden-brown pollinose, the golden brown more intense on sides and a large spot of this color behind humeri; transverse suture gray pollinose breaking into dorsocentral and lateral stripes; narrow lateral margins golden-brown pollinose; humeri gray pollinose. A number of moderately long black hairs on anterior part of notum; bristles black, 3 anterior and 3 posterior dorsocentral, 2 or 3 presutural, 1 supra-alar, and 1 postalar. Scutellum shining brown, the disk densely golden-brown pollinose, the margin very thinly so; 6 strong black bristles and a number of black hairs on margin. Pleura light golden and gray pollinose, the gray more evident below and on coxae; hairs yellowish white, about 6 medium long black ones on mesopleura, and 8 bristles in hypopleural row, 2 on one side white, the others black but some of these with yellowish tips. On anterior side of hind coxae near apical margin, a sharp, inwardly directed spur.

Abdomen polished dark brown, narrow posterior margins yellowish, posterior half of first and posterior third and sides of remaining segments, grayish-golden pollinose. Hairs on lateral margins of all segments and on sides of first four yellowish white; otherwise short, black, and golden, seventh segment entirely short, golden haired; 5 black bristles on sides of first segment. Venter uniformly grayish-golden pollinose, posterior margins yellowish; hairs yellowish, rather short. Hypandrium shining dark brown, nearly black, somewhat bulging in side view, posterior margin U-shaped, hairs and fringe black. Surstyli shining black, very thinly grayish-golden pollinose, densely black haired with some golden hairs along apical

and ventral margins; in side view $1\frac{1}{3}$ times as long as wide, but slightly narrowed basally, and with a prominent, rather wide, flange on lower half of apical margin; ventrally evenly curved from apex of flange to base, with a large basal umbo.

Legs shining black, thinly golden pollinose; middle part of claws reddish, base and tip black; pulvilli light brown; empodium half length of claws. Some yellowish white hairs below on femora, otherwise hairs and bristles black.

Base and lower stem of halteres brown; knob and upper stem whitish. Wings slightly infumated, more so on cross-veins; veins dark brown; anterior crossvein at one-third the distance from base to apex of discal cell.

Female: Length 10 mm. Similar to male. Dorsocentral stripes prominent, widened anteriorly; 3 anterior and 3 posterior dorsocentral, 2 presutural, 2 supra-alar, 2 postalar, 6 strong scutellar, and 6 lateral bristles on first abdominal segment. Hairs on sides and lateral margins of first three abdominal segments long and yellowish, otherwise short and black; ovipositor dark shining brown with short yellow hairs, spines black, ninth sternite entirely reddish, eighth sternite reddish brown, apically dark reddish, eighth tergite twice length of seventh. Wings hyaline, slightly clouded on crossveins; fourth posterior cell narrowed.

Holotype: Male, Sumner, Wash., VI-17 '32 (J. Wilcox); deposited in the California Academy of Sciences.

Allotype: Female, same data; deposited in the California Academy of Sciences.

Paratypes: More than 60 specimens taken in the type locality from V-28 to VI-21 '32 and '33 (C. H. and D. Martin, R. Latta, Wm. W. Baker, and Wilcox); Forks, VII-23 '33 (Martin and Wilcox); Olympia, V-13 to 28 '32 (Martin and Wilcox); Puyallup, V-15 to VI-20 '32 to '35 (Wm. W. Baker; Paul M. Eide and Wilcox); Mt. Rainier, Carbon River Entrance, VIII-7 '32 (Wilcox); and Electron, VI-26 '33 (Baker and Wilcox); all these localities in Washington and Morgan's Park, Portland, Oreg., VIII-28 '32 (Joe Schuh), O.S.C.

This species is closely related to *pacificus* and *aldrichi*, but is unique in having a sharp spur on the anterior side of the hind coxae in both sexes, and in the male by the broad flange on the lower apical half of the surstyli.

Lasiopogon quadrivittata Jones

(Plate I, Figure 2)

Lasiopogon quadrivittatus Jones, Trans. Amer. Ent. Soc., v. 33, p. 278, 1907.*Lasiopogon quadrivittatus* Back, Trans. Amer. Ent. Soc., v. 35, p. 302-303, 1909.*Lasiopogon quadrivittata* Melander, Psyche, v. 30, p. 136, 1923.

"Near *L. arenicola* O. S. ♀. Length 9-11 mm. Black, covered everywhere with dense grayish pollen. Front broad, densely gray pollinose, hair everywhere whitish, that of occiput with a more decided yellowish tinge, beard and hair on occipital margin fine, silky and pure white. Face in profile with a strong gibbosity reaching more than half the distance from the oral margin to the base of the antennae. Antennae black, first two joints nearly equal, second a trifle longer than the first, third longer than the first two together, style about one-half as long as the third joint, first two joints of the antennae with whitish hair. Thorax black, covered with dense grayish pollen and very fine white pile, a few light colored bristles on the lateral margins and posterior part of the dorsum, four brownish nearly median stripes on the dorsum, diverging anteriorly, the pollen on the margins brownish, forming an obscure stripe. The interval between the inner stripes is wider than that between the others so that there appear to be two geminate stripes. Scutellum flat, covered with pollen similar to that of the thorax, and with a row of light colored bristles on the posterior margin. Pollen of the pleura gray, with a brownish tinge. Halteres yellowish, the fan-like row of hairs in front white. Abdomen black, covered with dense grayish pollen and very fine, short, decumbent whitish pile, anterior margins of the second, third and fourth segments reddish-brown, last segment shining black. Bristles on the posterior lateral margins of the first segment whitish. Legs black, covered with dense, fine, whitish pile, longer on the underside of the femora, and interspersed with a few light colored bristles. Coxae and legs with brownish-gray pollen, thicker on the coxae, coxae with long white pile. Wings hyaline, anal cell closed and petiolate, fourth posterior cell slightly narrowed at the margin of the wing, anterior cross-vein at the middle of the discal cell."

"Type.—One female from Halsey, Nebraska, June 1, 1906 (H. S. Smith).

"*Paratypes*.—One female from War Bonnet Canon, Sioux Co., Nebraska, May 27, 1901 (M. A. Carriker); and one female from Bad Lands, Mouth of Monroe Canon, Sioux Co., Nebraska, May 28, 1900 (L. Bruner).

"This species can be readily distinguished from *L. arenicola* O. S. in being more densely pollinose and not so densely pilose as that species. The thoracic stripes will also serve to separate them, and my specimens of *L. arenicola* from Southern California have a few black bristles on the lateral margins of the thorax which *quadrivittatus* does not have."

The above is a copy of the original description and remarks. Specimens the writers have identified as this species have been seen from the following localities:

ALBERTA: Calgary, V-20 '24, C.N.C.; Medicine Hat, V-8 '26 (F. S. Carr), C.N.C., and V-24 to VI-1 '33 (F. S. Carr).

MONTANA: Labeled "Montana, C. U.," O.S.M.

NORTH DAKOTA: Bismarck, VI-14 '18 (J. M. Aldrich), U.S.N.M.

Lasiopogon ripicola Melander

(Plate I, Figure 7)

Lasiopogon ripicola Melander, Psyche, v. 30, p. 143-144, 1923.

"*Male*.—Length 10 mm. Dull brownish-gray, heavily pollinose and rather densely pilose species, upper part of head alutaceous, with abundance of black hairs but no bristles, face whitish, the dense hairs nearly white with slightly yellowish tinge, with a few black hairs intermixed on upper portion, lower occiput heavily white pilose, antennal hairs black, third joint compressed cylindrical, slightly more than twice the length of the acuminate style. Dorsum of thorax brownish-gray, the dorsocentral vittae widely separated, dark brown and rather narrow, bearing about six very fine black setae of which three are presutural, humeri cinereous, lateral markings very distinct, three prealar bristles; scutellum dark cinereous, the apical fine bristles black and hairs white; pleura cinereous with faint yellow tinge, mesopleura with black hairs behind, sternopleura with fine white hairs, hypopleural fringe consisting of a few white and black bristle-like hairs. Abdomen not shining, the segments dark brown with apical two-fifths cinereous, the brown color intensified as two semicircular spots, the gray color extending forward triangularly between the brown markings,

pile conspicuous and whitish; long on sides of second and third segments, sides of first segment with a cluster of black bristles in addition to the pile; hypopygium larger than diameter of end of abdomen, black, subshining, mainly black-hairy, dorsal fringe transverse and black, declivous beneath fringe and not emarginate but with strong central broad projection, lateral valves spoon-shaped, the inferior margin entire, without tooth below but with slight basal umbo, venter uniformly gray pollinose and with an abundance of fine whitish hairs. Legs coated with gray pollen, front femora with two preapical extensor bristles, hind femora with a complete row of black bristles along upper anterior face, bristles of tibiae and tarsi black, hairs of legs abundant, fine and white, pulvilli alutaceous. Wings hyaline, veins black, anterior crossvein at two-fifths the length of the discal cell, halteres yellow, the base brown, calypteres and fringe yellow.

“Female.”—Facial hairs more yellowish, ovipositor black polished, short, carina usually black.

“Types.”—Wawawai, Washington, May 20, 1911 (Melander). Eighteen paratypes from same locality and from Wilbur, and Yakima (Jenne), Wash. Most of the specimens were taken in the month of April.”

The above is a copy of Melander's description. Large series are on hand from the following localities:

OREGON: The Dalles, V-2 '27 (H. A. Scullen).

WASHINGTON: Wawawai, IV; female paratype, Wawawai, VII-20, U.K.; Pasco, IV-23 '33 (Itol J. and J. Wilcox), about 200 specimens taken in about an hour on the banks of the Snake River; Pasco, IV-16 to 17 '34 (C. H. and D. Martin); and Cashmere, V-12 '35 (C. W. Getzendaner).

IDAHO: Lewiston, V-12 '01, IV-26 '12 along R. R. tracks (J. M. Aldrich), U.S.N.M.

Lasiopogon shermani, n. sp.

(Plate II, Figure 20)

Male: Length 8.5 mm. Head black; lower cheeks, palpi, and proboscis shining; face densely golden-gray pollinose; front and upper occiput densely golden-brown pollinose; lower two-thirds of occiput gray pollinose. Mystax black, hairs on oral margin white or with white tips; hairs of front, of ocellar

tubercle, and of upper occiput, black, rather long, about 5 long curved hairs on upper occiput; beard and sparse hairs of palpi and proboscis white. Antennae black, gray pollinose, basal fifth of third joint yellowish red; first and second joints subequal in length, fine white haired below, on sides and above stouter black; third $1\frac{1}{3}$ times length of the first two together; style nearly two-thirds length of third joint.

Thorax brownish black with the following pattern: Humeri golden gray pollinose; central stripes, outer half of intermediate area, and dorsocentral stripes brown, dorsocentrals darker and more shining; narrow median bisecting line, outer sides of central stripes, and lateral stripes extending in back of humeri and shortening intermediate area, golden brown pollinose; inner half of intermediate area gray pollinose, extending into dorsocentrals and into outer intermediate area at transverse suture. Short hairs of humeri white; numerous short hairs anteriorly on notum black; bristles black, 2 or 3 anterior and 3 strong posterior dorsocentral, 1 posthumeral, 2 presutural, 2 supra-alar, and 3 postalar. Scutellum dark brown, disk slightly concave, densely golden-gray pollinose, posterior margin more golden, subshining; 2 pairs of strong black bristles on posterior margin and a number of black hairs. Pleura and coxae densely golden and gray pollinose, upper half golden; hairs white, about 5 long black ones on mesopleura; 6 hypopleural bristles, 3 black and 3 white on one side, 4 black and 2 white on the other.

Abdomen dark brown, shining, with narrow posterior margins yellowish red, sides and posterior half of each segment gray pollinose except first, which is wholly so. Hairs all yellowish white, longer on lateral margins of all segments and on sides of first three, some of the short hairs on sides of last three segments black; 2 or 3 black bristles on sides of first segment. Venter gray pollinose, sides and margins yellowish red, hairs yellowish white. Hypandrium transverse, reddish yellow, gray pollinose on sides, disk shining; hairs and fringe black. Surstyli reddish yellow, gray pollinose; in side view slender, more than twice as long as wide; apically evenly rounded above and below, angle before apex on dorsum obtuse; ventrally but slightly curved from base to apex, narrow ventral margin black; no basal umbo; hairs long and numerous, black.

Legs gray pollinose, black except narrow base and apex of femora, basal three-fourths of tibiae, and basal half and nar-

row apex of tarsi, which are reddish yellow; claws brown with black tips; pulvilli brown; empodium black, about three-fourths length of claws. Fine hairs on femora, most of those on fore and middle tibiae, and a few on hind tibiae white; usual golden pile on anterior side of fore tibiae; otherwise hairs and bristles black.

Base and lower stem of halteres brown, upper stem and lower part of knob light brown, remainder of knob white. Wings hyaline; veins dark brown; anterior crossvein at two-fifths distance from base to apex of discal cell; fourth posterior cell slightly narrowed.

Female: Length 11 mm. Similar to male. Style of antennae about two-thirds length of third joint, first joint slightly longer than second; hairs below on first and most of those below on second white; basal fifth of third yellowish. Thorax lighter in color all over, making central and dorsocentral stripes more prominent; humeri, median bisecting stripe, and inner half of intermediate area gray pollinose. Bristles as in male except hypopleurals, 4 strong black ones and 2 or 3 weaker white ones on each side. Abdomen somewhat greased but apparently marked as in male; long hairs on sides and lateral margins of first three segments and shorter hairs on lateral margins of remainder white, shorter appressed hairs on dorsum black; 5 black bristles on each side of first segment; venter entirely with short white hairs. Ovipositor shining, short yellow pilose with the usual apical black spines; eighth tergite brown with posterior and lateral margins reddish; eighth sternite reddish brown; ninth sternite dark brown, nearly black. Legs as in male except that most of the hairs on the hind tibiae are white. Halteres darker; upper stem and knob yellowish red. Fourth posterior cell of wings more broadly open.

Holotype, male, and *allotype*, female, on the same pin; Longcreek, S. C., III-26 '32 (O. L. Cartwright); in the Clemson Agricultural College.

Paratypes: 1 male, Little River Salem, IV-21 '29 (O. L. Cartwright), C.A.C.; 1 male, Raleigh, N. C., IV-20 '32 (C. S. Brimley), N.C.D.A.

Named in honor of Prof. Franklin Sherman, who kindly allowed us to study the Clemson Agricultural College material.

The specimen from North Carolina has all the hairs below on the first two antennal joints black, only the basal half of the tibiae red-

dish, only the narrow bases and apices of the tarsi reddish, and the fourth posterior cell of the wings quite narrowed.

The reddish legs separate it from the other eastern species.

Lasiopogon slossonae, n. sp.

(Plate II, Figure 19)

Male: Length 10 mm. Head black; lower cheeks, palpi, and proboscis shining; face densely grayish-golden pollinose; front, vertex, and upper occiput densely golden-brown pollinose; lower occiput gray pollinose. Mystax black, a few hairs on sides below golden brown; front, vertex, ocellar tubercle, and upper occiput with long black hairs, a pair of longer black hairs on ocellar tubercle; beard and sparse hairs of palpi and proboscis grayish white. Antennae black; apex of second joint and immediate base of third on inner side reddish; first and second joints subequal in length, both black haired; third about $1\frac{1}{2}$ times length of first two together; style four-fifths length of third.

Thorax brown, densely golden-brown pollinose with touches of gray; dorsocentral stripes, central stripes, and most of intermediate area brown, subshining; median bisecting stripe, lateral stripes, and dorsocentral stripes in some lights golden brown; humeri, anterior sides of median stripe and inner fourth of intermediate area grayish-golden pollinose. Hairs of humeri yellowish; sparse hairs on anterior part of notum black; bristles black, 1 strong and 1 weak anterior and 3 posterior dorsocentral, 1 or 2 rather weak posthumeral, 3 presutural, 2 supralar, and 2 postalar. Scutellum densely gray pollinose, 6 strong black marginal bristles and a number of shorter black hairs. Coxae and lower pleura gray pollinose, upper pleura golden pollinose, mesopleura golden-brown pollinose; hairs white, about 5 black ones on mesopleura, 3 brown and 3 yellowish hypopleural on each side.

Abdomen shining dark brown; posterior margins narrowly yellowish; posterior fourth and sides of all segments gray pollinose, except first, which is largely so; some thin golden pollen on dorsum and sides of all segments, and segments 6 and 7 mostly this color obscuring the gray. Hairs on lateral margins of segments 1 to 4 and on sides of 1 to 3 white; remainder short, black haired; about 6 long yellowish white bristles on sides of first segment. Venter uniformly grayish golden pollinose, margins yellowish red, long white haired. Hypandrium transverse, rather

wide longitudinally; central portion shining reddish brown, dorsum thinly and sides densely grayish-golden pollinose; dense hairs and sparse posterior fringe black. Surstyli densely grayish-golden pollinose and densely long black haired; in side view about three times as long as wide, apical fourth bent down; apical margin slightly emarginate, upper angle obtuse; ventrally the margin sharply curves mesad near the apex, from which it slightly curves to the base, no basal umbo.

Legs black, thinly gray pollinose; claws reddish with black tips; empodium black, three-fourths length of claws; pulvilli brown. Hairs on underside and above at base of femora white; on anterior side of fore tibiae golden; otherwise black; bristles black.

Stem and knob of halteres yellowish white, the base brown. Wings evenly infumated with reddish, lighter posteriorly; veins dark brown; anterior crossvein at three-sevenths distance from base to apex of discal cell; fourth posterior cell nearly closed.

Female: Length 10 mm. Face dull golden pollinose; mystax entirely black. Style of the antennae nearly as long as third joint. No posthumeral and 2 presutural bristles. Hypopleurals entirely yellowish white except a blackish one on one side. Lateral bristles on first abdominal segment entirely yellowish white. White hairs on abdomen confined to sides and lateral margins of first three segments, otherwise short black. Venter of seventh segment partly black haired, remainder yellowish-white haired. Ovipositor shining black, exceptionally broad in lateral view, somewhat narrowed apically; short black haired, those below black apical spines yellowish. Stem of halteres light brown, knob yellow. Anterior cross vein at one-third distance from base to apex of discal cell; fourth posterior cell nearly closed in one wing, narrowly open in the other.

Holotype: Male, Franconia, N. H. (Mrs. A. T. Slosson), Ac. 26226; in the American Museum of Natural History.

Allotype: Female, same data; in the American Museum of Natural History.

Paratypes: 4 specimens (2 on one pin), same data, A.M.N.H.; 2 males, 2 females, Bretton Woods, N. H., VI-26 and 28 '13 (C. W. Johnson), B.S.N.H.; 3 specimens, Clementon, N. J., V-9 '97 (C. W. Johnson) and Bretton Woods, N. H., VI-28 '13 (C. W. Johnson), M.C.Z.; 1 male, Glencarlyn, Va., V-21 '17 (C. T. Greene), U.S.N.M.

This species was received labeled both as *opaculus* and *tetragram-*

mus. The male is unique in having the surstyli extremely long and noticeably bent down apically.

Lasiopogon testaceus, n. sp.

(Plate II, Figure 13)

Male: Length 8 mm. Head black; lower cheeks, palpi and proboscis shining; face, front and upper occiput densely dull-golden pollinose; lower occiput grayish-golden pollinose. Mys tax black, a few yellowish-white hairs on oral margin; hairs of front, ocellar tubercle, vertex, and upper occiput black; beard and hairs of palpi and proboscis white. Antennae black; first joint shining, second and third golden pollinose; first two subequal in length, black haired; third $1\frac{1}{2}$ times length of first two together, with 2 or 3 short black hairs on upper side near apex; style about one-third length of third joint.

Thorax and scutellum densely brassy-golden pollinose; dorsocentral stripes faintly brownish. Hairs of humeri yellowish, otherwise sparse hairs black; bristles black, 3 anterior and 3 posterior dorsocentral, 1 or 2 posthumeral, 2 presutural, 2 supra-alar, and 2 postalar. Scutellum with about 9 black bristles and a few black hairs on posterior margin. Pleura and middle and posterior coxae colored like the mesonotum, anterior coxae gray pollinose; hairs white, 4 black ones posteriorly on mesopleura; 6 strong black hypopleural bristles on each side plus 1 or 2 weaker ones.

Abdomen brown; first segment entirely and remaining segments with the sides and posterior two-fifths dull-golden pollinose; anteriorly thinly brownish pollinose, subshining. Hairs on sides and lateral margins whitish, longer on first three segments; on dorsum short, recumbent, black; 3 black bristles on each side of first segment. Venter uniformly pollinose and whitish pilose. Hypopygium entirely bright orange red, narrow ventral and apical margins black; entirely short black pilose; hypandrium bulging, posterior margin V-shaped, sparse posterior fringe black. Surstyli in side view about twice as long as wide, upper apical angle obtuse, lower angle evenly rounded; ventral margin evenly curved from base to apex except for a shallow emargination at two-thirds distance from base to apex; small basal umbo.

Femora except extreme base and apex black, remainder of legs, including trochanters, reddish; claws reddish with black tips; pulvilli light brown. Hairs and bristles black, hairs below on femora and short pile on anterior side of fore tibiae yellowish.

Base of halteres brown, remainder whitish except for a touch of brown at base of knob on dorsum. Wings uniformly tinged with red, basal and anal cells and anal angle white; veins brown, anterior cross vein at two-fifths distance from base to apex of discal cell; fourth posterior cell quite open.

Female: Length 9 mm. Similar to male. A faint narrow median brown bisecting stripe on mesonotum. White hairs of abdomen confined to sides of first two segments and on lateral margins to about middle of third segment, otherwise short, black; 5 black bristles on each side of first segment; narrow posterior margins of segments yellowish (these obscured by pollen in male); hairs on venter of segments 1 to 5, whitish, on segments 6 to 7 mostly black. Ovipositor reddish orange, except outer third and lateral margins of eighth tergite, which are black, and ninth sternite, which is somewhat brownish; short sparse hairs white; apical spines brown. Wings uniformly reddish brown.

Holotype: Male, Angora Park, Tahoe, Calif., VII-8 (E. P. Van Duzee); in the California Academy of Sciences.

Allotype: Female, Fallen Leaf Lake, Lake Tahoe, Calif., VII '15 (L. S. Rosenbaum); in the California Academy of Sciences.

Paratypes: 1 male, 1 female, same data as allotype, O.S.M.; 1 female, same data as allotype, C.A.S.; and 1 male, Pinecrest, Tuolumne County, Calif., V-23 '31 (A. C. Browne).

This species is quite close to *fumipennis* Melander and *currani*, new species, differing from both by the halteres being whitish without the dorsum of the knob being black; by the male genitalia being a brighter orange red and the basal two-thirds of the eighth tergite of the ovipositor the same color; and by the tibiae and tarsi being also more reddish than in the above species.

Lasiopogon tetragrammus Loew

(Plate II, Figure 21)

Lasiopogon tetragrammus Loew, Berlin Ent. Ztsch., v. 18, p. 368, 370, 1874.

Lasiopogon tetragrammus Back, Trans. Amer. Ent. Soc., v. 35, p. 301-302, 1909.

Lasiopogon tetragrammus Melander, Psyche, v. 30, p. 137, 1923.

"♀.—Length about 9 mm.—Translation. Black; the usual thoracic stripes fuscous, the intermediate one narrowly bisected,

the lateral ones much abbreviated anteriorly, and the lateral ones of the same color; the space between the lateral and intermediate stripes and the last segment of the abdomen polished black, the latter white pilose, the rest of the body black pilose; the several segments of the abdomen grayish pruinose on the posterior margin. Length of body 4-7-12 lin., of wing 4 lin.

"Not greatly unlike *L. bellardi* Jaen., but the bloom of the head and thorax, with the exception of the more yellow of the face, yellowish-brown or almost deep brownish. The bisected middle thoracic stripe blackish-brown, sharply defined, the lateral stripes greatly abbreviated anteriorly, of the same color, but less sharply defined; between the middle and lateral stripes on each side is inserted a blackish-brown stripe, the fore part of which is bent outward and extends as far as the grayish pruinose humeri. Abdomen black, only moderately polished; the first segment everywhere, and the six following ones only on the sides and hind border, grayish pruinose; the last segment wholly without bloom and highly polished. Halteres yellowish. Wings grayish, the venation normal, veins brownish-black; the small cross-vein lies considerably before the middle of the discal cell. The arrangement of the hair and bristles is as usual in this genus. *Mystax*, hair on the first two antennal segments, the front and upper part of the occiput black; the hair on the larger lower part of the occiput and on the under side of the proboscis white; that on the lateral oral margins yellowish-white. The prothorax only on the sides with more whitish, above with more black hair; dorsum of mesothorax and scutellum with black pile and bristles; the scant pile on the pleura whitish in front of the mesopleural suture, the fine hairs and the trichostical hair black. The first abdominal segment whitish pilose, on the posterior lateral margins with black bristles; the pile on the whole lateral margin of the second segment and on the outermost lateral edge of the third segment is white; the pile of the rest of the second and third and of the following four segments is wholly black; that of the last segment whitish; on each segment, beginning with the second, there is a transverse row of perhaps four conspicuous black bristles. The prevailing black and sharply-defined white hair of the legs is arranged as usual; all the bristles are black.

"*Type*.—M.C.Z. A single female type specimen from Canada (Provancher).

"*Habitat*.—Canada; White Mts., N. H.

"Osten Sacken has named a male and a female *Lasiopogon* from the White Mountains *opaculus* with a question mark. They are not *opaculus*. I believe they are *tetragrammus*. They agree with the type of the latter in size, general coloration of abdomen, but the genitalia are rather large, grayish-brown pruinose, with black pile."

The above is a copy of the description given by Back. The male is described below.

Male: Length 9 mm. Head black; face densely golden-brown pollinose; front and vertex dull brown pollinose, with some golden along orbits; upper occiput golden gray pollinose; lower occiput gray pollinose. Lower hairs of mystax yellowish white, upper hairs black, mostly with yellowish-white tips; hairs of front, vertex, ocellar tubercle and upper occiput black, some on inner occiput stout curved; beard and sparse hairs of palpi and proboscis white. Antennae black, the first joint shining, otherwise golden-brown pollinose; joints 1 and 2 black haired; third $1\frac{1}{2}$ times length of first two together; style one-half length of third joint.

Thorax black, densely pollinose; central and dorsocentral stripes and outer two-thirds of intermediate area brown, subshining; humeri, area behind humeri, lateral stripes, and area between central and dorsocentral stripes on anterior half golden gray pollinose; inner third of intermediate area and somewhat broadening at transverse suture, and broad central bisecting stripe, gray pollinose. Hairs short, black; bristles black, 3 anterior and 3 posterior dorsocentral, 1 posthumeral, 2 or 3 presutural, 2 supra-alar, and 2 or 3 postalar. Scutellum densely golden-gray pollinose, transversely impressed in middle, 2 strong and 6 weak black marginal bristles and a number of short black hairs on margin and a few as far back as impression. Pleura and coxae densely golden-gray pollinose and yellowish-white pilose, 2 to 4 black hairs posteriorly on the mesopleura, 6 or 7 black hypopleural bristles.

Abdomen broad, shining brown, narrow posterior margins yellowish, and sides and posterior fourth of segments gray pollinose, excepting first, which is largely so. Hairs yellowish white, longer on lateral margins and on sides of first three segments, remaining very short appressed; 5 black bristles on sides of first segment. Venter golden-gray pollinose and yellowish-white pilose, some short brownish hairs on apical margin of sev-

enth sternite. Hypandrium transverse, shining reddish brown; sides gray pollinose; hairs and fringe black. Surstyli brownish black with some red at base on sides, densely gray pollinose and black pilose; in side view about twice as long as wide, truncate apically, lower angle rounded, upper angle rectangular; ventrally deeply curved; no basal umbo.

Legs black, gray pollinose; apices of tarsi appearing reddish; claws reddish brown with black tips; empodium black; pulvilli brown. Hairs on femora and anterior side of fore tibiae yellowish white; otherwise black; bristles black.

Base and lower stem of halteres brown, upper stem and knob yellowish white. Wings lightly tinged with brown; veins brown; anterior crossvein at one-third distance from base to apex of discal cell; fourth posterior cell slightly narrowed.

Described from a male with the following data, Peru, N. Y., VI-8 and 10 '16 (C. R. Crosby and W. T. M. Forbes), C.U.

Specimens have been seen from the following localities:

NEW YORK: Peru (see data above); Blackbrook, Clinton County, VI-21 '15, C.U.

CONNECTICUT: Avon Old Farms, Avon, VI-25 '29 (C. H. Curran), A.M.N.H.; Poquonock, V-22 '06 (B. H. Walden), B.S.N.H.

MASSACHUSETTS: Sunderland, V-29 '23 (C. W. Johnson), B.S.N.H.

NEW HAMPSHIRE: Intervale, VI-16 '06 (G. M. Allen), B.S.N.H.
QUEBEC: Lanoirae, V-24 '33 (Chagnon), C.H.M.

This species was at first thought to be new, as none of the specimens seen had the bristles on the second and following abdominal segments as given in Back's description. Richard Dow and Nathan Banks have kindly examined the type and report that there are no such bristles on the abdomen. The specimens from New Hampshire mentioned by Back are probably *slossonae*, new species.

Lasiopogon trivittatus Melander

Lasiopogon trivittatus Melander, Psyche, v. 30, p. 144-145, 1923.

"Female.—Length 7 mm. Entirely black in ground color, the halteres and calypteres pale fuscous, the carina of the ovipositor castaneous, upper part of head yellowish-gray, bristles and hairs black, face whitish, its hairs nearly white with slightly yellowish tinge, lower pile of occiput fine and white. Thorax thickly coated with cinereous pollen, the dorsocentral stripes

full brown, a median stripe of similar brown color and supraalar indications of lighter brown; bristles prominent and black, a strong presutural dorsocentral present, scattered black setulae on anterior portion of mesonotum; scutellum densely cinereous, bare except for black marginal bristles and setula; pleura heavily coated with cinereous, almost pruinose, a slight tinge of yellowish developed beneath root of wing. Abdomen scarcely at all shining, first segment wholly cinereous, second to seventh segments fulvous over greater portion, the posterior margins narrowly cinereous, the gray color extending forward at the sides merge into the fulvous, no long pile, hairs appressed, whitish, becoming black on posterior segments, ovipositor slightly longer than seventh segment, polished, blunt, but little tapering; venter heavily cinereous pollinose. Legs densely coated with gray pollen, femora with a few whitish long bristle-like hairs beneath, no coating of pile but the short hair of femora and under side of tibiae white, hairs of remainder of tibiae and of tarsi and bristles black, pulvilli brownish. Wings nearly hyaline, veins blackish, anterior crossvein slightly before middle of discal cell.

"*Holotype*.—Gold Creek, Montana, July 29, 1918 (Melander)." The writers have not seen this species.

Lasiopogon willametti, n. sp.

(Plate III, Figure 32)

Male: Length 10 mm. Face densely, front and upper occiput thinly, golden pollinose; lower occiput gray pollinose. Mystax black, a few of lower hairs white or black with white tips; hairs on front and upper occiput black; beard and hairs on palpi and proboscis gray. Antennae black, thinly pollinose; first two joints black haired; third joint $1\frac{1}{2}$ times length of first two together; style slightly more than half length of third.

Thorax shining brown, densely golden-brown pollinose, especially dense on central portion and on lateral margins; dorsocentral stripes shining brown, only apparent for their full length by rotating the specimen; central stripe bisected but rather vaguely indicated owing to layer of pollen; intermediate area shining brown, thinly pollinose, not nearly so evident as dorsocentral stripes. Hairs black; bristles black, 3 strong and 4 rather weak anterior and 4 posterior dorsocentral, 1 posthumeral, 2 or 3 presutural, 2 supra-alar, and 3 postalar. Scu-

tellum densely golden pollinose, numerous black slender bristles on posterior margin. Pleura and coxae densely golden pollinose, merging somewhat with gray below; hairs white, a cluster of short stout black hairs posteriorly on mesopleura, 6 or 7 black hypopleural bristles.

Abdomen shining dark brown, narrow posterior margins white; first segment entirely, and sides, posterior margins, and median part of remaining segments grayish-yellow pollinose, so that these segments are marked with two anterior semicircular shining spots. Long hairs on sides of all segments white, on dorsum short, appressed, black; 7 black bristles on sides of first segment. Venter densely grayish-yellow pollinose with long white hairs. Hypandrium transverse, shining black dorsally, golden pollinose on sides, numerous short hairs black, fringe black with a tendency toward golden. Surstyli densely golden pollinose and black haired, in side view about twice as long as wide, apically evenly rounded below and shallowly emarginate above; ventral margins but slightly curved; no basal umbo.

Legs entirely black; claws black basally and apically, reddish in middle. Many short appressed hairs on sides and dorsum of femora, and longer hairs below on femora and tibiae, yellowish white; otherwise hairs of tibiae and tarsi black; bristles black.

Base and stem of halteres brown, knob light yellowish brown. Wings hyaline, veins dark brown, anterior cross vein at one-third distance from base to apex of discal cell.

Female: Length 12 mm. Central bisected stripes of mesonotum more prominent. White hairs on abdomen confined to first three segments and to anterior lateral angles of segments 4 or 5, otherwise short and black. Ovipositor shining black, short white pilose; apical spines black. Knob of halteres reddish brown but lighter than base and stem. Fourth posterior cell of wings slightly narrowed.

Holotype: Male, Kiger's Island, Benton County, Oreg., IV-19 '30 (J. Wilcox); deposited in the California Academy of Sciences.

Allotype: Female, same data, IV-8 '30; deposited in the California Academy of Sciences.

Paratypes: More than 200 specimens, representing both sexes, from the following localities: OREGON: type locality, April and May (R. E. Dimick and Wilcox); Albany and Crabtree, V-15 '31 (Wilcox); Lebanon, V-27 '31 (Wilcox); Corvallis, V- '31 (Dimick and Wilcox); Wheatland, V-10 '31 (Wilcox); WASHINGTON: Sumner,

IV-27 to VI-17 (R. Latta, C. H. Martin and Wilcox); Roy, IV-19 to 29 '32 (Martin and Latta); Auburn, V-10 '32 (Wilcox); Enumclaw, V-12 '32 (Wilcox); Buckley, VI-14 '32 (Wilcox); Mt. Rainier, Ipsut Creek Camp, VI-26 '32 (Wm. W. Baker) and VII-23 '35 (S. E. Crumb, Jr., and Wilcox); Forks, Clallam County, VII-2 '20 (E. P. Van Duzee), C.A.S.; BRITISH COLUMBIA: Agassizi, V-18 '27 (H. H. Ross), C.N.C.

This species is collected early in the spring on the banks of the Willamette and Santiam Rivers in Oregon and on the banks of the Puyallup and White Rivers in Washington, usually taken on the dry sands.

Some of the specimens taken in Washington are designated as variety *puyallupi*; they have only the sides and posterior half of the abdominal segments pollinose, the basal half shining; and the pollen all over tends to be gray rather than golden.

See note under *dimicki*, new species.

Lasiopogon yukonensis, n. sp.

(Plate III, Figure 28)

Male: Length 11 mm. Head black; lower cheeks and proboscis shining; face and occiput light but evenly gray pollinose; front dull black (greased?). *Mystax* and numerous hairs on front, vertex, ocellar tubercle, and upper occiput black; beard and hairs of proboscis white. Antennae black, third joint thinly pollinose; first two black haired, subequal in length; third about twice length of first two together, widest at middle, with a short black hair on upper side near middle; style broad, about half length of third joint, acute at tip.

Thorax black, thinly gray pollinose, narrow median bisecting line and dorsocentral and lateral stripes brown; intermediate area more shining. Numerous hairs black; bristles black, about 4 anterior and 4 posterior dorsocentral, 1 posthumeral, 3 or 4 presutural, 4 or 5 supra-alar, and 2 or 3 postalar. Scutellum black, shining, grayish-golden pollinose, with numerous black bristles and hairs on posterior margin. Pleura and coxae black, subshining, thinly gray pollinose, hairs white, a few black ones posteriorly on mesopleura; hypopleurals mostly black, 9 black on one side, 6 black and 2 pale weaker ones on the other.

Abdomen black; narrow posterior margins yellowish; apical half of first and apical fourth of remaining segments gray pollinose, this pollen apparently not extending along lateral margins anteriorly. Hairs entirely golden white, longer on sides and

lateral margins, shorter and recumbent dorsally; 6 black bristles on sides of first segment. Venter thinly gray pollinose and yellowish-white pilose. Hypopygium shining black with thick, short, black hairs; hypandrium bulging, posterior margin V-shaped, fringe black; surstyli about $1\frac{1}{2}$ times as long as wide, wider apically than at base, upper apical angle produced into a short cone-shaped projection, apical margin slightly concave, lower angle evenly rounded, slightly flanged; ventrally but slightly curved from base to apex, with a small basal umbo.

Legs shining black; claws black, reddish brown at base; pulvilli light brown. Hairs on femora and on anterior side of fore tibiae yellowish white, otherwise black; bristles black.

Base and lower stem of halteres brown, knob and upper stem dull yellow. Wings nearly hyaline, faintly brownish all over; veins dark brown; anterior crossvein at one-third distance from base to apex of discal cell; fourth posterior cell somewhat narrowed.

Holotype: Male, Whitehorse, Yukon Territory, Canada, Fish Lake Bench, VI-16 '23 (J. A. Kusche); in the California Academy of Sciences.

A unique specimen and, although not perfect for description, differing from all other species by having the upper apical angle of the surstyli produced into a conelike projection or tubercle.

Lasiopogon zonatus, n. sp.

(Plate I, Figure 11)

Male: Length 8 mm. Cheeks, palpi, and proboscis shining black; face and lower occiput gray pollinose; front, vertex, and upper occiput yellowish-gray pollinose. Mystax, hairs, and bristles on front, on ocellar tubercle, on vertex, and on upper occiput black; beard and hairs of palpi and proboscis white. Antennae black, thinly gray pollinose; first joint with white hairs below, above and second joint black haired; third joint but slightly longer than first two joints together; style two-thirds length of third.

Thorax brown, subshining; central stripes, dorsocentral stripes, and intermediate area of this color; remainder yellowish-gray pollinose; humeri, transverse suture, and lateral stripes behind suture gray pollinose. Hairs on humeri mostly white; the 3 or 4 longer hairs on humeri and those on notum black; bristles black, 3 or 4 anterior and 4 posterior dorso-

central, 1 posthumeral, 3 presutural, 2 supra-alar, and 2 to 4 postalar. Scutellum yellowish-gray pollinose, with about 18 rather weak black marginal bristles. Pleura and coxae yellowish-gray pollinose, white haired, a row of black ones posteriorly on mesopleura, and 8 black hypopleural bristles.

Abdomen mostly shining dark brown; sides and posterior fourth of segments gray pollinose with a yellowish tinge at some angles. Hairs on sides and lateral margins of first three segments and lateral margins of remaining segments white; remainder short black haired; 5 or 6 black bristles on sides of first segment. Venter yellowish-gray pollinose and with rather long white hairs. Hypandrium somewhat bulging, dorsum shining black, thinly and sides densely yellowish-gray pollinose, hairs and posterior fringe black. Surstyli densely yellowish-gray pollinose and black haired; in side view about twice as long as wide, evenly rounded below apically, upper angle rectangular slightly rounded; ventrally the margin nearly straight from base to apex, the intervening area narrowly V-shaped.

Legs black, densely yellowish-gray pollinose; tarsi a dirty yellowish red at bases and apices, claws reddish with black tips; pulvilli light brown; empodium black. Hairs below and near base and shorter ones dorsally on femora white; anterior side of fore tibia short yellowish pilose, otherwise the hairs black; bristles black.

Knob of halteres yellowish white; stem and base brown. Wings with a uniform grayish tinge; veins dark brown; anterior crossvein at one-third distance from base to apex of discal cell; fourth posterior cell quite open.

Female: Length 9 mm. Ovipositor shining brown dorsally and at base of eighth sternite, remainder of eighth and the ninth sternite lighter reddish brown; short sparse hairs white; apical spines black. Most of hairs below on femora and tibiae white.

Holotype: Male, Santa Ana Canyon, Orange County, Calif., IV-'33 (M. W. Stone); deposited in the California Academy of Sciences.

Allotype: Female, same data, IV-1 '33 (K. Sloop, and M. W. Stone); deposited in the California Academy of Sciences.

Paratypes: About 50 specimens, representing both sexes, from the type locality, same data as types and III-11 to 21 '34 (M. W. Stone); Whittier, Calif., III-31 '32 (C. H. Martin); Artesia, Calif., III-27 '34 (M. W. Stone); and Los Angeles County, Calif. (Coquillett), U.S.N.M.

This species is very similar to *californicus* and may be the southern form of that species. The zonate appearance of the abdomen; the more numerous and longer hairs on the legs; and, in the females, the absence of black hairs on the lateral margins of the last three abdominal segments and on the venter of the last segment, and the reddish ninth sternite, serve to separate it from *californicus*.

Alexiopogon Curran

Alexiopogon Curran, North Amer. Dipt., p. 183, 1934.

"Distinguished from *Lasiopogon* Loew by the absence of dorsocentral bristles. The figures of *Lasiopogon* will also serve for this genus. Genotype:—*Lasiopogon terricola* Johnson."

Genotype: *Daulopogon terricola* Johnson.

Additional characters for separating the two genera are given in the key on page 6. Only the type species, *terricola* Johnson, can be included according to the writers' understanding of the genus.

Alexiopogon terricola (Johnson)

(Plate II, Figure 14)

Daulopogon terricola Johnson, Ent. News, v. 11, p. 326, 1900.

Lasiopogon terricola Back, Trans. Amer. Ent. Soc., v. 35, pp. 300–301, 1909.

Lasiopogon terricola Melander, Psyche, v. 30, p. 136. 1923.

"♂ ♀.—Length 5–7 mm.—Black, head and thorax grayish-brown pruinose; the abdomen polished black, the posterior margins and corners of all the segments except the first, and the legs more or less reddish-brown; the posterior lateral margins of the abdominal segments grayish pruinose.

"Head grayish pruinose; the front, except narrowly along the orbits, and the upper portion of the occiput brownish; the antennae and proboscis black; the mystax, fine pile on lower half of occiput and the proboscis beneath white; the bristly hair of the basal segments of the antennae, frontal orbits, ocellar tubercle and upper occiput black. Thoracic dorsum yellowish-brown pruinose, the humeri and scutellum more grayish; pleurae grayish pruinose, more brownish on the mesopleurae. On either side of the middle of the dorsum is a rather indistinct line of a much browner bloom. The short hair and bristles of the dorsum and the trichostical bristles blackish; a patch of pile on the lower part of the prothorax and on the coxae white. Abdomen polished black, thinly white pilose and finely

punctate; segments from the second on, with their posterior borders and posterior angles, brownish, but this color on the latter is more or less obscured by a grayish bloom; side of the first segment and the venter grayish pruinose. Genitalia of male brownish, with whitish pile; spines of the female ovipositor black. Legs brownish; the coxae, front, and usually the middle femora, except at tip and base, and the terminal segments of the tarsi blackish; the coxae and femora more or less obscured by a whitish bloom; pile of coxae and legs short, fine, white, the under side of all femora with longer pile; all the bristles of the legs black. Wings grayish hyaline; the veins dark brown, sometimes slightly bordered with fuscous; the anal cell closed on the margin, all the posterior and submarginal cells open. Halteres whitish-yellow.

"*Type*.—Collection of Prof. C. W. Johnson, Curator of the Boston Society of Natural History. There are two metatypes in the collection of the Massachusetts Agricultural College.

"*Habitat*.—Chicopee, Mass. (May 18–24, F. Knab); Ocean County (J. B. Smith), Clementon (May 9, 30), Wenonah (May 14) and Riverton (May 29), N. J.

"Prof. C. W. Johnson, who is responsible for the last three references, states that this is a quite common species during the spring on the low damp ground of southern New Jersey, where he has taken it in good numbers."

The above is copied from Back. Specimens have been seen from the following localities:

ALBERTA: Medicine Hat, V-24 '33 (F. S. Carr).

INDIANA: Bare sand, Lafayette, V-2-27 '16, U.S.N.M.

MARYLAND: Plummer's Island, IV-28, V-10 '16 (J. M. Aldrich and W. L. McAtee); Beltsville, V-2 '15 (W. L. McAtee), U.S.N.M.

MASSACHUSETTS: Amherst, V-13 '23, S.W.B.

NEW JERSEY: Clementon, V-12, U.K. and V-9 '97, R.H.P.; Lahaway, Ocean County, O.S.M.; Riverton, V-4 (C. W. Johnson), S.W.B. and R.H.P.

NORTH DAKOTA: Mott (C. N. Ainslee), C.N.C.

OHIO: Pine Creek, Hocking County, sand bar, VI-17 '31 (E. S. Thomas), O.S.M.

VIRGINIA: Great Falls, IV-30 and V-19 (N. Banks).

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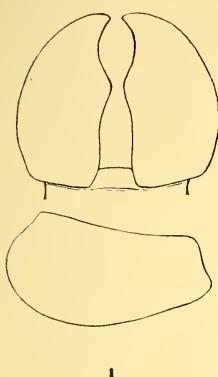
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- Belonging to the Subfamilies Leptogastrinae and Dasy-pogoninae. *Trans. Amer. Ent. Soc.*, v. 35, p. 137-396, 1909.
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 5. ———. Notes on the Dipterous Family Asilidae, with Descriptions of New Species. *Pan-Pacific Ent.*, v. 1, p. 7-13, 1924.
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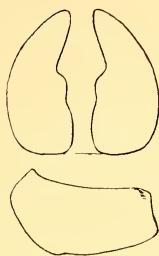
PLATE I

Note: In the following figures of the male genitalia (figs. 1-35, Pls. I-III), the upper figure in each case is a ventral view of the surstyli with the apex toward the top of the page, and the lower figure is a lateral view of the surstyli with the apex toward the left-hand side of the page.

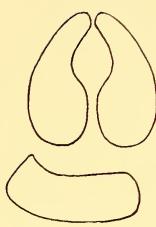
- Fig. 1.—*Lasiopogon aridus*, new species.
- Fig. 2.—*Lasiopogon quadrihvittatus* Jones.
- Fig. 3.—*Lasiopogon arenicola* (Osten Sacken).
- Fig. 4.—*Lasiopogon actius* Melander.
- Fig. 5.—*Lasiopogon littoris* Cole.
- Fig. 6.—*Lasiopogon albidus*, new species.
- Fig. 7.—*Lasiopogon ripicola* Melander.
- Fig. 8.—*Lasiopogon drabicola* Cole.
- Fig. 9.—*Lasiopogon chaetosus*, new species.
- Fig. 10.—*Lasiopogon delicatulus* Melander.
- Fig. 11.—*Lasiopogon zonatus*, new species.
- Fig. 12.—*Lasiopogon oklahomensis*, new species.



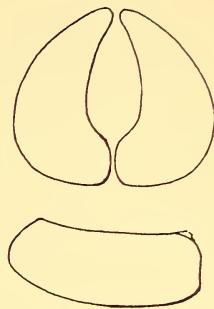
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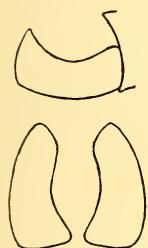
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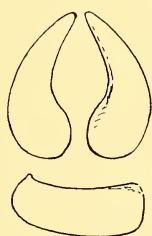
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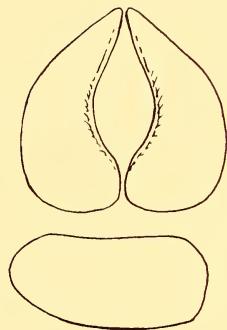
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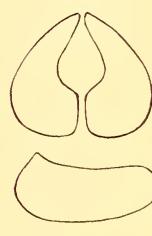
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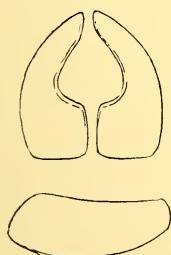
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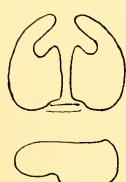
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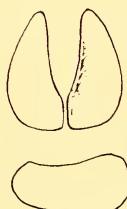
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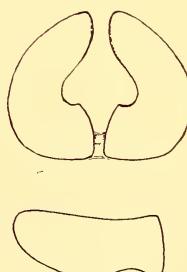
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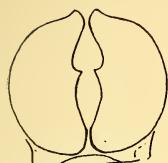
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PLATE II

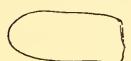
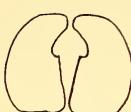
- Fig. 13.—*Lasiopogon testaceus*, new species.
- Fig. 14.—*Alexiopogon terricola* (Johnson).
- Fig. 15.—*Lasiopogon currani*, new species.
- Fig. 16.—*Lasiopogon fumipennis* Melander.
- Fig. 17.—*Lasiopogon opaculus* Loew.
- Fig. 18.—*Lasiopogon carolinensis*, new species.
- Fig. 19.—*Lasiopogon slossonae*, new species.
- Fig. 20.—*Lasiopogon shermani*, new species.
- Fig. 21.—*Lasiopogon tetragrammus* Loew.
- Fig. 22.—*Lasiopogon hinei*, new species.
- Fig. 23.—*Lasiopogon aldrichii* Melander.
- Fig. 24.—*Lasiopogon pugeti*, new species.



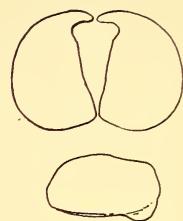
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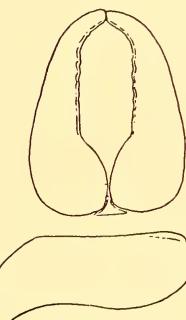
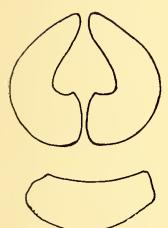
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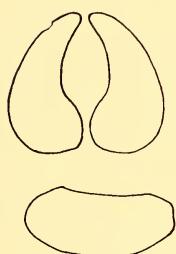
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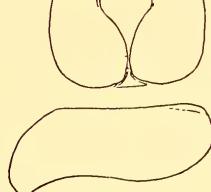
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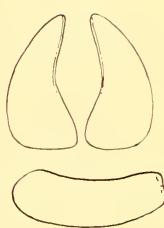
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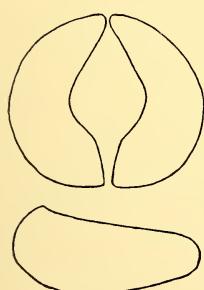
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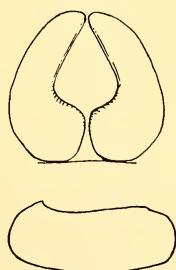
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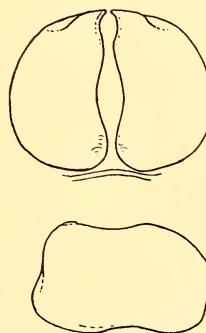
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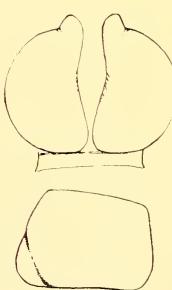
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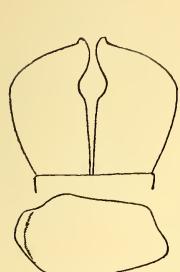
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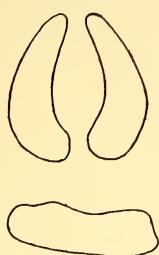
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PLATE III

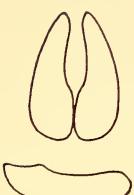
- Fig. 25.—*Lasiopogon canus*, new species.
- Fig. 26.—*Lasiopogon cinereus* Cole.
- Fig. 27.—*Lasiopogon atripennis*, new species.
- Fig. 28.—*Lasiopogon yukonensis*, new species.
- Fig. 29.—*Lasiopogon bivittatus* Loew.
- Fig. 30.—*Lasiopogon martinensis*, new species.
- Fig. 31.—*Lasiopogon monticola* Melander.
- Fig. 32.—*Lasiopogon willametti*, new species.
- Fig. 33.—*Lasiopogon gabrieli*, new species.
- Fig. 34.—*Lasiopogon californicus*, new species.
- Fig. 35.—*Lasiopogon dimicki*, new species.



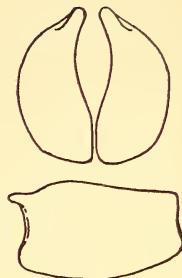
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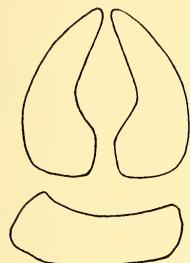
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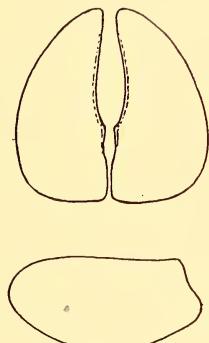
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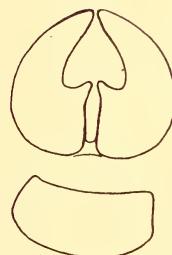
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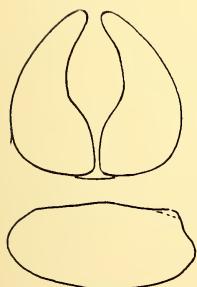
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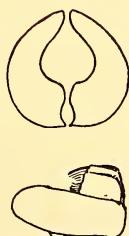
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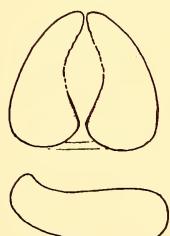
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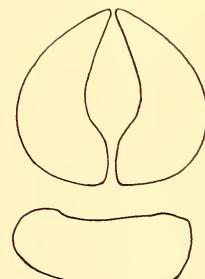
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A REVIEW OF THE GENUS SCAPHINOTUS, SUBGENUS SCAPHINOTUS DEJEAN (COLEOPTERA- CARABIDAE)

BY EDWIN C. VAN DYKE

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There has been great need for a restudy of this group of beetles, for some time, for though Roeschke completely monographed the tribe to which they belong in 1907,¹ the work was written in German and published in Hungary, therefore not readily accessible to most of our workers. Besides much more material has been accumulated since this work was published, necessitating a changed viewpoint with regard to certain of the species, also several new species discovered as well as much new information gathered, rendering that splendid work somewhat obsolete. I have, therefore, felt that the time was ripe for the publication in English of a work which would be more up to date.

The material that has served as the basis for this work has been my own collection which has been built up over a period of many years and which contains the Charles Leng Collection as well as many specimens secured from early collectors. I have also used freely the general collection of the California Academy of Sciences and been aided by the following persons: H. P. Löding, F. H. Parker, Owen Bryant, R. T. Kellogg, M. A. Cazier and E. S. Ross who have either generously supplied me with specimens or placed their collections at

¹ Monograph d. Carab. tribus Cychrini, by Hans Roeschke, Ann. Mus. Nat. Hung., V, pp. 99-277, pt., 1907.

my service. I have also examined critically all the types that are in this country as well as a portion of those which are abroad. I am, therefore, under obligations to many institutions and many friends, for without their aid, I could not have properly done the work. The drawings have been made by Mrs. Frieda Abernathy.

Scaphinotus was established by Dejean² in 1826, with *Cychrus elevatus* Fab. as its only species. Since that time numerous other forms have been described by various authors, some of which have remained in our catalogues as good species while others have been relegated to subspecific rank or even to synonymy. At first *Scaphinotus* was considered by most American authors, Le Conte and George Horn in particular, as merely a subgenus of the Old World genus *Cychrus*, but in 1920, was again elevated to generic rank by Leng in his catalogue. Roeschke in 1907, had amplified it to include most of the North American Cychrini, treating *Scaphinotus* in its restricted sense as a subgenus of this. I am more or less in agreement with Roeschke in believing that most of our American species belong in one large genus, *Scaphinotus*, and that this large polymorphic genus is made up of a number of somewhat divergent subgenera, *Scaphinotus sensu stricto*, being one of these. Only by so considering them can one properly evaluate them and show their true relationships, for their differences or divergent features are small in comparison with their points of resemblance. Classification is primarily concerned with stressing relationships, not divergencies.

Scaphinotus as considered in this paper, in its restricted sense, is a subgenus of the genus *Scaphinotus*. As such it is restricted to the territory east of the Rocky Mountains but in the Southwest extends into southwestern Colorado, New Mexico and Arizona, and along the Sierra Madre Mountains at least as far south as the State of Durango in Mexico. In the more eastern parts of its range, the species are generally to be found at lower elevations while in the Southwest they are almost entirely confined to the mountains, generally along the streams or scattered over the damper areas near the summits.

The subgenus as limited is characterized in particular by having the head elongate, infrequently punctured, genae simple, not dilated and without a tooth or an incisure in front of eyes; clypeus without lateral grooves; labrum deeply bilobed, with base of emargination with four setae and inner margin entirely confined to it, not invad-

² Species general des Coleoptera, by le Compte Dejean, II; p. 17, 1826.

ing the clypeus; labial palpi with more than two setae; antennae long and with the first three or four segments glabrous; prothorax large with sides of pronotum wide, wing like and more or less reflexed and the margin with or without a seta near the middle; the prosternal process inflexed at apex; the proepisternum and epimeron distinctly separated by a groove; the elytra with fourteen more or less distinct striae; the epipleura as a rule thickened and coarsely punctured and the epipleural groove terminating in an expansion before the apex; the middle coxae with marginal seta and the hind coxal plate generally with one or two posteriorly placed setae; the third ventral segment with setiferous punctures; and the upper side of tarsi with a few short erect hairs and the front tarsi in males more or less dilated, generally widely, and papillose beneath.

The species are among the most attractive of our Carabidae, generally somewhat metallic, lilac or cupreous in color and readily recognized by the wide and often greatly reflexed sides of the pronotum. In some species there is a fair degree of constancy but in most, particularly the more western, there is a great amount of individual variation as to size, sculpturing and particularly the breadth and degree of elevation of the wings or sides of the pronotum. The more eastern species are limited in number, have a wide range but break up to a certain degree into more or less well marked races or subspecies, each of which is confined to a definite territory. In the Southwest, particularly in New Mexico and Arizona where the mountains are more or less isolated from one another, the species which are restricted to them are more or less limited in their distribution, sometimes confined to a single mountainous area. Roeschke considered the presence or absence of certain setae as of specific importance. That may be so as regards certain species but large numbers of specimens have shown that certain of these setae as those near the middle of the side margin of the pronotum vary greatly, therefore are of less diagnostic value than was at first thought. The degree of union of the ventral sclerites at the sides, a character used by Roeschke, I am also unable to find of any great value.

KEY TO SPECIES

1. Pronotum more or less densely and coarsely punctured, generally with seta near middle of side margin; epipleura, meso- and metapleura and sides of basal segments of abdomen coarsely punctured 2
- Pronotum generally rugose and with a limited number of punctures at most, the lateral seta present in a few cases though generally absent 5

2. Prothorax small as compared with afterbody, with rather narrow and but slightly reflexed side margins especially in front; elytra about a third longer than broad 3
 Prothorax large as compared with afterbody, but little narrower than elytra, and with side margins wide and considerably reflexed 4
3. Reflexed side margins of pronotum thickened, but little more than a marginal bead in front and but little wider behind, the infolded bead extending backwards well beyond middle; elytral punctures large and deep, the intervals well elevated and markedly crenulated, the general surface somewhat reticulate *snowi*
 Reflexed side margins of pronotum more than a bead in front and quite broad posteriorly, the infolded bead hardly extending posteriorly behind middle; elytral punctures somewhat shallow, generally confined to striae and producing but a slight crenulation of intervals, the latter also but moderately elevated *roeschkei*
4. Reflexed side margins of pronotum fully as wide in front as behind, front margin deeply emarginate as result of marked forward extension of front angles; elytra one third longer than broad, striae distinctly impressed with punctures large and deep, the intervals sharply outlined, crenulate and often transversely united *kelloggi*
 Reflexed side margins of pronotum wider behind than in front, front margin but moderately emarginate, the front angles broadly rounded; elytra proportionally broader, never a third longer than broad, discal sculpturing variable. *vandykei*
5. Pronotum punctured if at all only posteriorly, reflexed side margins or wings variable as to size; elytra either with striae and intervals moderately well defined and strial punctures rather fine or the intervals and striae somewhat obliterated, epipleura discretely punctured; fourth antennal segment always more or less pubescent, at least towards apex; male front tarsi very broad, the second broader than long 6
 Pronotum either dull and finely or coarsely rugose, not distinctly punctured, or smooth with coarse punctures limited to depressions, reflexed side margins wide throughout; elytra with continuous and sharply defined striae and intervals, the strial punctures close together, the lateral margin

- at humeri very broadly reflexed, epipleura densely punctured and rugose; fourth antennal segment glabrous like preceding segments; male front tarsi less broad, segments never broader than long 13
6. Basal portion of pronotum with a limited number of punctures, sometimes vague; fourth antennal segment sparsely pubescent towards apex; violaceous or metallic species 7
- Pronotum sericeous, with punctures absent or but obscurely defined; fourth antennal segment entirely glabrous like preceding segments; black species or with but a faint violaceous tint 10
7. Elytral striae and intervals well defined and quite regular, strial punctures rather fine and confined to striae; smaller, more elongate species with prothorax much narrower than elytra, the reflexed side margins narrow; elytra about one third longer than broad 8
- Elytral striae vague, punctures large and well spaced, intervals but little elevated if at all, the disk therefore more or less even; more robust species with the prothorax not much narrower than elytra, the reflexed side margins broad and elytra less than a third longer than broad 9
8. Apex of pronotum feebly emarginate, reflexed side margins narrow in front, but little more than a beading, gradually wider posteriorly and with seta near middle of margin, front angles narrow and close to emargination, hind angles acute and projecting back of base to a moderate degree; elytral intervals sharply defined, rather regular except for an occasional transverse connection and striae rather deep with fine strial punctures which hardly indent the intervals *grahami*, n. sp.
- Apex of pronotum shallowly emarginate, reflexed side margin moderately wide, almost as broad in front as at middle, front angles broadly rounded, the lateral seta generally absent, hind angles blunt or rounded at apices and projecting back of base to but a slight degree; elytral striae distinct but shallowly impressed and with punctures rather large, indenting the intervals so that they are crenulated as well as sinuous *petersi* var. *catalinae*
9. Apex of pronotum deeply emarginate, reflexed side margins broad and markedly elevated, fully as wide in front as one fourth width of disk and as wide in front as at middle, marginal seta generally absent; elytra with prominently

- reflexed margin at humeral angle, striae vague or absent and strial punctures large and well spaced; epipleura and sides of basal abdominal segments coarsely, deeply punctured *petersi*
- Apex of pronotum shallowly emarginate, reflexed side margin in front much less than one fourth width of disk, gradually wider from apex to base, without marginal seta; elytra with but moderately reflexed margin at humeral angle, striae poorly defined and strial punctures moderate in size and shallowly impressed; epipleura shallowly punctured and rugose *biedermani*
10. Elytral striae, intervals and strial punctures always distinct; hind angles of prothorax blunt and rounded, extending to but a moderate degree beyond base 11
- Entire upper surface more or less smooth; the elytral striae obliterated but the strial punctures very fine and regularly impressed; hind angles of prothorax acute and projecting considerably behind base 12
11. Elytral striae always distinctly impressed, with punctures to a great extent confined to striae, indenting the convex intervals but feebly; reflexed side margins of pronotum not twice as wide posteriorly as in front *mexicanus*
- Elytral striae feebly impressed, the punctures rather large and distinctly indenting the hardly elevated intervals; reflexed side margins of pronotum about twice as wide behind as in front *corvus*
12. Hind angles of prothorax extending one third the length of prothorax beyond its base; elytra one third longer than broad, quite smooth above, with obsolete striae yet with strial punctures observable though minute; general surface above with a violaceous gloss *macrogonus*
- Hind angles of prothorax extending one third the length of prothorax beyond its base; elytra one fifth longer than broad, with striae faintly indicated and strial punctures distinct though fine; general surface above a coal black. *horni*, n. sp.
13. Pronotum finely or coarsely rugose, punctuation at most shallow and vague, breadth rarely less than two thirds breadth of elytra, the posterior area of hind angles, flat, not sulcate; species averaging 25 mm. in length and with elytra violet or cupreous *elevatus*
- Pronotum with disk somewhat smooth but coarsely punctured

apically and basally and on reflexed sides, breadth generally less than two thirds breadth of elytra, the posterior area of hind angles with a broad and distinct sulcus parallel to hind margin; species averaging 3 cm. in length and with entire upper surface a deep violet or black with a feebly violet gloss *unicolor*

Scaphinotus snowi (Le Conte)

(Plate IV, fig. 4)

Cychrus (Scaphinotus) snowi Lec., Trans. Kansas Acad. Soc., VII, 74, 1881.

Scaphinotus snowi Roesch., Annls. Mus. Nat. Hung., V, 135, 1907.

Scaphinotus snowi Nicolay and Weiss, Journ. N. Y. Ent. Soc., XLII, 193-195, Pl. XIII, 1934.

Moderate in size, somewhat elongate, black, upper surface a deep violet with elytra often with a cupreous lustre. Head with front smooth except for a few, fine, sparsely placed punctures and minute transverse rugae; antennae with three basal segments and basal half of fourth smooth, the apical half of fourth pubescent as are the following segments. Prothorax about 1 mm. broader than long, apex feebly emarginate, sides evenly arcuate or somewhat straight and convergent posteriorly, the reflexed sides twice as broad in front as the beading, gradually wider posteriorly from the middle, hind angles right angled and in typical specimens projecting about .5 mm. behind base, thus making the base rather deeply emarginate, and generally with a seta near the middle of lateral margin; disk feebly convex, with median longitudinal line sharply impressed and coarsely, rather densely punctured throughout. Elytra more than three tenths longer than broad and three fifths longer than prothorax, oblique laterally at base, sides feebly arcuate at middle, arcuate and narrowed from posterior third to apex, the reflexed margin slightly broader and feebly subangulate at humeri, elsewhere narrow, disk moderately convex, striae well impressed, rather regular within but irregular towards sides, with large, somewhat closely placed and well impressed punctures, the intervals convex, sharply defined, crenulate as the result of the indenting by the strial punctures and transversely united here and there by short cross bars; epipleura coarsely and irregularly punctured and feebly rugose. Beneath smooth

in front, mesoepimeron, metaepisterna and epimera and sides of basal abdominal segments coarsely punctured, abdominal sutures distinct throughout; the hind coxal plates with two posterior setae. Length 16–17 mm., breadth 17–18 mm.

Males with terminal segments of palpi triangularly dilated and spoon-shaped; first three segments of front tarsi dilated and papillose beneath, the first entirely with the exception of short shank, the second feebly transverse.

Holotype male in Le Conte Collection, Mu. Comp. Zoo., Cambridge, Mass., paratype female in Snow Coll., Kansas Univ., both collected by Prof. F. H. Snow in Sante Fé Cañon, N. Mex., alt. 7000 ft., in 1880. Other specimens listed are a series of nine specimens in the Phil. Acad. of Nat. Sci., collected by Dr. H. A. Pilsbury in the Black Range, Sierra Co., N. Mex., 8000–9000 ft. alt.; two others noted by Darlington (see Nicolay and Weiss), one from the vicinity of Durango, La Plata Co., Col, 5500–7000 ft., July 23–Aug. 8, 1885, in Bowditch Coll. of Mu. Comp. Zoo., Cambridge, Mass., and the other from the Blue Mts., La Sal Nat. Pk., Monticello, Utah, collected July 20, 1933, by W. S. Creighton, in Darlington Collection; and a male, figured by Nicolay and Weiss, from Diamond Creek, White Mts., Ariz., collected by D. K. Duncan, July, 1926, in Nicolay Collection. Besides the above, I may mention the following specimens in my own collection now deposited in the Calif. Acad. of Sciences in San Francisco, a series of ten specimens from the type locality, the Sante Fé Cañon, N. Mex., collected by myself, three specimens, a male and two females, July 22, 1926, and seven specimens, three males and four females, June 12, 1935; three specimens from southern N. Mex., two specimens from the original series collected by Dr. Pilsbury, one somewhat injured given to me by Dr. Henry Skinner and one received with the C. W. Leng collection, and the third from the Black Mts., Grant Co., N. Mex., coll. Aug. 11, 1935, by R. T. Kellogg; besides a series of eight specimens from the White Mts. of Ariz., coll. July 10, 1936, by F. H. Parker. I have also examined other specimens from the White Mts. in the collections of F. H. Parker and Owen Bryant. The general distribution of the species is thus shown as western New Mexico, eastern Arizona, southwestern Colorado and southeastern Utah.

This species like its relatives is very variable. I consider that the Sante Fé Cañon specimens should be considered as the most typical. In these the hind angles of the prothorax extend backwards to an appreciable degree beyond the median portion of the base pro-

ducing a definitely emarginate base as mentioned by Le Conte and as indicated in the figure. The hind angles are also definitely angulate apically and the apical margin of prothorax is also rather feebly emarginate. The specimens from southern New Mexico are generally larger, proportionally more elongate and with the apex of prothorax more deeply emarginate and the hind angles blunter apically. The White Mts., Arizona, specimens average about the same size as the Sante Fé Cañon specimens but have the apex of the prothorax more deeply emarginate, the reflexed side margins less broad, more bead like, and the hind angles often less projecting and more rounded at apices. There are in fact two phases or varieties of the beetle from the White Mts., the normal type which approaches very close to the typical form and a second which I am describing as a variety as follows:

Scaphinotus snowi var. *parkeri* Van Dyke, new variety

(Plate V, fig. 9)

Similar in size and general proportions to typical *snowi* but having the prothorax as a whole proportionally smaller and flatter, the anterior margin more deeply emarginate, the reflexed sides but little more than a bead throughout, barely broader behind than in front and the hind angles well rounded and hardly extending at all beyond median basal margin of prothorax so that the basal margin as a whole is almost straight or but feebly emarginate.

Holotype male (No. 4679, Mus. C. A. S. Ent.) and two male paratypes, collected in the White Mts. of Arizona, by F. H. Parker, the first July 7, 1933, the others July 10, 1933. The two latter were taken in company with numerous more typical specimens.

This variety contrasts quite strongly with the usual forms. Whether it is a more alpine phase I cannot say. The male figured by Nicolay and Weiss is of this variety. In one of my paratypes there are two well developed setae near the middle of each side margin and in my holotype, two on the left side only and in the other paratype, two on the right side only. In a specimen of the more typical phase, there are at least four short setae on each side. This seems to indicate that the lateral setae are of less value in defining species than claimed by some, also that the multiple setae seem to suggest a more definite relationship with the subgenus *Nomaretus* where this multiple condition is most evident and likewise claimed by certain students to be of fundamental importance.

Scaphinotus roeschkei Van Dyke

(Plate V, fig. 12)

Scaphinotus roeschkei Van Dyke, Ann. Mus. Nat. Hung., V, 135–136, 1907.

Somewhat smaller in general than the preceding and with the upper surface a deep violet color. Head with front showing a few minute transverse rugae and a number of small punctures; antennae with three and a half basal segments smooth. Prothorax about .5 mm. broader than long, apex slightly emarginate, sides evenly arcuate in front, almost straight and somewhat convergent behind, the reflexed side margins twice as wide in front as beading and gradually wider from apex to base, front angles broadly rounded and somewhat projecting in front, hind angles slightly acute and extending backwards about .5 mm. beyond base, lateral setae present or absent; disk feebly convex, the median longitudinal impressed line distinct, the general surface alutaceous and subopaque and with rather large though shallow punctures, rather densely and irregularly distributed over entire area. Elytra somewhat elliptical, slightly over a third longer than broad and about two and a half times length of prothorax, oblique at base laterally, sides arcuate and gradually narrowed towards apex, reflexed margin quite wide at humeri but narrow elsewhere; disk moderately convex, striae distinctly though shallowly impressed and with punctures of moderate size, well but not deeply impressed, mostly confined to striae and but slightly indenting the convex intervals which are in general quite regular; epipleura coarsely and irregularly punctured. Beneath smooth in front, mesoepimeron and episterna and sides of basal abdominal segments coarsely punctured, abdominal sutures distinct throughout, hind coxal plates with two posterior setae. Length 13–14 mm., breadth 5.5–6 mm.

Males with terminal segments of palpi dilated as in *snowi*, three basal segments of front tarsi dilated and papillose beneath except for the short shank, the second about as broad as long.

Holotype male collected by Prof. F. H. Snow from Humphrey's Peak (25 miles S. W. of Flagstaff), Arizona, at 9500 ft. alt. in August. This specimen was kindly given to me by Prof. Snow, later loaned to Dr. Roeschke of Berlin, where it now is. A paratype male and female collected at the same time and place are now in the Snow Collection at the University of Kansas. I also have in my collection

a series of eight specimens, four males and four females from San Francisco Peak, Ariz., one collected in July, 1910, by Wm. Mann, the others collected June 4, 1935, by myself.

This species is as indicated a species restricted to the high mountains of northern Arizona. It is quite closely related to *snowi*, having the same general shape though with the prothorax as a rule proportionally smaller, the apex of pronotum more deeply emarginate, the reflexed side margins more abruptly elevated and in general broader, at least from the middle backwards, the front angles more prominent, the hind angles more acute and projecting, the disk more shining and with punctures shallower, and the elytra with the striae punctures less coarse and deeply impressed and the intervals much less elevated.

Scaphinotus kelloggi (Dury)

(Plate IV, fig. 3)

Cychrus kelloggi Dury, Journ. Cincinn. Soc. Nat. Hist., XXI, p. 104, 1912.

Moderate in size, somewhat elongate and parallel sided, black with upper surface a deep violet color. Head minutely alutaceous under high magnification, with a few scattered punctures and fine rugae, antennae with three basal segments and basal half of fourth smooth, the apical half of fourth and following segments pubescent. Prothorax only .5 mm. broader than long, broadest in front of middle, apex deeply emarginate, sides broadly arcuate in front, oblique and convergent behind, the reflexed side margins very broad, at least 1 mm. wide in front and behind and but little less at middle, front angles subangulate, extending 1 mm. forward beyond apex of pronotum, hind angles acute and projecting well beyond base, median marginal setae rarely present; disk feebly convex, with medial longitudinal linear impression sharply defined, the general surface shining, alutaceous under magnification, and coarsely, irregularly and more or less closely punctured throughout, the punctures extending on to the reflexed margins as far as the marginal beading, and with well marked, transverse impressions near apex and in front of base. Elytra three-elevenths longer than broad and over twice as long as prothorax, feebly oblique at base laterally, humeral angles obtuse, sides moderately arcuate, reflexed side margins broad and much reflexed at humeri, elsewhere narrow; disk slightly convex, striae shallowly impressed

but strial punctures coarse, well impressed yet irregularly spaced and more or less irregularly arranged towards apex and sides, the intervals well defined but feebly convex and distinctly crenulated as a result of the indenting by the punctures; epipleura coarsely punctured. Beneath smooth in front, mesoepimeron, metaepisterna and sides of basal segments of abdomen coarsely and rather sparsely punctured. Length 16 mm., breadth 7.5 mm.

Males with terminal palpal segments irregularly dilated and spoon shaped; first three front tarsal segments broadly dilated and papillose beneath, the first completely papillose beneath except for short shank, the second segment appreciably transverse.

Holotype collected by R. T. Kellogg in Box Cañon, upper Gila River, New Mexico, in the Charles Dury Collection, now in the possession of his son in Cincinnati, Ohio. Fourteen specimens are now in my collection: two paratypes collected in Grant Co., New Mexico, July 4, 1915, by R. T. Kellogg, one of which was received from Charles Dury and the other obtained with the Charles Leng collection; the other specimens collected in Grant Co., New Mexico, July 4, 1933, Aug. 8, 1935, and other dates, by R. T. Kellogg, and received from him. Numerous other specimens are also known to have been collected and distributed by Mr. Kellogg.

This very elegant and distinct species can always be readily recognized by the fact that the pronotum is much broader in front of the middle and the rather broad reflexed sides as broad in front as behind. The coarsely, densely punctured pronotum associates it with the two preceding species. It is apparently quite restricted in distribution, being found in the mountains of southwestern New Mexico, in Grant Co., and other places in the neighborhood of Silver City. I believe that R. T. Kellogg is the only person who has collected it.

Scaphinotus vandykei Roeschke

Scaphinotus vandykei Roesch., Ann. Mus. Nat. Hung., V, 136–137, 1907.

Somewhat small, rather broad and robust, black with the upper surface a brilliant violet. Head with minute transverse rugae, antennae with three basal segments and basal half of fourth smooth, the apical half of fourth sparsely pubescent, the following densely pubescent as usual. Prothorax in general about .5 mm. broader than long, slightly broader just in front

of middle, apex quite evidently emarginate, sides arcuate in front, oblique and moderately convergent behind, the reflexed sides rather broad, close to 1 mm. in width, gradually wider behind the middle and considerably reflexed, with marginal setae generally present, front angles well rounded and extending well forward, hind angles acute and projecting backwards at least 1 mm. beyond base; disk feebly convex, with median longitudinal linear impression fairly well marked, surface densely, coarsely yet shallowly punctured throughout with punctures on margins vague, and with moderately well defined subapical and subbasal transverse impressions. Elytra at least 1.5 mm. longer than broad and about twice as long as prothorax, with basal margin quite transverse, humeral angles rounded, sides feebly arcuate, reflexed lateral margin broad at humeri, narrow posteriorly; disk moderately convex, striae well impressed and in general separated from each other by intervals of their own width which are rather convex, sharply outlined, crenulate as the result of being indented by the strial punctures, and also transversely united here and there, the strial arrangement likewise more irregular at sides and apex as usual; epipleura coarsely, deeply punctured. Beneath smooth in front, mesoepimeron, metaepisterna and epimeron and sides of basal segments of abdomen generally more or less coarsely punctured, abdominal sutures distinct throughout; posterior coxal plates with two posterior setae. Length 15–16 mm., breadth 6.5–7.5 mm.

Males with terminal segments of palpi irregularly dilated and spoon shaped; the three basal segments of front tarsi broadly dilated and papillose beneath, the first completely papillose beneath except for short shank, the second segment definitely transverse.

The holotype collected by Prof. F. H. Snow on the headwaters of the Santa Maria River, in Arizona, in October, is in the collection of Dr. Roeschke in Berlin. Other specimens in Dr. Roeschke's collection were also collected by Prof. Snow but from Oak Creek Cañon (south of Flagstaff), Arizona, at 6000 ft. alt., during August. I have the following series of twenty-eight specimens: one from the Monte Christo Mine, near Phoenix, July 8, 1909; five from near Phoenix, May, 1910; three from Groom Creek, Yavapai Co., 8000 ft., June 9, 1910, and one from Granite Creek, Yavapai Co., June 10, 1910, all collected by J. August Kusche; besides two from south-

ern Arizona collected in Aug., 1902, by Prof. F. H. Snow, four from Oak Creek Cañon, Sept. 12, 1933, ten from the same locality, collected June 3, 1935, by myself, and one from Payson, Ariz., collected by D. K. Duncan. Numerous other specimens are in the collections of various entomologists throughout the country.

The species is a very variable one, differing not only as to size but especially as to the width of the reflexed sides of the pronotum and the degree to which these are reflexed or elevated. It is readily separated from the species discussed previously by the proportionately greater width of elytra and the widely reflexed sides or wings of the pronotum. From *petersi* it differs primarily by having the pronotum rather uniformly punctured, the punctuation in *petersi* being either sparse or irregularly disposed. The elytral striae are also very definitely impressed in *vandykei* while vague in *petersi*. The species *vandykei* seems to be confined to southern Coconino and Yavapai counties in Arizona, being found both on the mountains and along the margins of the cold water streams coming from them. A form of this species described by Roeschke as a distinct species, I am considering as but a variety. It is the following:

Scaphinotus vandykei var. *fuchsi* Roeschke

Scaphinotus fuchsi Roesch., Ann. Mus. Nat. Hung., V, p. 570, 1907.

This variety, for a considerable number of specimens proves that it is such and not a subspecies, has all the important characters of *vandykei* and only differs by possessing a pronotum with the side margins less reflexed or much more depressed, thus making the prothorax as a whole much broader, little narrower in fact than the elytra, whereas in typical *vandykei* it is considerably narrower. In *fuchsi* the hind angles of the prothorax are also less acute and extend backwards a shorter distance than they do in *vandykei*, and the elytral striae are in general less well impressed, in this regard suggesting *petersi*. Specimens of *fuchsi* have always been taken in company with typical *vandykei*.

The holotype of *fuchsi* was collected near the Mt. Union Cash Mine, Arizona, on Sept. 12, 1907, presented to Dr. Roeschke by Charles Fuchs of San Francisco and is now in the collection of Dr. Roeschke in Berlin. Presumably the specimen was collected by J. August Kusche. I have in my own collection thirty-five specimens of this variety, collected near the Cash Mine, Crown King, Groom Creek, and other places in the mountains near Prescott, Arizona, all by J. August Kusche. Mr. Kusche widely distributed his material so that this variety is now represented in many collections.

Scaphinotus grahami Van Dyke, n. sp.

Rather small, and delicate, somewhat narrow and elongate, black with the upper surface a very deep violet, almost black in poor light. Head smooth, with a few minute punctures, antennae with three basal segments and basal half of fourth smooth. Prothorax barely broader than long, apex feebly emarginate, sides moderately areuate in front, oblique and slightly convergent behind, the reflexed sides about twice as broad in front as the beading, gradually wider posteriorly until behind the middle then more abruptly wider, front angles narrow and close to apical margin, hind angles acute and extending backwards to a slight degree, a seta near middle of lateral margin; disk slightly convex, with median longitudinal linear impression distinct, the subapical and subbasal transverse impressions well marked, the general surface finely rugose with a few punctures scattered over the basal half and behind the apical margin. Elytra somewhat elliptical, about three-tenths longer than broad and two and a half times as long as prothorax, oblique at base laterally, sides rounded at humeri, moderately areuate at middle, the reflexed margin rather broad at humeri, elsewhere narrow; disk slightly convex, striae rather deeply impressed with the punctures fine, somewhat more than their own width apart and confined to striae, hardly indenting the intervals which are quite regular, convex and transversely united here and there by transverse bars; epipleura irregularly and not deeply punctured. Beneath smooth in front, mesoepimeron, mesoepisternum and metaepimeron and sides of basal segments of abdomen sparsely punctured, abdominal sutures distinct throughout; hind coxal plates with two posterior setae. Length 16 mm., breadth 7 mm.

Males with terminal segments of palpi irregularly dilated and spoon shaped; first three segments of anterior tarsi dilated and papillose beneath, the first entirely so with exception of shank, the second segment transverse.

Holotype male (No. 4680, Mus. C. A. S. Ent.), collected by F. H. Parker on Graham Mt., Arizona, July 25, 1933. I have also studied three similar paratypes, collected by Owen Bryant on Graham Mt., Arizona, one on Aug. 12, the others on Aug. 16, 1933.

This attractive species differs from its fellows by its much finer punctuation, both above and below. It most closely simulates *catalinae* but its striae are always finer and the elytral inter-

vals more regular and less crenulated as a result. It seems to be confined to the Pinaleño Mts., an isolated mountain mass.

Scaphinotus petersi Roeschke

(Plate V, fig. 7)

Scaphinotus petersi Roesch., Anns. Mus. Nat. Hung., V, 137–138, 1907.

Moderate in size, robust, broad and much flattened, black with entire upper surface a deep violet color, and shining. Head shining with a few weak transverse rugae back of eyes; antennae with three basal segments and base of fourth smooth, the apical area of fourth sparsely pubescent. Prothorax barely broader than long, apex quite deeply emarginate, sides arcuate to middle thence straight or feebly sinuate and convergent posteriorly, the setae near middle of side margin generally absent, front angles broadly rounded and projecting well forward in front of apex, basal angles broad, acute at apex and extending over one mm. behind base, the reflexed lateral margin about 1 mm. wide in front, widening rapidly behind middle and obliquely elevated; disk moderately convex with median longitudinal linear impression sharply defined, the general surface smooth or minutely alutaceous with a limited number of punctures at base or extending forwards in the lateral depressions, subapically and sometimes obscurely indicated on the reflexed sides, the subapical and subbasal transverse impressions distinct. Elytra three-elevenths longer than broad and about twice as long as prothorax, almost transverse at base, with sides feebly arcuate medially, more broadly so and convergent posteriorly, the reflexed margin broad at the obtusely rounded humeri where about 1 mm. wide, gradually narrowed to middle and from there narrow to apex; disk moderately convex, striae feebly impressed or more often obscure, the strial punctures, however, coarse, well impressed and well spaced, the intervals feebly convex or generally flattened and not well outlined; epipleura coarsely, irregularly punctured and somewhat rugose. Beneath smooth in front but with coarse punctures on mesoepimera, metaepisternum and epimera and sides of basal segment of abdomen, abdominal sutures distinct throughout, hind coxal plates with two posterior setae. Length 18–20 mm., breadth 8–9.5 mm.

Males with terminal palpal segments broadly irregularly dilated and spoon shaped as usual; the three basal segments of

anterior tarsi dilated and papillose beneath, the first with shank and margins towards base smooth, the second barely transverse.

The holotype male of this species, now in the collection of Dr. Roeschke at Berlin, was collected by Dr. E. D. Peters, a companion of H. F. Wickham, in the Pinal Mts. of Arizona, during 1890 and by the latter transmitted to Dr. Roeschke. Four or five other specimens were also taken at the same time, most of which are now, no doubt, in the Wickham collection at the U. S. National Museum. Since this time other specimens have been collected by various workers. I have in my own collection several typical specimens from the Pinal Mts., collected, six on June 18, 1934, and one on Aug. 20, 1933, by F. H. Parker. I also have a specimen from the Sierra Ancha Mts., Ariz., collected in August by D. K. Duncan which is of this species though having the pronotum more generally punctured and the elytral striae distinctly defined. In the Santa Catalina Mts., large numbers of specimens have also been taken. I have five specimens from a large series collected at Soldiers Camp near the top of Mt. Lemmon, 7700 ft. alt., Aug. 18, 1934, by Ian Moore and the California Academy has two specimens collected by J. R. Slevin, one from Marshall's Gulch, the other from the summit of Mt. Lemmon, June 6, 1912. A series of sixty-six specimens collected by M. A. Cazier and an almost equal number collected by E. S. Ross, on July 1, 1936, from near the summit of Mt. Lemmon, have been loaned to me for study purposes. As a result of studying this large number of specimens, I find that there is a very great deal of variation within the species, not only as to size and general proportions which is great, but as to proportionate breadth of prothorax, width and degree of reflexion of side margin of prothorax, denseness of pronotal punctuation and degree of impression of the elytral striae and prominence of elytral intervals. The large series collected by Cazier and Ross within a few acres of territory, shows all of the above-mentioned variations and brings out the fact that there are in general two quite contrasting assemblages of forms, one series of which includes what might be called more or less typical *petersi* as described above, specimens of considerable breadth with the sides of pronotum wide and much reflexed, quite flattened elytra with the striae feebly impressed at most but with the striae punctures conspicuous; the other series comprising somewhat depauperized specimens such as I described some years ago as *catalinae*, which are in general narrower and proportionally more elongate than *petersi*, with prothorax proportionally narrower, the side margins narrower and less reflexed, the hind

angles less acute and shorter and the elytra more elliptical, the striae better impressed, strial punctures finer and the intervals more regular. These two forms I was at first inclined to consider as distinct species but the large series mentioned above shows that they intergrade in every imaginable manner. There are specimens with the typical *petersi* afterbody and *catalinae* forebody as well as specimens intermediate in regard to all features. A large series of specimens with the genitalia dissected out of both males and females shows that these organs though variable as to minor details are of essentially the same type in the two forms. The typical *petersi* seems to be distributed throughout the mountains of southwestern Gila County and extends south into eastern Pinal and northeastern Pima County. It is the broadest, most flattened and generally most robust of our southwestern species. The variety *catalinae* as I am now considering it is, however, so distinct when of the extreme form, that I am going to redescribe it in order to have it contrasted with the more typical *petersi*.

Scaphinotus petersi var. *catalinae* Van Dyke

(Plate V, fig. 13)

Scaphinotus catalinae Van Dyke, Pan-Pacific Entom., I, 2,
1924.

Rather small, more or less elongate, black with the usual violet color above. Antennae with the three basal segments and basal half of fourth smooth, the apex of fourth sparsely pubescent. Prothorax at least .5 mm. broader than long, apex feebly emarginate, reflexed sides narrow in front, gradually wider behind middle, but slightly reflexed or elevated with front angles well rounded but close to apical margin and hardly projecting beyond it, the hind angles triangular, acute at apex and extending backwards not more than .5 mm. beyond basal margin, the marginal setae rarely present; disk with punctures sparse and generally confined to basal area. Elytra somewhat elliptical, reflexed margin rather wide at humeri but narrow elsewhere; disk slightly convex, with striae distinctly impressed, strial punctures fine, not deep, intervals well elevated and convex, more or less regular and but feebly indented by strial punctures; epipleura coarsely punctured. Beneath as in *petersi* and male tarsal characters likewise similar. Length 15-18 mm., breadth 6.5-8 mm.

The above description was drawn from one of the original paratypes which comprised a series of more or less uniform small specimens. In this series there were ten specimens collected June 9–10, 1912, by J. K. Slevin, from near the top of Mt. Lemmon, Santa Catalina Mts., Ariz. The California Academy of Sciences also has a series of seventeen specimens from the same locality, collected July 26, 1924, by J. O. Martin, which are quite uniform with the type series. In the lot collected by Cazier and Ross, the series of this variety is large, fifty or sixty in number, but it is not uniform as to character. The specimens are generally larger than are those mentioned before and a large number are intermediate in structural details between typical *catalinae* and typical *petersi* as mentioned previously. The variety *catalinae*, I am inclined to consider as but a depauperized phase of *petersi* which is to be found only on the higher levels of the Santa Catalina Mountains of Arizona. The Slevin and Martin specimens were all collected high up near the top of Mt. Lemmon, and as stated are all rather small and of quite a uniform type. The Cazier, Martin and Moore specimens were collected near Soldiers Camp and other localities at a lower level, at an altitude which, I am inclined to believe, was the maximum for typical *petersi* so that high altitude influences were already beginning to have their effect in producing the more alpine, depauperized, phases.

The specimens of *catalinae* that are most typical are as stated, quite distinct from *petersi* and much more like specimens of *snowi* and *roeschkei*. They differ from these latter, however, by not having the disk of the pronotum uniformly, rather densely punctured, but with the punctures sparser and to a great extent confined to the basal area.

Scaphinotus biedermani Roeschke

Scaphinotus biedermani Roesch., Ann. Mus. Nat. Hung., V, 571–572, 1907.

This species collected in the Huachuca Mts. of southern Arizona was supposed to differ from *petersi* in having the sutures at the sides of the abdominal segments somewhat obliterated. In all other essential regards it was much like *petersi*. The description was based upon two males received from Biederman. I have in my own collection a female, likewise received from Biederman and from the same locality from whence the males came. I have critically compared this with numbers of *petersi* and cannot see any great differences; the abdominal sutures seem to be distinct in all. Other characters which were used to separate them, supplementing the above, are

such as are very variable. In the large series of *petersi* which I have had the opportunity to study this variability is distinctly brought out. As far as I know, no specimens of *biedermani* have been collected in recent years. As indicated above, I am inclined to consider this as nothing more than a weak variety of *petersi*, but I believe that until more examples can be secured to finally settle its status, it should be allowed to stand as a species.

Scaphinotus mexicanus (Bates)

(Plate IV, fig. 5)

Cychrus mexicanus Bates, Ann. Mag. Nat. Hist., IX, 320,
1882.

Cychrus mexicanus Bates, Biol. Cent. Amer., Ins. Col., I
Pt. 1, Suppl. 263, t XIII, f. 16, 1884.

Moderate in size, somewhat elongate, black with at times a faint violaceous color. Head smooth, front feebly transversely wrinkled, antennae with three basal segments smooth, the fourth pubescent but to a lesser degree than the following segments. Prothorax barely broader than long, apex slightly emarginate, sides moderately arcuate in front, straight and feebly convergent behind, the reflexed sides somewhat more than .5 mm. wide in front, gradually wider behind, quite obtusely elevated, front angles sharply rounded and close to apical margin, hind angles broadly angulate with apex somewhat acute and extending back almost 1 mm. beyond basal margin, the median longitudinal linear impression fine and but feebly impressed, the subapical and subbasal transverse impressions well marked, the general surface finely alutaceous and somewhat opaque, finely transversely rugose medially and impunctate. Elytra somewhat elliptical, one-third longer than broad, one-sixth longer than prothorax, almost transverse at base, sides moderately arcuate from humeri to beyond middle thence more evidently arcuate and convergent, reflexed margins rather wide at humeri but narrow elsewhere; disk moderately convex, striae well impressed with strial punctures fine, rather close together and confined to striae, the intervals convex, regular except at sides and apex and but feebly indented by punctures; epipleura coarsely, shallowly punctured. Beneath smooth in front, sides of abdominal sclerites with a few scattered punctures, the sutures at sides somewhat connate, hind coxal plates with two posterior setae. Length 19 mm., breadth 8 mm.

Males with the usual dilated and spoon shaped terminal segments of palpi; front tarsi broadly dilated and papillose beneath, the first segment entirely papillose beneath except for short shank, second segment broadly transverse.

Holotype in the Bates Collection, now in the possession of R. Oberthür at Rennes, France. It was collected at Milpas, Ciudad, in Durango, alt. 5900 ft. (Forrer). Other specimens are in the British Museum. I have in my own collection the following: one specimen, somewhat injured, collected by O. T. Baron in Mexico, many years ago and given to me by J. J. Rivers; and a series of twenty-two specimens, several immature, collected by M. A. Embury and Albert R. Mead, at Juan Manuel, El Salto, Durango, Mex., at an altitude of 9000 ft., June 15, 1937.

Scaphinotus corvus (Fall)

Cychrus corvus Fall, Tr. Am. Ent. Soc., XXXVI, No. 2, 89-90, 1910.

Of moderate size, elongate, black with a faint violaceous tinge above. Head smooth in front, obscurely transversely rugose behind; antennae with three basal segments glabrous, the fourth pubescent though not as densely so as following segments. Prothorax .5 mm. broader than long, apex rather deeply emarginate, sides arcuate to middle thence straight and moderately convergent posteriorly, the reflexed side margin almost one mm. wide in front and as far as middle, thence rather suddenly wider posteriorly, anterior angles rounded but narrow and extending forward to but a slight degree, hind angles prominent, somewhat acute at apices and projecting from .5-1.5 mm. posteriorly behind base, the median lateral setae often present; disk feebly convex, with well defined but not deeply impressed median longitudinal line, subapical and subbasal transverse impressions distinct, the general surface dull, somewhat sericeous, with obscure and minute transverse rugae, and a limited number of obscure punctures in the sulci at the base of the obtusely reflexed side margins. Elytra subelliptical, three tenths longer than broad, and from two to three times as long as prothorax, depending on specimen, transverse at base, sides slightly arcuate at first and gradually more arcuate and convergent towards apex, the reflexed margin somewhat broad at humeri, gradually narrower to middle thence uniformly narrow to apex; disk

slightly convex, striae feebly impressed but strial punctures moderate in size, placed their own width apart and here and there longitudinally separated from each other by cross bars, the intervals feebly convex, regular near center but often quite confused towards sides; epipleura rather coarsely, irregularly punctured and rugose. Beneath smooth in front, including mesopleura, the metapleura and sides of abdominal segments coarsely to finely punctured, abdominal sutures distinct throughout, the usual two setae on the hind coxal plates behind. Length 16–18 mm., breadth 7–7.5 mm.

Males with terminal segments of palpi strongly triangularly dilated and spoon shaped as usual; the front tarsi strongly dilated and papillose beneath, the first segment entirely so except for short shank, the second segment somewhat transverse.

The type is a male in H. C. Fall's Collection, which was collected in the "Chiricahua Mountains, Arizona. A single male specimen collected and given me by my friend Mr. V. W. Owen of Los Angeles." In my own collection are seven specimens, one male and six females, all collected along Cave Creek, Chiricahua Mts., Cochise Co., Ariz., as follows: the male, Aug. 14, 1927, five females June 21, 1927, and one female June 24, 1927, all by J. August Kusche. Beside these I have studied three more specimens, two males and a female, collected by E. R. Ross, in the Chiricahua Mts., Ariz., July 10, 1936. There is considerable variation observed in the series studied, most of the specimens having the reflexed side margins of the prothorax very obtusely elevated, with hind angles extending less than one mm. behind base of prothorax, and the disk of elytra rather convex and the intervals feebly convex and quite regular. Presumably these are like Fall's type. In my male, the reflexed sides of the prothorax are much more upright and prominent and the hind angles very acute, projecting fully 1.5 mm. behind base of prothorax, while the elytral striae are less deep and regularly impressed. In regard to the prothorax, especially the hind angles, this specimen approaches the Mexican *macrogonus* and *horni*. In my other divergent specimen, a female, the prothorax is much smaller than usual, with reflexed side margins narrower, but little bit more than the lateral beading in front, and the elytra much flattened with the strial punctures more prominent and the cross bars joining the intervals very numerous producing a somewhat reticulate appearance.

This species is rather closely related to *mexicanus*, undoubtedly arising from the same common stock. *Mexicanus* is in general larger, with the elytral striae deeper and more regular, the strial punctures finer and less conspicuous and the intervals more elevated, convex and regular. The extreme degree of plasticity of *corvus* as of most species of *Scaphinotus*, is indicated by the fact that in the Chiricahua Mts. is to be found *Carabus forreri* Bates, not at all distinguishable from the specimens found in the mountains of Durango, Mexico, while *Scaphinotus corvus* of the Chiricahua and *Scaphinotus mexicanus* of Durango, two species undoubtedly having a common origin, and living under somewhat similar conditions with *Carabus forreri*, in both places, have become quite divergent so that they are now easily distinguishable species.

Scaphinotus macrogonus Bates

(Plate V, fig. 11)

Scaphinotus macrogonus Bates, Tr. Ent. Soc. Lond., Pt. II,
June, No. IX, 229-230, Pl. XIII, f. 5, 1891.

Scaphinotus macrogonus Roesch., Ann. Mus. Nat. Hung.,
V, 138-139, 1907.

Moderate in size, elongate black or rufopiceous (immature) with the upper surface violaceous. Head smooth with a few vague transverse rugae; antennae with three basal segments glabrous, the fourth fully as pubescent as following. Prothorax including hind angles as long as broad, apex quite deeply emarginate, sides arcuate to middle thence almost straight and feebly convergent to apices of hind angles, the reflexed margins quite upright, rather broad in front, .75 mm. wide, and from middle rather suddenly wider, anterior angles rounded, not broad and projecting but slightly beyond apex, hind angles very prominent and very acute, extending about 2 mm. beyond base, median lateral setae absent; disk flattened, with fine, feebly impressed median longitudinal line, with subapical and subbasal transverse impressions quite well marked, the general surface somewhat dull, alutaceous under magnification, and without punctures. Elytra subelliptical, one fourth longer than broad and twice as long as prothorax, base transverse, sides arcuate, gradually more rounded and convergent towards apex; disk feebly convex, quite flattened towards suture and smooth, the striae obliterated, strial punctures minute but in most cases observable under magnification and serially arranged, intervals not sharply demarcated from

the generally smooth surface; epipleura shallowly, rather finely punctured. Beneath generally smooth, even the side pieces of metapleura smooth and but few vague punctures at sides of abdomen, abdominal sutures distinct, the two posterior setae on hind coxal plates present. Length 20 mm., breadth 8 mm.

Males with characters of following species.

The type, collected by Höge, from Refugio in Durango, Mexico, passed with many of the Bates types into the hands of René Oberthür of Rennes, France, and it presumably is still there. In the British Museum there are other specimens collected by Höge at Refugio and a single female specimen of the original series was kindly given to me by the authorities of the British Museum through Dr. K. G. Blair. In this connection it is well to quote Bates as follows: "All the numerous examples of *Scaphinotus*, labelled by Herr Höge with the above locality, are conformable to the diagnosis given above, while all those ticketed 'Ciudad' belong to *S. mexicanus*, in which the hind angles of the thorax are only moderately produced, *i.e.*, not prolonged into a fine point, and the elytra closely and strongly punctate-striate with narrow raised intervals."

This very distinct species may be readily separated from all of its fellows, by its elongate body, smooth and somewhat violaceous upper surface, and very long and acute hind angles to the prothorax. It is most closely related to the following.

Scaphinotus horni Van Dyke, n. sp.

(Plate V, fig. 10)

Medium sized and sooty black throughout, similar in structure to the preceding but shorter and proportionally broader. Head smooth; antennae with but three basal segments glabrous. Prothorax about .5 mm. broader than long, apex slightly emarginate, sides arcuate to middle, thence almost straight and slightly convergent backwards, the reflexed sides very obtusely elevated, about .75 mm. wide in front and rapidly wider behind the middle, front angles rather broadly rounded and slightly extending forwards, hind angles very prominent and very acute at apices, projecting fully 1 mm. beyond base, seta absent from middle of lateral margin; disk flattened with median longitudinal line finely impressed and subapical and subbasal transverse impressions well marked, the general surface opaque, alutaceous under good magnification and without punctures. Elytra cordiform,

three elevenths longer than broad and somewhat more than twice as long as prothorax, basal margin oblique laterally, humeral angle subangulate and rounded and convergent posteriorly, the reflexed margin broad at humeri, narrowed behind and slightly though gradually narrower from basal fourth to apex; disk moderately convex, with striae vaguely impressed and strial punctures fine, rather regularly arranged and about twice their own diameter apart, the intervals and general surface smooth, flat and subopaque; epipleura distinctly though rather shallowly punctured. Beneath generally smooth and impunctate, abdominal sutures distinct throughout and the usual two posterior coxal setae present. Length 17 mm., breadth 8 mm.

Male with last palpal segments broadly dilated and irregularly spoon shaped; the front tarsi broad and papillose beneath, the first completely so except for shank, the second transverse.

Holotype, a unique male in the Kraatz Collection of the Deutsches Entomologische Institut at Berlin-Dahlem, bearing the label "Mexico," kindly referred to me for study and description, by Dr. Walther Horn.

This species is rather closely related to *macrogonus* but somewhat shorter and proportionately broader, with the reflexed sides of pronotum more acutely elevated, the hind angles long and acute but slightly less lengthened and spinose, the strial punctures of elytra more evident, and the general color a sooty black in contrast to the distinctly violaceous color of *macrogonus*. There was some doubt as to the correctness of the locality Mexico, as expressed to me by Dr. Horn, but from its close relationship to *macrogonus*, I believe that it could have come from nowhere else. It is with great pleasure that I name this fine species after my old and dear friend, Dr. Walther Horn.

Scaphinotus elevatus (Fabricius)

Carabus elevatus Fabr., Mant. Ins. I, p. 198, n. 37, 1787.

Carabus elevatus Fabr., The Fabrician Types of Insects,
Staig, Cambridge, 13-15, Pl. 6, 1931.

Carabus elevatus Oliv., Entom. III, No. 35, 46, Carabus Pl.
VII, f. 82, 1789.

Cychrus elevatus Fabr., Syst. Eleuth. 7, 166, 1801.

Cychrus elevatus Knoch, Neue Beiträge I, 188, t. 8, f. 12,
1801.

Cychrus elevatus Say, Tr. Am. Phil. Soc., II (new series),
7, Pl. 45, f. 4, 1825.

Cychrus elevatus Blatch., Col. of Indiana, 43, 1910.

Scaphinotus elevatus Dej., Spec. Gén., II, 17, 1826.

Scaphinotus elevatus Horn, Tr. Am. Ent. Soc., VII, 172, 1878.

Scaphinotus elevatus Roesch., Anns. Mus. Nat. Hung., V, 140-143, 1907.

Scaphinotus elevatus Leng, Journ. N. Y. Ent. Soc., XXII, 139-142, 1914.

Scaphinotus elevatus (Fabr.) is a widely distributed species in eastern North America, occurring from Nebraska, eastern Colorado, Sante Fe and the Sacramento Mts. of New Mexico in the west to the Atlantic seaboard and thence extending from New York to Florida. Within this area it is, however, quite variable, breaking up into numerous more or less definable subspecies and races. As much as the species cannot be properly characterized without having reference to these dissimilar elements, it seems best to fully describe the first made known or so-called typical form, then compare the various subspecies with this, noting wherein they resemble and how they differ. The variety described by Leng as *floridensis*, from Florida, is not a variety of *elevatus* as described but of *unicolor* as will be shown later.

KEY TO SUBSPECIES OF S. ELEVATUS

1. Apex of prothorax rather distinctly emarginate and with front angles projecting well in front of it; the reflexed sides or wings very wide, 1 mm. or more in front and much wider behind, more or less obtusely elevated and with prominent hind angles which extend at least 1 mm. behind basal margin 2
- Apex of prothorax shallowly emarginate, the front angles projecting but slightly forward; the reflexed sides much narrower, less than 1 mm. wide in front and the hind angles not extending back behind basal margin as much as 1 mm. 5
2. Elytra brilliantly metallic, cupreous or cupreous violet, contrasting strongly with the head and pronotum 3
- Elytra deep violet, sometimes shining, but not contrasting greatly against the head and pronotum 4
3. Reflexed sides of prothorax elevated posteriorly at least 30 degrees; disk finely transversely rugose and opaque.
elevatus (sens. str.)

- Reflexed sides much less acutely elevated, rarely as much as 30 degrees; disk rather coarsely irregularly rugose *flammeus*
4. Reflexed sides of prothorax but moderately convergent posteriorly; elytral striae deeply impressed and coarsely, closely punctured *tenebricosus*
- Reflexed sides of prothorax strongly elevated and convergent posteriorly; elytral striae less deeply impressed and more finely punctured, the intervals also less carinate, in general more flattened *lengi*
5. Elytra brilliantly cupreous or cupreous violet as in typical *elevatus*, the intervals very regular but slightly crenulate as result of strial punctures being fine and to a great extent confined to striae *coloradensis*
- Elytra deep violet, almost black, the intervals very sinuous and crenulate, often broken, as the result of the coarse strial punctuation *neomexicanus*

Scaphinotus elevatus (Fabricius), *sensu stricto*

(Plate IV, fig. 2)

Medium size, broad and robust, black, with the epipleura a deep violet, the head and prothorax above dull black or bluish black and the elytra brilliantly cupreous or cupreous violet in color. Head with fine transverse rugae, often faint; antennae with four basal segments glabrous. Prothorax averaging one fourth broader than long, apex with well defined emargination, sides arcuate and diverging to beyond middle then somewhat straight and feebly convergent posteriorly, without marginal setae, the reflexed margin elevated posteriorly at about a 30 degree angle, very broad, generally over 1 mm. wide in front and markedly increasing in width from about the middle to hind margin, the front angles in the form of small, well rounded lobes, close to apex and projecting slightly forward, the hind angles broadly angulate with apices somewhat acute, generally depressed at tip and extending backwards beyond base to the extent of about 1 mm., the hind marginal area always flattened; disk with median longitudinal line finely impressed, the subapical and subbasal transverse impressions shallow yet distinct, the general surface densely, finely, transversely rugose, of a dull black color or obscurely violaceous, the inner surface of wings coarsely, shallowly, irregularly punctured and rugose, and the flattened base rarely more than two thirds as wide as the

hind margin of posterior angles. Elytra about one sixth longer than wide and twice as long as prothorax, somewhat transverse at base, with humeral angles subangulate yet rounded and broadly reflexed, the sides moderately arcuate until near apex then almost straight or feebly sinuate to suture, the reflexed margins narrow behind humeri and gradually narrower towards apex; disk evenly but not strongly convex, punctate-striate, the striae deeply impressed with close set, rather coarse punctures, with as a rule fourteen quite regular intervals besides several irregular ones near margin, which are abruptly elevated, convex and with sides finely crenulate or indented by the strial punctures. Beneath smooth in front, epipleura coarsely, densely punctured and rugose, the meso- and metapleura and sides of first and second ventral segments also somewhat punctured; the hind coxal plates with the usual two posterior setae present. Length 15–23 mm., breadth 10 mm.

Males with the terminal palpal segments broadly, irregularly dilated and spoon shaped and the front tarsi dilated and papillose beneath, the first segment fully two and a half times as long as broad with papillose area, an elongate triangular patch clothing the apical two thirds and leaving the rather long shank naked, the second segment quadrate and distinctly longer than broad.

This the typical and first described form is of course somewhat variable, the variability being shown most in the degree of elevation of the reflexed sides of the prothorax, the degree of convergence of these reflexed margins posteriorly, the sculpturing of the disk of the pronotum, and the color and to a slight extent the sculpturing of the elytra. It is generally found along the Atlantic seaboard ranging from New York to about North Carolina. I have a specimen before me from Lawrence, Kansas (Benedict Coll.) from the Blaisdell Collection which belongs here. The pronotum is a deep violet and the reflexed margins of prothorax are quite markedly elevated and hind angles very acute. Normally, the specimens from this territory would be of the subspecies *flammeus*.

Scaphinotus elevatus flammeus Haldeman

Cychrus flammeus Hald., Proc. Ac. Nat. Sc. Phil., II, 54,
1844.

Cychrus dilatatus Lec., Tr. Am. Phil. Soc., X, 398, 1853.

Scaphinotus flammeus Lec., Ann. Lyc. Nat. Hist., N. Y., IV, 440, 1848.

Scaphinotus elevatus flammeus Roesch., Anns. Mus. Nat. Hung., V, 141, 1907.

Scaphinotus elevatus flammeus Leng, Journ. N. Y. Ent. Soc., XXII, 140-141, 1914.

In this subspecies we have an insect which is generally proportionally broader than the more typical form, with the reflexed margins of the prothorax less acutely elevated so that a cross view gives it the appearance of being much flatter; the disk of the pronotum is also generally more coarsely rugose and the punctuation on the reflexed margins also much coarser and the general surface likewise more rugose.

The Haldeman type was from Marietta, Ohio, on the Ohio River and was described as follows: "Elytra pale brilliant violet, distinguished from *elevatus* by the wide prothorax and elytra and lighter color; profile flatter above when viewed laterally." Because of the stated "pale brilliant violet," Le Conte later on described a specimen from St. Louis, Missouri, as *dilatatus*. These were no doubt but slight variants of the same thing. The lighter color could easily be caused by immaturity. The violet color as contrasted with the generally cupreous color is not of great moment in this species for the color varies considerably. This subspecies ranged from Ohio south to Tennessee and west through Iowa to Nebraska, Kansas, Missouri and Arkansas. The Nebraska and Missouri specimens which are fairly common in collections, are in general in agreement with Le Conte's *dilatatus*. Exceptions do occur, however, as noted previously. The subspecies grades gradually into typical *elevatus* along its eastern boundary and into *coloradensis* along its western boundary. The gradation is noted especially as regards the size of the papillose area of the first segment of the front tarsi of the males. The material that I have studied consists of some twenty-six specimens from Nebraska, Kansas, Missouri and Arkansas.

Scaphinotus elevatus tenebricosus Roeschke

Scaphinotus elevatus tenebricosus Roesch., Anns. Mus. Nat. Hung., V, 141, 1907.

Scaphinotus elevatus tenebrosus auct.

Scaphinotus unicolor Lec. (nec. Fab.), Tr. Am. Phil. Soc. X, 398, 1853.

Scaphinotus heros Lee. (nec. Harris), Ann. Lyc. Nat. Hist., N. Y., 440, 1848.

The specimens of this subspecies differ from the typical *elevatus*, primarily by having the elytra dark, a deep violet, almost black, thus offering very little in the way of a color contrast to the forebody. Other features as judged by my specimens are that the reflexed sides of the pronotum are generally more acutely elevated, the hind angles more convergent; the elytra often proportionately broader, the disk a bit more convex, the intervals generally more carinate and crenulate, the latter produced by the apparently more decidedly impressed striae punctures. There is a great deal of individual variation, though, and specimens even from the same region may vary greatly, particularly as to the character of the reflexed sides of pronotum. In general this subspecies might be considered as but a melanotic race of *elevatus*.

Roeschke did not state from what locality his type specimen came, merely mentioning the fact that the subspecies ranged along the coast from New Jersey to South Carolina. The series of specimens that I have studied consists of fourteen, four from Newport News, Virginia; four from Southern Pines, North Carolina (Manee Coll.); one from Wilkesbarro, Virginia, the others simply labeled "Va." It is apparently confined to the more maritime or coastal portion of the South Atlantic States, replacing almost entirely the typical phase in its area of distribution.

Scaphinotus elevatus lengi Van Dyke, new subspecies.

At first sight and because of its distribution, this subspecies would be placed as but an extreme example of the above. It has the same uniform dark color but is somewhat narrower, has the reflexed sides of pronotum more upright, the hind angles more acute and much more convergent, the pronotal disk more finely, transversely rugose, the hind margin of disk more narrowed, hardly two thirds width of hind margin of hind wings and the elytra slightly flatter, with the striae regular, much more shallowly impressed than usual in the species and the striae punctures fine, close together and practically confined to the striae with the result that the intervals which are not sharply elevated are straight or feebly sinuous, not strongly crenulate as in *tenebrisosus* or in fact any of the other subspecies. The punctuation of the epipleura is also less dense than in the latter.

The male has similar palpal characters to the above but the front tarsi are but slightly dilated, the first segment over three times as long as broad, with a long narrow shank so that the papillose area beneath covers but little more than half of the

segment, the second segment is also elongate triangular, not quadrate as in the other subspecies.

Holotype male (No. 4681, Mus. C. A. S. Ent.), a unique, received with the Charles Leng Collection but collected by G. P. Engelhardt in the Dismal Swamp of Virginia, on July 22.

Scaphinotus elevatus coloradensis Van Dyke

(Plate V, fig. 6)

Scaphinotus elevatus coloradensis Van Dyke, Ann. Mus. Nat. Hung., V, 141-142, 1907.

This subspecies is rather closely related to the subspecies *flammeus*, sharing the less strongly reflexed margin, the cupreous-violet elytra, and the general appearance. It is, however, generally smaller, proportionately narrower, the prothorax always much narrower, the reflexed sides in particular, the hind margin of posterior angles barely wider than the base of the disk, the sculpturing of the disk much finer and the strial punctuation of the elytra also much finer. The males have the first segment of the front tarsi much more extensively papillose beneath, the papillose area covering the entire under surface except for a short shank, and the second segment is almost as broad as long whereas in *flammeus* and most of the other subspecies of *elevatus*, the males have the first tarsal segment of the front tarsi papillose beneath for but little more than two thirds of its length and the second segment is decidedly longer than broad. With this subspecies I have included a race from Sioux Co., Nebraska, that differs from the usual *coloradensis* by having the elytra in general of a deep violet color, the strial punctures of the elytra very coarse and the intervals as a result much crenulated and in places quite irregular, and the pronotum rather coarsely rugose.

The original description of *coloradensis* was based upon specimens in the American Museum of Natural History at New York collected in eastern Colorado, and the designated holotype is there. I now have in my own collection six specimens, one collected along Williams Creek near Manitou, Colorado, June 20, 1926, and five collected in Santa Fe Cañon, New Mexico, June 22, 1926, by myself, besides a specimen which came to me with the C. W. Leng Collection with a Julich label on it, from Colorado. This last I am inclined to believe was from the same lot from whence the type specimens came. I have also had the opportunity to study two specimens from the Fenyes Collection, that were collected in Santa Fe Cañon, New

Mexico, as well as a series of sixteen specimens, mentioned above, in the Owen Bryant Collection that were collected by F. H. Shoemaker in Warbonnet Canyon, Sioux Co., Nebraska, June 27, 1911.

Scaphinotus elevatus neomexicanus Van Dyke

Scaphinotus elevatus neomexicanus Van Dyke, Pan-Pacific Ent., I, 1, 1924.

The original description of this subspecies is as follows: "This subspecies differs from the typical *elevatus* by being of a deep violet black color, by being proportionally narrower, the prothorax smaller, less than two-thirds as long at the middle as broad, with a broad somewhat convex and cordate disc, the lateral wings abruptly elevated from the sides, not gradually as in the other, but little arched and with the margin almost equally thickened throughout; the elytra with the margins only moderately explanate in the humeral region and rather narrow elsewhere, the disc broadly convex and quite flattened at the middle, and the striae deep and closely crenulately punctured. When viewed from behind, the contrast in outline between this and the typical form is most marked. Length 19 mm., breadth 8.5 mm."

"Type, female in my collection, collected at Cloudcroft, Sacramento Mountains, New Mexico, altitude 8000 feet, July 5, 1917, by Professor W. M. Wheeler and by him kindly presented to me." The holotype is now in the Entomological Collection of the California Academy of Sciences, San Francisco, where my entire collection is permanently deposited.

This subspecies because of its uniform coloration superficially suggests the subspecies *tenebricosus* but can always be readily separated from that as from all of the unicolorous species by the markedly sinuous and crenulated elytral intervals and the very coarse strial punctuation. The type and only specimen seen is a female, so I cannot give the male characters.

Scaphinotus unicolor (Fabricius)

(Plate IV, fig. 1)

Carabus unicolor Fabr., Mant. Ins., 198, n. 38, 1787.

Carabus unicolor Fabr., Staig. The Fabrician Types of Insects, Cambridge, 16-17, pl. 6, 1931.

Carabus unicolor Oliv., Entom. III, No. 35, 47, pl. 6, f. 62, 1789.

- Cychrus unicolor* Knoch, Neue Beyträge, 187, 5, 8, f. 1, 1801.
- Scaphinotus unicolor* Roesch., Ann. Mus. Nat. Hung. V, 142–143, 1907.
- Scaphinotus unicolor* Leng, Journ. N. Y. Ent. Soc., XXII, No. 2, 141–144, 1914.
- Cychrus heros* Harris, Proc. Boston Soc. N. H., 196–197, 1839.
- Scaphinotus heros* Roesch., Ann. Mus. Nat. Hung., V, 142–143, 1907.
- Scaphinotus unicolor heros* Leng, Journ. N. Y. Ent. Soc., XXII, No. 2, 141–142, 1914.
- Scaphinotus unicolor shoemakeri* Leng, Journ. N. Y. Ent. Soc., XXII, No. 2, 141–142, 1914.
- Scaphinotus elevatus* var. *floridanus* Leng, Bull. Am. Mus. Nat. Hist., XXXIV, 564, 1915.

This splendid species is found on both sides of the Alleghany Mountains, on the east side from the District of Columbia and Maryland to Florida and on the west side in Ohio, Indiana and Missouri. There has been for a long time confusion with regard to it, many of the early workers confusing it with *viduus* Dej. even though Say recognized the difference when he sent a specimen of the latter to DeJean to be described, and with *elevatus* Fabr. In recent years numerous specimens of both have been collected so that a study of these in connection with the original description and those types which still exist has made it possible to clear up the confusion. Roeschke and Leng have been chiefly responsible for this. In a species that is rather widely spread it is not surprising to find that it breaks up into several divergent forms or weak subspecies which are, however, sufficiently different to be recognized. These I will now attempt to define.

KEY TO SUBSPECIES OF *S. UNICOLOR*

1. Rather large, 25 mm. or more in length 2
- Somewhat smaller, 21 mm. in length and with reflexed sides of prothorax but slightly elevated *floridanus*
2. Unicolorous, shining black or in strong light a very deep violet, the reflexed sides of pronotum strongly elevated so that the transverse diameter of prothorax is very much less than that of the elytra; the latter with margins at middle very feebly sinuate if at all *unicolor*

- Deep violet above, the elytra generally lighter in color and more brilliant than the forebody, the reflexed sides of pronotum generally more obtusely elevated so that the transverse diameter of prothorax is but little narrower than base of elytra 3
3. Side margin of elytra behind middle very feebly if at all emarginate and sinuate *heros*
 Side margin of elytra behind middle very distinctly emarginate and sinuate *shoemakeri*

Scaphinotus unicolor (Fabricius) *sensu stricto*

Large, robust, black and shining above with but the faintest violaceous tint in strong light. Head with front smooth, eyes but moderately convex, first four antennal segments glabrous. Prothorax generally somewhat broader than long, 1 mm. or over, apex rather deeply and abruptly emarginate, apical angles narrow yet well rounded and close to apical margin, sides broadly arcuate and gradually divergent to beyond middle then almost straight or feebly arcuate and slightly convergent posteriorly, the reflexed sides of moderate width in front and much incurved and rather broad behind the middle where also less acutely elevated than in front and much flatter and with bead-ing less pronounced, hind angles broad, subacute but rounded at apices, extending fully 1.5 mm. behind base and with shallow sulcus parallel to and within hind margin; disk feebly convex, more or less smooth, with median longitudinal impression linear and well marked, the subapical and subbasal transverse impres-sions distinct, and rather strongly, sparsely punctured apically, basally and along the base of the reflexed sides as well as upon the inner face of the sides themselves. Elytra one third longer than broad, transverse at base, with sides moderately arcuate, side margin straight or feebly sinuate back of middle, and gradually convergent and feebly sinuate before apex, the re-flexed margin broad at humeri and narrow behind; disk moderately convex, striae regular and well impressed medially, irregular or confused at sides, and with fine, rather closely placed punctures, the intervals slightly broader than striae, feebly crenulate and but moderately convex. Beneath smooth in front; epipleura coarsely, closely punctured and rugose; meso- and metapleura and sides of three basal abdominal seg-ments sparsely and gradually more finely punctured posteriorly, the remainder of abdomen smooth; hind coxal plates

with only one posterior seta. Length 25–28 mm., breadth 12–14 mm.

Males with terminal segments of palpi broadly dilated and spoon shaped as usual; the anterior tarsi elongate and but very little dilated, the first segment about four times as long as broad and with but a small papillose area near apex beneath, hardly more than a fourth of the length of segment, the second segment about twice as long as broad and this as well as the two following segments somewhat cuneate and papillose beneath.

The typical *unicolor* as described above was first described by Fabricius in 1787 from a specimen in the Hunterian Collection at Glasgow. Recently Staig (1931) restudied the type, redescribed and figured it in his work on "The Fabrician Types of Insects." No locality was given for the specimen, but the probabilities are that it came from the South Atlantic States as surmised by Leng. Recently H. P. Löding has collected quite a number of specimens of this species in northern Alabama, which agree in every regard with the original description as well as that given by Staig. These specimens as indicated in my description are unicolorous black with but the faintest violaceous tint in strong light. In Staig's work the illustration is too highly colored. Dr. Staig has informed me, however, that the type itself is not so brightly colored. I am inclined to believe that these black Alabama specimens are typical. In examining a number I also find that there is a good deal of variation, chiefly as regards the degree to which the reflexed margins of the prothorax are elevated; in some where they are more widely separated and flattened, the apices of the hind angles are about 8 mm. apart while in others, the margins are much more abruptly elevated and closer together with the hind angles but 5 mm. apart. In all of these specimens the sides of elytra back of middle are feebly emarginate and sinuate.

Scaphinotus unicolor shoemakeri Leng

Scaphinotus unicolor shoemakeri Leng, Journ. N. Y. Ent. Soc., XXII, 143, fig., 1914.

This very weak subspecies differs primarily from the more typical form by being generally larger; of a decidedly violaceous color with the elytra quite brilliant and contrasting with the darker pronotum, hence somewhat bicolored; and by having the sides of elytra behind the middle more definitely emarginate and sinuate. The reflexed margins of prothorax are also somewhat variable as

to degree of elevation. The type which is now in my collection, deposited in the California Academy of Sciences, and most of the specimens in collections have been collected near Washington, D. C., either on the Maryland or Virginia side of the Potomac River. Other specimens seen which cannot be separated from the above, have been collected at Monte Sano, Madison Co., Alabama, by H. P. Löding, indicating that the subspecies range along the eastern flanks of the Alleghanies for a considerable distance. In Alabama certain specimens also show that it grades gradually into the typical *unicolor*. I consider it but a very weak subspecies at most.

Scaphinotus unicolor heros Harris

Scaphinotus heros Harris, Boston Journ. Nat. Hist., 196–197, 1839.

The type of *heros* Harris which came from Ohio has been lost. From the description, however, I am inclined to agree with Leng (1914) that it is not absolutely identical with *unicolor* but a very weak race or subspecies of the same characterized by having the elytra a pronounced violet color, quite shining, and contrasting with the somewhat duller forebody as does *shoemakeri*, and by having the sides of elytra behind the middle with but the feeblest indication of an emargination or sinuation, in this latter regard approaching the typical *unicolor*. The degree of reflection of the sides of pronotum is so variable among individuals that I consider it of no great value for defining races. All specimens from west of the Alleghanies as from Ohio, Indiana, Kentucky, Tennessee and Missouri might be considered as of this subspecies. It is, however, a very weak one like *shoemakeri*.

Scaphinotus unicolor floridanus Leng

Scaphinotus elevatus var. *floridanus* Leng, Bull. Ann. Mus. Nat. Hist., XXXIV, 564, 1915.

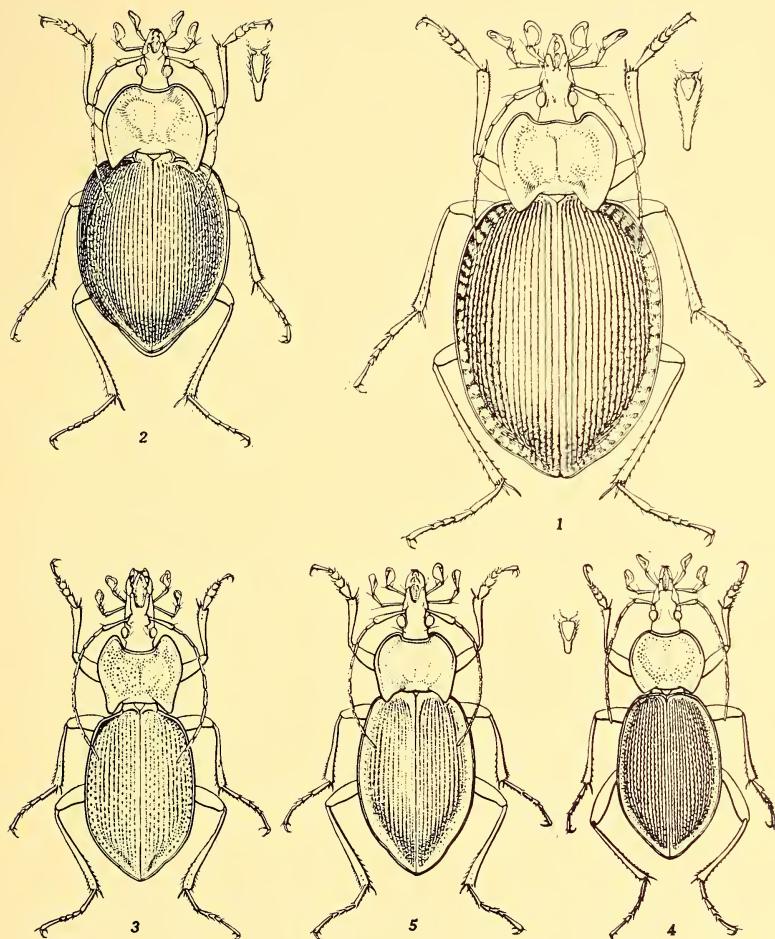
As indicated previously, I consider *floridanus* as but a depauperized variety or subspecies of *unicolor* not a variety of *elevatus* as supposed by Leng. The type is now in my collection, deposited in the California Academy of Sciences. A careful examination shows that the posterior portion of the hind angles of the prothorax has a feeble sulcation parallel to the hind margin, a diagnostic character of *unicolor*, not flattened as in *elevatus*. The pronotal sculpturing and type of male tarsi is also that of *unicolor*, not that of *elevatus*. The characters that separate it from typical *unicolor* are its smaller

size, length 21 mm., the reflexed side margins of prothorax but little elevated and with the beading very much thickened and the discal area strongly punctured at sides. In color it is a very deep violet, almost black and unicolorous, thus in agreement with typical *unicolor*. As stated by Leng, the type of *floridanus* was originally in the Schaupp collection, then passed into the hands of Luetgens and later to Leng and finally to me.

EXPLANATION OF PLATE IV

- Fig. 1. *Scaphinotus unicolor* (Fabr.), with greatly magnified 1st seg. of ♂ front tarsus.
- Fig. 2. *Scaphinotus elevatus* (Fabr.), with greatly magnified 1st seg. of ♂ front tarsus.
- Fig. 3. *Scaphinotus kelloggi* (Dury).
- Fig. 4. *Scaphinotus snowi* (Lec.), with greatly magnified 1st seg. of ♂ front tarsus.
- Fig. 5. *Scaphinotus mexicanus* (Bates).

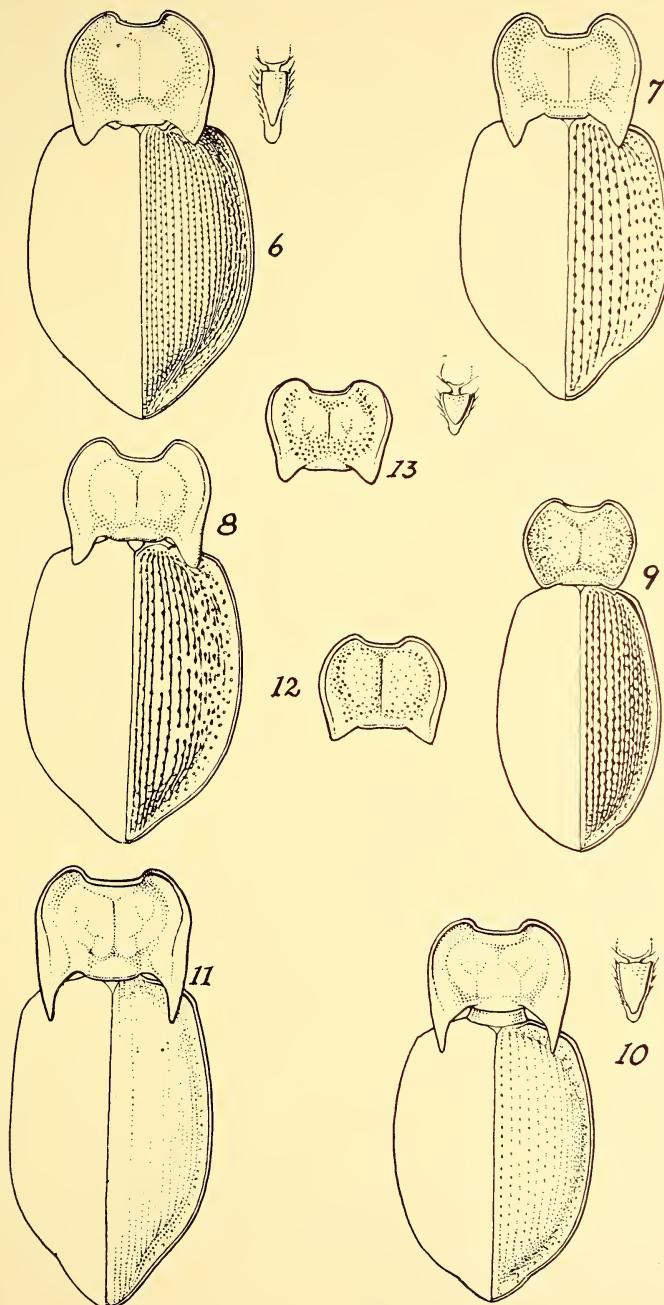
Figures magnified five times.



EXPLANATION OF PLATE V

- Fig. 6. Body of *Scaphinotus elevatus coloradensis* Van Dyke,
with greatly magnified 1st segment of ♂ front tarsus.
- Fig. 7. Body of *Scaphinotus petersi* Roesch.
- Fig. 8. Body of *Scaphinotus biedermannii* Roesch.
- Fig. 9. Body of *Scaphinotus snowi* var. *parkeri* Van Dyke.
- Fig. 10. Body of *Scaphinotus horni* Van Dyke, with greatly mag-
nified 1st seg. of ♂ front tarsus.
- Fig. 11. Body of *Scaphinotus macrogonus* Bates.
- Fig. 12. Prothorax of *Scaphinotus roeschkei* Van Dyke.
- Fig. 13. Prothorax of *Scaphinotus petersi* var. *catalinae* Van Dyke,
with greatly magnified 1st segment of ♂ front tarsus.

Figures magnified five times.



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THE AMERICAN PATROBINI (COLEOPTERA, CARABIDAE)

By P. J. DARLINGTON, JR.

MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE, MASS.

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INTRODUCTION AND ACKNOWLEDGMENTS

This paper is intended to revise the American genera and species of the Carabid tribe *Patrobini*, a group badly in need of revision as a result of the arch-conservatism of George Horn and the vile "Observations" of T. L. Casey, and then to utilize taxonomic and other data to reconstruct, so far as possible, the history of the species of *Patrobus* in America. Coleopterists are so far from agreement on the conceptions and methods underlying taxonomy, however, that a good deal of discussion of generalities is necessary before the real work of the paper can be begun.

The material I have used is, first, that in the Museum of Comparative Zoölogy, Harvard University. This includes Leconte's types; probable cotypes of several species received by Leconte from Eschscholtz, Mannerheim, and Motschulsky; and series from Labrador (Asa S. Packard and Samuel Henshaw) and Newfoundland (Percy Gardner Bolster). During the course of the work I have visited the United States National Museum, which contains the Casey Collection as well as much other material; the American Museum of Natural History; and the Philadelphia Academy of Sciences, which contains the George Horn Collection. I have borrowed material for further study from some of these institutions and from the California Academy of Sciences, the Canadian National Collection, and the University of Kansas, as well as from Mr. John Carr (collection of F. S. Carr), Dr. H. C. Fall, Mr. C. A. Frost, Dr. M. H. Hatch, Mr. Ralph Hopping, Mr. H. B. Leech, Mr. Howard Notman, Mr. J. B. Wallis, Mr. G. Stace Smith, and Miss Edith Mank. I am indebted also, for various favors, to Dr. E. C. Van Dyke, Dr. Walther Horn, Mr. W. J. Brown, Mr. L. L. Buchanan, Mr. H. P. Löding, Mr. M. W. Sanderson, and Dr. F. M. Carpenter. I have used, also, material from my own collection, including Labrador specimens given me by Mr. John D. Sherman, Jr. Several European *Patrobus* have been received by exchange from Dr. Carl H. Lindroth and Dr. Walther Horn, and other Old World species have been purchased from Staudinger and Bang-Haas.

NOMENCLATORIAL UNITS

The criteria which I have used to decide whether given forms should be called *species* or *subspecies*, in cases where morphological differences are not decisive, are these: two closely allied forms are species if their ranges overlap without definite intergradation (*Platidius aterrimus* and *flicornis*, Pl. 4, map A); subspecies, if their

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ranges are complementary or nearly so, especially if there is intergradation at the boundary (*Patrobus fossifrons dimorphicus* and *P. f. stygicus*; see discussion under latter), or if the two forms occupy similar but discontinuous habitats and are unquestionably slightly modified forms of a single original stock, even if their ranges are not in contact and if no intergradation occurs (*Thalassotrechus barbara*e *barbara*e and *T. b. nigripennis*, footnote 3). These criteria work reasonably well, although there is room for differences of opinion in some cases. They make the subspecies a purely geographical concept, usage which is becoming more or less standardized in zoölogy. Non-geographical variations, often called varieties or aberrations, are here regarded as not worth special names, by which, of course, I do not mean that they are not worth study. Too many coleopterists make no distinction between what is worth examining and recording and what is worth naming. The Patrobini, like many other boreal Carabidae, are often extremely variable individually,¹ so that it is necessary to be conservative in making subspecies. In certain species there are minor, average, inconstant differences which distinguish series from nearly every different locality. Such local resemblances are probably of about the same significance as family resemblances among human beings. To attempt to distinguish and name such indefinite forms (as Casey tried to do) would lead to endless confusion. Sometimes, too, species show slight, continuous geographical variation in certain structures (e.g., the development of the tooth near the apex of the phallobase in males of *Patrobus longicornis*), but I do not believe that this justifies a division into subspecies unless there is a distinct break in the range of variation.

Subgenera can probably be usefully employed in several ways. They may be geographical, like subspecies; i.e., groups of species inhabiting different geographical areas may conveniently be treated as subgenera if the groups are natural but not distinct enough to stand as full genera. Subgeneric names may profitably be used, too, to designate poorly defined but natural groups of species in large genera which would otherwise be unwieldy. Or subgenera may be used, as in *Patrobus* in this paper, to emphasize important phylogenetic relationships.

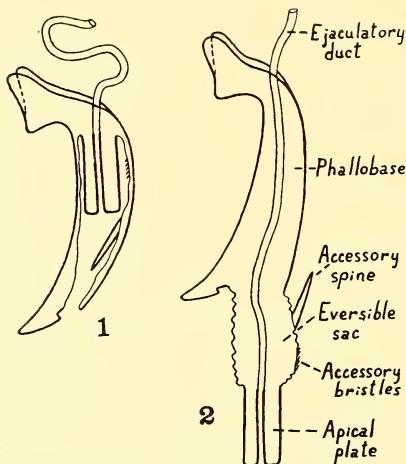
On the other hand, it seems to me that neither the subspecies nor the subgenus should be used, as they sometimes are, merely to desig-

¹ This is perhaps the result of alternate periods of isolation and mixing of poorly defined local forms in the north, during and immediately following successive Pleistocene glaciations.

nate groups about which an author is doubtful or ignorant. The description of these categories should require more rather than less knowledge than the description of full species and full genera, for to describe the latter it is not absolutely necessary to know more than that they are *different* from previously described forms, while the proper description of subspecies and subgenera requires a thorough knowledge of *relationship and of difference*. Properly employed, the concepts of subspecies and subgenus are very useful, but, if they are improperly used, they are likely to make an already confusing system of taxonomy still more confusing.

GENITALIA

The male copulatory organs of Patrobini, as usual among Carabidae, consist of a median lobe and a pair of lateral lobes or parameres.



Text Figs. 1 & 2. Diagrams of middle lobe of male genitalia of *Patrobus*, from left. Fig. 1, with eversible sac retracted as it usually is in museum specimens; fig. 2, with eversible sac extended.

The median lobe (Text figs. 1 and 2) is derived from a single continuous tube which is, however, modified to form a basal piece or phallobase (called also the tegmen), an eversible sac, and an ejaculatory duct.

The phallobase is an asymmetrical, strongly chitinized, trough-like or tube-like organ with a hook-shaped base. It is open pos-

teriorly and dorsally, or the sides may overlap dorsally, but without fusing. In repose, the phallobase lies on its right side in the abdomen; at such times it contains and protects the delicate eversible sac. During copulation the phallobase is exserted and performs the first entry into the abdomen of the female. The hooked basal portion of the phallobase then serves to hold the tip of the abdomen of the male securely to that of the female while the sac is everted through the apical trough- or tube-like portion. The function of the phallobase is, therefore, that of an anchor and protective casing through which more delicate organs perform insemination.

The eversible sac is extremely variable even in the single tribe *Patrobini*, but some part of it is always so lightly chitinized that it can be reversed like the finger of a glove as the sac is drawn out of or back into the phallobase. Rarely the sac is simple and little differentiated (*Patroboidea*), more commonly it is divided into a soft eversible portion and a chitinized apical spine or plate. The eversible portion may be divided in turn into a less and a slightly more chitinized (but still pliable) part, and the latter may be provided with many small bristles (*Platidius*), or the sac may be provided with one or two conspicuous accessory spines and sometimes with special, pigmented, localized patches of bristles (*Patrobus*). (See Text figs. 1 and 2 for diagrams; Pl. 1, figs. 1-4 for drawings of eversible sacs of *Platidius* and *Patrobus*.) The accessory spines and bristles are, I think, invariably adaptations to aid in the folding and unfolding of the sac. I have not studied the muscles of the copulatory organs, but it is obvious that the sac is everted chiefly by fluid pressure, not by muscles. The accessory spines, which emerge from the phallobase point first and then turn backwards, must act as levers aiding both the drawing out and, later, the refolding of the sac into the phallobase. They probably tend to prevent the sac from crumpling irregularly, as a simple sac operated partly by fluid pressure might do. The areas of bristles are probably creeping organs which help to carry the unfolding sac into the vaginal cavity of the female and which may help also in orderly refolding.

The apical plate of the eversible sac may be simple and spine-like (*Platidius*) or very complex (*Patrobus*). Through its base, but not always through its whole length, the sperm is actually discharged, and it is sometimes, therefore, called the "transfer apparatus." However, this is probably not a good term, for it implies more than is really known about the organ's function. Its primary function is probably that of an apodeme which strengthens the eversible sac at the point where the ejaculatory duct is attached, and which may

serve also as an attachment for retracting muscles. In some Patrobini I think the apical plate has, for one of its functions, merely to simplify the folding and unfolding of the eversible sac. A mechanism consisting of two telescoping tubes (phallobase and apical plate of *Patrobus*) connected by a membrane is probably much simpler in operation than a single tube into and out of which a voluminous undifferentiated sac must be forced partly by fluid pressure. This is more than a guess. I have found it much easier artificially to evert sacs with well developed than with poorly developed apical spines or plates. For example, it is easier to push out with a blunt pin the sac of *Platidius aterrimus*, which has a stiff apical spine, than of *P. filicornis*, in which the apical spine is membranous, and the sac of *Patrobus foveocollis*, which has an enormous apical plate, is the easiest of any of the *Patrobus* to evert.

The ejaculatory duct is a slender tube running from the testes through the phallobase and eversible sac, and attached to the apex of the latter, to the base of the apical plate or spine if one is present, so that the duct is drawn out when the sac is everted. The duct, of course, actually carries the sperm; all the other parts of the copulatory apparatus serve merely to draw out the duct and later to return it to its place in the male abdomen.

The lateral lobes or parameres of the male copulatory organs articulate with the base of the phallobase (left paramere outlined in Pl. 1, fig. 6; Pl. 2, figs. 18, 28, 38; Pl. 3, figs. 55, 70, 77). In the Patrobini the right and left parameres are approximately equal. They are tipped with setae, and are probably tactile organs.

In the female there are three pairs of retractile, chitinized plates at the tip of the abdomen. These are often called the female genitalia, but functionally they are probably as much concerned with excretion, oviposition, and other activities involving the tip of the abdomen as with copulation. It is better to call them retractile plates than genitalia. The latter name should probably be reserved for the vaginal cavity, the ovaries, and the other parts of the true genital system. The latter sometimes is not even mentioned in papers on "female genitalia"!

The male copulatory organs are extremely useful in taxonomy of Patrobini. The form of the apex of the phallobase, beyond the sub-apical orifice, yields useful specific characters. The position and form of the plates and spines of the eversible sac frequently distinguish species and genera, and are particularly useful in showing true relationships among groups of superficially similar species. Details of the phallobase and eversible sac are often too unstable to

be used in classification of higher categories, but the parameres are more stable and yield tribal as well as generic characters. There are slight *and inconstant* differences also in the form of the retractile plates of female *Patrobus* of different species, but the differences are of little practical use and add nothing to our knowledge of phylogeny. There are variations also in the structure of the vaginal cavity of different *Patrobus*. These variations seem to be somewhat correlated with the form of the apical plate of the male copulatory organs, but it is difficult to make proper dissections, and the females can be identified better by other characters.

It should be noted that there is often great variability in the genitalia of single species of Patrobini. The variation is both individual and geographic, and occurs in both sexes. For this reason genitalic characters in the Patrobini must be tested as carefully as any other characters, by examination of series of specimens and correlation with other structures.²

INNER WINGS

Recently (1936) I have described the variation of the wings of certain Carabidae and the correlations which usually exist between the state of the wings and the habitat of the insects. The wings of different American Patrobini range from a uniformly full, through dimorphic, to a uniformly vestigial condition, and the correlation between the state of the wings and the habitat of the insects is about as described in the paper cited. The majority of the species (those of *Patroboidea*, *Platypatrus*, and *Platidius*, and *Patrobus septen-*

² The very fact that striking genitalic characters so often distinguish otherwise similar species of insects suggests that the genitalia are more variable than other parts of the body, for rapid evolution of differences practically requires great individual variation. In some cases the variation can be seen in nature. For example, in *Platidius aterrimus* the apex of the phallobase of the male genitalia (Pl. 3, figs. 89-92) is more variable than any other part of the insect. It seems probable that the genitalia of insects, like their wings, may sometimes undergo mutation and dimorphism, and that two or more distinct forms of genitalia may exist in one species at one time and place. The difference in form of the apex of the phallobase in *Patrobus fossifrons dimorphicus* and *P. f. stygicus* (see discussion under latter) is very suggestive of mutation and dimorphism overlain by a certain amount of other variation. It would be interesting to see certain recent taxonomic papers reviewed with the possibility of mutation and dimorphism in mind.

trionis) are probably always fully winged and capable of flight, and are probably all strictly riparian hydrophiles, except that *Patrobus septentrionis* is merely a facultative hydrophile, and that the habits of *Platypatrobus* are unknown. The wings of the remaining American species of *Patrobus* are dimorphic, but not uniformly so. *Patrobus longicornis* is probably dimorphic throughout its entire range. Typical *lecontei* of north-central North America is dimorphic, too, but its subspecies *gravidus* of Newfoundland has the wings uniformly vestigial in the small series seen. The three subspecies of *Patrobus fossifrons* show the whole range from uniformly vestigial (typical *fossifrons* of islands off Alaska), through dimorphic (subspecies *dimorphicus* of western continental regions), to uniformly full wings (subspecies *stygicus* of central and eastern boreal America). Finally *Patrobus foveocollis* of the Aleutian Islands, and its North American subspecies *tenuis*, have uniformly vestigial wings, but a subspecies from islands off Kamchatka has the wings uniformly full, although it is otherwise indistinguishable from *tenuis*. All the American species of *Patrobus* are less strict hydrophiles than the fully winged genera of Patrobini, but they are still facultative hydrophiles, except that *foveocollis*, the only species which is always flightless in America, seems to have become a more or less strict mesophile.

ISLAND FORMS

There is an obvious tendency for several species of *Patrobus* to develop large insular subspecies on the islands of Unalaska and Newfoundland. This might be an interesting subject for special study. The state of the wings in some insular *Patrobus* is of interest, too. I have been accumulating data on the wings of mountain and island Carabidae for several years, and hope eventually to publish a paper on the subject.

GEOGRAPHICAL DISTRIBUTION

Most American Patrobini have moderately wide or very wide ranges. In mapping them (Plates 4 & 5) I have shown not only specific localities, but the approximate gross ranges of the species, to enable the reader to appreciate more easily both the extent of different ranges and their interrelationship. It must not be forgotten that the gross ranges are only approximate. It should be remembered especially that I have seen very little material from the far north between the coast of Labrador and that of southern Alaska, so that the northern limit of range of the arctic species is almost unknown.

If the maps are looked at obliquely from the direction of the lines which mark any given range, it will be found that that range will stand out more sharply than the others.

METHODS

My descriptions have been drawn from small series of each species, selected to show extremes of variation, but important characters have been checked in all material. All relative proportions of parts of the body (*e.g.*, the width of the head in relation to the prothorax) have been determined by actual measurements made with a ruled ocular in a binocular microscope. As for the male copulatory organs, the tip of the phallobase is often sufficiently exerted for identification in ordinary museum specimens. When not, the specimens have been relaxed, the abdomens removed, and the copulatory organs dissected out from above. Both the organs and the abdomens have usually then been mounted with shellac on points under the specimens. This has the advantage of allowing the state of the inner wings to be seen from below. Genitalia to be dissected or everted or drawn in detail have been softened in 10% caustic potash (half an hour or more, cold), manipulated in alcohol, drawn in alcohol or xylol, and finally mounted on slides.

The references cited under the different species do not include incidental references or records from faunal lists. So many of the species of *Patrobus* (except *longicornis*) have been misidentified in the past that most published records are worthless.

The tribe Pogonini of Horn (1881, p. 135) and others, which is the same as the Trechini of Sloane (1923, p. 245), is unnatural and must be divided into three groups, each of which is usually now called a tribe. The American representatives of the three may be separated as follows:

KEY TO TRIBES

1. Frontal foveae deep, regular, curving around behind eyes; ligula 8-setose at apex; (parameres of ♂ genitalia symmetrical or nearly so, compact, without elongate bases) *Trechini*
- Frontal foveae not extending behind eyes; ligula 2-setose 2
2. Head without basal constriction; (parameres very asymmetrical, left moderately large, right very small, both compact, without elongate bases) *Pogonini*³

³ Besides *Pogonus*, *Pogonistes*, and *Diplochaetus*, *Thalassotrechus* goes in the Pogonini, as might be inferred from Van Dyke's (1918,

- Head more or less constricted basally; (parameres approximately symmetrical, articulating by means of relatively slender basal projections) *Patrobini*

The tribe Patrobini as thus defined is equivalent to the Patrobidae of Chaudoir (1871, p. 39).

I am not prepared to discuss the affinities of the Patrobini, except to say that they are probably with some group of the Pterostichini rather than with the true Trechini.

pp. 303–304) discussion, although Horn first described *barbarae* as a species of *Trechus*. *Thalassotrechus* is not *Pogonus*-like in appearance, it lacks the internal elytral plica of typical Pogonini (notwithstanding Horn's and Sloane's classifications, *Pogonus* and its allies and *Patrobus* and its allies have this plica well developed), and it has the hind coxae slightly separated. However, these anomalies are probably merely the natural results of the adaptation of *Thalassotrechus* to an intertidal habitat. The inner wings of the insect have atrophied, as they have in so many seaside beetles; the metathorax has been reduced as a consequence of the loss of the wing muscles; and the elytra have at the same time been narrowed across the humeri, the narrowing being accompanied by a coaptive narrowing of the base of the prothorax. All this has resulted in a change from a *Pogonus*-like to a *Trechus*-like form. The change in shape of the metathorax may well have resulted in the slight change which has occurred in its relation to the hind coxae. And the loss of the elytral plica may conceivably be due to a change or partial loss of function of the elytra following the atrophy of the wings. The ♂ genitalia of *Thalassotrechus* (Pl. 1, fig. 5) are definitely of the *Pogonus* type.

Since I have had series of both known forms of *Thalassotrechus* for study, I give the following notes on their taxonomy. The two are best considered subspecies. *T. barbarae barbarae* (Horn) was described from Santa Barbara, California, and was rediscovered there a few years ago by the late Dr. J. G. Gehring. *T. barbarae nigripennis* Van Dyke, of which Dr. Van Dyke has very kindly supplied me with topotypes, was described from Moss Beach, just south of San Francisco, California, and is known from two or three other localities in the San Francisco region, which is about 300 miles by coast north of Santa Barbara. It is a very distinct subspecies, differing from typical *barbarae* in having the elytra duller and black rather than rufo-testaceous or castaneous. There is no constant difference in width of prothorax, but the anterior angles of the latter are minutely more flattened and more prominent in *barbarae* than in *nigripennis*. The ♂ genitalia of the two are not distinguishable.

KEY TO AMERICAN GENERA OF PATROBINI⁴

1. Elytra each with numerous dorsal setigerous punctures on third interval, with additional punctures basally on first and fifth intervals; (male unknown).... 2. **Platypatrus** gen. n.
- Each elytron with 3 (rarely 4) dorsal setigerous punctures on third stria or outer edge third interval 2
2. Palpi with apical segments subconical; genae longer than eyes; total length of insect less than 6 mm.; (δ genitalia with apices of parameres relatively short; phallobase open above; eversible sac without distinct apical plate or spine).
 1. **Patroboidea** Van Dyke
 - Palpi with apical segments subcylindrical, subtruncate; genae shorter than eyes; total length over 8 mm. (apices of parameres longer; sides of phallobase overlapping above; eversible sac with apical plate or spine) 3
 3. Relatively depressed; occipital constriction shallow; basal foveae of pronotum shallow; middle groove of pronotum faint or obsolete at base; mesosternal epimera broadly triangular; (eversible sac of δ genitalia with simple spine at apex, without accessory spines) 3. **Platidius** Chd.
 - More convex; occipital constriction deep; basal foveae of pronotum deep; middle groove of pronotum very coarse basally; mesosternal epimera narrow; (eversible sac with complex apical plate and 1 or 2 accessory spines).
 4. **Patrobus** Dej.

1. *Patroboidea* Van Dyke

Van Dyke 1925, p. 67.

GENOTYPE: *Patroboidea rufa* Van Dyke (Pl. 1, figs. 6-8) Van Dyke 1925, p. 69.

There is no point in repeating Dr. Van Dyke's recent good descriptions of genus and species. The male genitalia are like those of other Patrobini but with parameres only briefly produced at apex, sides of phallobase not meeting above, and eversible sac without dis-

⁴ Dr. Hatch (1935, p. 118) has recently pointed out that his *Monillipatrus* is a synonym of *Psydrus*. This genus probably belongs with the primitive Pterostichini, but is not very closely related to the Patrobini. The δ genitalia of *Psydrus* have the parameres symmetrical but are otherwise unlike those of the Patrobini. A proper understanding of the relationships of the Pterostichini and related groups would require an enormous amount of study and dissection, especially of exotic genera.

tinet apical plate or accessory spines, but apparently with several strong, parallel bristles near base.

Type: From Monroe, Washington State (California Acad. Sci.) (not seen by me).

Distribution: I have seen specimens from Stanley and Spious Creek, B. C. (the latter Van Dyke's paratype, now in the Canadian Nat. Coll.; the former received for the M. C. Z. through the kindness of Mr. Ralph Hopping) and Ft. Yukon, Alaska (Coll. H. C. Fall). The species seems to be rare everywhere. It is found under cover by streams.

2. *Platypatrus* gen. n.

A typical member of the Patrobini (= Patrobidae) as characterized by Chaudoir (1871, p. 39). Characterized within the tribe by rather depressed form; excessively prominent eyes; genae very short, with deep basal constriction of head immediately behind eyes; vertex and sides of head not hairy; frontal sulci well impressed; apical segments of palpi subcylindrical and subtruncate; prothorax with side margins plurisetose, basal foveae deep, middle groove very coarse basally; elytra with numerous setigerous punctures on intervals 1, 3, and 5; mesosternum plurisetose between coxae, with epimera moderately broadly triangular; appendages slender (general structure as in *Patrobus*); tarsi not hairy above, 4th segment of two anterior pair moderately broad, emarginate.

This genus does not fit very well into any of the subtribal groups proposed by Chaudoir (*l. c.*). The form and appearance are very *Nebria*-like. The extra setae of margins of prothorax and of the mesosternal process suggest the European genus *Deltomerus*, but in the latter the eyes are very much less prominent, much removed from the basal constriction of the head, and the vertex and sides of head are hairy. The new genus resembles *Patrobus* but is more depressed, with more prominent eyes, with more setae on thoracic margins, elytral intervals, and mesosternum, and with broader mesosternal epimera. Until the male is found and the copulatory organs examined it is useless to guess at the true relationships of the new genus.

GENOTYPE: *Platypatrus lacustris* sp. n. (Pl. 1, fig. 9).

Form as figured, rather broad, depressed; dark rufous; appendages slender, rufo-testaceous; head and prothorax shining, elytra finely alutaceous. Head $\frac{9}{10}$ width prothorax; eyes very prominent; frontal sulci well impressed, not punctate,

curved outward posteriorly, ending about opposite middle of eyes; front not transversely impressed; basal constriction deep, slightly punctate; antennae with 3rd segment between 3 and 4 times long as wide; maxillary palpi with apical segment $\frac{1}{4}$ longer than subapical; sides of neck below punctate; gular puncture weak. *Prothorax* cordate, not quite $\frac{1}{2}$ wider than long; sides arcuate anteriorly, strongly sinuate before right posterior angles; latter weakly carinate; side margins moderate, left with 4, right with 3 setae before middle, and each with seta at basal angle; basal foveae slightly punctate; anterior transverse impression moderate but not well defined posteriorly, with a few coarse punctures. *Elytra* not quite $\frac{2}{3}$ wider than prothorax; humeri moderately rounded, slightly narrowed; striae entire, slightly impressed, very finely punctate on disk; 3rd interval with 11 or 12 (over entire length), 1st with 1 or 2 (basally, outside scutellar stria), 5th with 5 or 6 (basal $\frac{1}{2}$) setigerous punctures. Inner wings full. Prosternum with a few punctures at sides anteriorly; mesosternum distinctly, metasternum less distinctly, punctate at sides; abdomen impunctate, alutaceous.

Measurements: ♀ just over 11 by 4.4. mm.

Type: Holotype ♀ (M. C. Z. no. 21, 781) unique from "Bachwng B,"⁵ Lake Superior, dated "15.8" (presumably August 15), from Hubbard and Schwarz in the Leconte Collection in the Museum of Comparative Zoölogy.

Distribution: Known only from the type locality. It is astonishing to find so distinct a new form from such a locality, but there is no reason to doubt the label. The genus is not very close to anything previously known even outside of America.

3. *Platidius* Chd.

Chaudoir 1871, p. 51.

GENOTYPE: *Patrobus aterrimus* Dej., by present designation (*Platidius* originally described for this species and *P. depressus* Gebler of Asia).

Platidius has been combined with *Diplous* Mots. (Asiatic), apparently as the result of some indecisive notes by Bates (1873, p. 295), but I prefer to follow Chaudoir until the synonymy can be settled

⁵ Spelled Bachewauung, Bachewauuaung, Batchawaung, and Batchawana Bay on various maps. It is a part of Whitefish Bay, eastern end of Lake Superior, Ontario, Canada.

more definitely. The genus is a natural one, related to *Patrobus* but differing in many details, the more important of which are given in the key to genera, above. The American species are mutually similar in appearance, depressed form, black color (elytra often brownish in *aterrimus*), full inner wings, and most other asexual characters, as well as in the general structure of the male copulatory organs. The males of our four species are easily separable by secondary sexual and slight genitalic characters; the females can usually be placed by the relatively slight asexual characters. All four species (I have taken them all) live in coarse gravel or among stones or under other cover beside brooks and rivers.

KEY TO AMERICAN SPECIES OF *PLATIDIUS* CHD.⁶

1. ♂ hind trochanters $\frac{3}{4}$ (rarely slightly less) to equal length of femora; ♂ hind tibiae curved at base; ♂ front femora tuberculate or angulate (sometimes faintly) below *near middle*; ♂ front tibiae curved; (prothorax subquadrate; average size larger) 1. *californicus* (Mots.)
- ♂ hind trochanters $\frac{1}{2}$ or less length of femora; ♂ hind tibiae not curved at base; ♂ front femora denticulate or subangulate *about $\frac{1}{3}$ from base*, or not modified; ♂ front tibiae straight; (prothorax more cordate; average size smaller) 2
2. ♂ hind trochanters usually pointed, about $\frac{1}{2}$ length femora (but somewhat variable); ♂ front femora angulate or dentate; (pronotum less rugosely punctate) (western America) 3
- ♂ hind trochanters more blunt, about $\frac{1}{3}$ length femora; ♂ front femora simple; (pronotum more rugosely punctate across base and apex) (eastern America) 4. *rugicollis* (Rand.)
3. Apex of phallobase (middle lobe) ♂ genitalia truncate, with left side irregular, angulate, or hooked; apical spine of eversible sac entirely chitinized; (body slightly larger, more depressed, with intervals of elytra usually flatter and duller) 2. *aterrimus* (Dej.)
- Apex phallobase rounded, left side not angulate nor hooked; apical spine of eversible sac chitinized only at base, membranous apically; (slightly smaller, less depressed, elytral intervals usually more convex and more shining). 3. *flicornis* Csy.

⁶ The following species are incorrectly cited as *Platidius* (or *Diplous*) in the Leng and Junk Catalogues: *obtusiusculus* Chd., *stygicus* Chd., *angusticollis* Mann. They will be found below under *Patrobus*.

1. *Platidius californicus* (Mots.)

(Male genitalia, Pl. 3, figs. 80-88; range, Pl. 4, map A)

Patrobus californicus Mots. 1859, p. 123 (listed previously in
Kaefer Russl. 1850, p. 6); *Lec.* 1869, p. 375; *Horn* 1875, p.
 131; *Patrobus trochantericus* *Lec.* 1869, p. 375; *Platidius*
californicus *Csy.* 1918, p. 399; *latipennis* *Csy.* 1918, p. 399;
incisus *Csy.* 1918, p. 399; *strenuus* *Csy.* 1918, p. 400; *rectus*
Csy. 1918, p. 400; *sierranus* *Csy.* 1918, p. 401; *breviusculus*
Csy. 1918, p. 401.

The important characteristics of this species are given in the key. The male genitalia have the apex of phallobase rounded, left side not hooked nor angulate; apical spine of eversible sac rounded-spatulate at apex, with base flatter and less trough-like than in other *Platidius*.

Measurements: ♂ 10.5⁷-17 by 4.1-5.6; ♀ 12-17 by 4.3-5.5 mm.

Types: *Californicus* was described by Motschulsky from near San Francisco, California; the type(s) are probably now in the Moscow Museum; there is a ♀ from Motschulsky in the Leconte Collection which may be a cotype (type no. 8,232). Leconte's *trochantericus* was from Fort Crook, northern California [in the upper Sacramento Valley]; the type is, of course, in the M. C. Z., no. 5,593. Casey's *latipennis* was from Mendocino and Humboldt Cos., California; *incisus*, south of San Francisco; *sierranus*, California (Mokelumne Hill, Calaveras Co.) and Nevada (Reno); *rectus* and *breviusculus*, Reno, Nevada; *strenuus*, Washington State. The Casey types are all in the U. S. N. M.; I have seen them.

Distribution: "South of San Francisco," California, to southern British Columbia, east to western Nevada and Montana. Including material borrowed, I have had 108 specimens of this species at the M. C. Z. for study, and have seen many additional elsewhere.

Discussion: There is a good deal of variation in size, development of male secondary sexual characters, exact shape of prothorax, relative lengths of segments of maxillary palpi (apical $\frac{1}{3}$ longer to scarcely longer than subapical), exact form of apex of phallobase (examined in more than 40 males) and of apical spine of eversible

⁷ Casey gives 9 mm. for the unique ♂ type of his *breviusculus*. This is correct for the specimen in its present position. However, with characteristic lack of discrimination, and in spite of the fact that he makes size one of the first characters in his key description of *breviusculus*, Casey fails to mention that the specimen is hunched up, and would measure at least 10.5 mm. if it were straightened.

sac (examined in several males from well scattered localities), and in some other characters, but I have been unable to divide the species into satisfactory subspecies.

2. *Platidius aterrimus* (Dej.)

(Male genitalia, Pl. 3, figs. 89-97; range, Pl. 4, map A)

Patrobus aterrimus Dej. 1828, p. 32; Horn 1875, p. 130 (part):

Patrobus fulcratus Lec. 1869, p. 374: *Platidius aterrimus* Chd. 1871, p. 51; *breviceps* Csy. 1918, p. 402: *tenuitarsis* Csy. 1918, p. 403: *coloradensis* Csy. 1918, p. 403: *reflexus* Csy. 1918, p. 403.

Distinguishing characters given in key. Male genitalia with apex of phallobase truncate, left side before apex irregular, angulate, or hooked; apical spine of eversible sac rounded or pointed at tip, more or less folded or trough-like at base, entirely chitinized.

Measurements: ♂ 9-12.5 by 3.3-4.4; ♀ 10-13 by 3.6-4.5 mm.

Types: Described by Dejean from specimen(s) received from Eschscholtz, from Norfolk Straits, northwest coast of North America; type probably now in Oberthür Coll. This type locality is probably the old Norfolk Sound, near Sitka; there is a ♀ in the Leconte Collection labeled, “*P. aterrimus!* Sitka Esch.” which may be a cotype. Leconte’s *fulcratus* (type in M. C. Z., no. 5,594) was from Vancouver Island; all of Casey’s species (types seen by me, all in U. S. N. M.), from Colorado, where no *Platidius* except *aterrimus* is known to occur. *Coloradensis* is more specifically from Red Cliff; *breviceps*, from Boulder Co.

Distribution: Southern Alaskan coast south to central Oregon, east to Edmonton, Alberta, and southeast to Colorado. Altitudinal range is from sea level on the coast to from 7,000 to 10,000 ft. in Colorado (extremes of 10 Colorado localities of which altitudes are given). I have had 178 specimens (many borrowed) at the M. C. Z. and have seen more in other museums.

Discussion: My identification of *aterrimus* is based upon specimens from Sitka, which is certainly very near the type locality. Besides Eschscholtz’ female mentioned above, I have seen and dissected a male collected at Sitka by T. Kincaid and now in the U. S. N. M. I think that the present species is the only *Platidius* which occurs as far north as the Sitka region. There is a good deal of individual variation in size, in color, and in form of apex of phallobase of male genitalia. Some of the variation is indefinitely geographic—coastal specimens run smaller and blacker than those from Alberta, and coastal males usually have the apex of the phallobase

only weakly angulate on the left side, but coastal specimens can be matched in all characters by some of those from the interior, especially from Colorado and Utah. Individual variation is so great that I cannot define recognizable subspecies. Males from single localities in southern British Columbia show almost the entire range of variation of apex of the phallobase. I have examined this character in practically all the males I have had for study; the spine of the eversible sac has been examined in relatively few specimens, but from well scattered localities.

3. *Platidius filicornis* Csy.

(Male genitalia, Pl. 3, figs. 98–101; range, Pl. 4, map A)

Patrobis aterrimus Horn 1875, p. 130 (part) : *Platidius filicornis* Csy. 1918, p. 404.

Differs from *aterrimus* as described in key above and in discussion below. Male genitalia with apex of phallobase rounded, left side before apex oblique, not angulate nor hooked; apical spine of eversible sac irregularly rounded or spatulate at tip, more or less folded at base, strongly chitinized only at base, membranous apically.

Measurements: ♂ 8.5–11.5 by 3.2–3.9; ♀ 10–11.7 by 3.7–4.1 mm.

Type: A ♀ from Redwood Creek, Humboldt Co., California, in U. S. N. M.; I have seen it.

Distribution: Besides the type, I have seen 40 males, 24 females, from northern California to southern British Columbia. As compared with the related *aterrimus* in the coastal part of its range, *filicornis* seems usually to occur along smaller brooks and at higher altitudes. It is characteristic of the streams on the slopes of Mt. Hood and Mt. Rainier, for instance, and sometimes ranges up nearly to the foot of the glaciers (White River Glacier and Zigzag Cañon, Mt. Hood). However, its range probably overlaps that of *aterrimus*, for *filicornis* occurs also below 1,000 ft. In several cases the two species are known from the same localities; I have males of each, well characterized by both external and genitalic characters, from Spious Creek and from mountains between Hope and Okanagan, British Columbia.

Discussion: This species averages smaller than *aterrimus*, slightly more convex, with elytral intervals almost always more convex, although there is some variation in both species. Individual variation in form of prothorax, presence or absence of carinae in basal angles, development of male secondary sexual characters, and in some other details is much greater within each species than any difference between the two. I consider *filicornis* a species rather than a sub-

species of *aterrimus* because the two remain distinct even where their gross ranges overlap. In *filicornis* as in *aterrimus* I have examined the apex of the phallobase in practically every male specimen I have seen. I have dissected out the spine of the eversible sac in only a few specimens, but from well distributed localities.

4. *Platidius rugicollis* (Rand.)

(Male genitalia, Pl. 1, fig. 1; Pl. 3, figs. 77-79)

Patrobus angicollis Rand. 1838, p. 1 (misprint) : *rugicollis* Rand. 1838, p. 560 (list errata); Horn 1875, p. 130: *Patrobus longipalpus* Notman 1919, p. 231.

Sufficiently defined in key. Male genitalia with apex of phallobase rounded, left side not angulate nor hooked; apical spine of eversible sac more or less pointed at tip, folded at base, entirely chitinized.

Measurements: ♂ 10-11 by 3.7-4.0; ♀ 9.5-12.0 by 3.5-4.2 mm.

Types: Randall's type, from Hallowell, Maine, is probably lost; I here designate as neotype a male from Grafton Notch, near Bethel, Maine, collected by Dr. J. G. Gehring (type no., M. C. Z. 23,357). Notman's type, a ♀ from Keene Heights, Essex Co., New York, is in Mr. Notman's collection, where I have seen it.

Distribution: Northeastern North America. I have seen a good series from Nova Scotia (Port-au-Pique) and "Canada," Maine (Bethel), Vermont (Clarendon), New Hampshire (various localities in the White Mts.), New York (including Adirondack and Catskill Mts.), and "Pennsylvania." In the White Mts. the species is usually found locally beside large streams in the "notches" or at the foot of the larger mountains, at 1,000 or 2,000 ft. altitude. It has been recorded also from the summit of Mt. Washington, but is certainly not established there.

Discussion: The proportions of the segments of the maxillary palpi (apical $\frac{1}{2}$ longer than subapical) used by Notman to distinguish his species from *rugicollis* (apical segment relatively shorter) are within the range of variation of *rugicollis* from New Hampshire. I have no doubt of the synonymy.

4. *Patrobus* Dej.

Dejean 1821, p. 10.

GENOTYPE: *Carabus atrorufus* Stroem.^s

This genus is sufficiently defined in my generic key; for a bibliog-

^s The name *Patrobus* was first proposed by Megerle in correspondence. So far as I can find, however (and Dr. Walther Horn

rathy of the genus see the *Junk Catalogue*, Vol. 2, p. 337 (Pars 98, by E. Csiki, 1928). The following is not a definition of the genus but a discussion (for the American species) of some characters which can be disposed of more economically by generalities than by repetition under the species.

Form, including degree of ventricosity, often variable, usually not dependable in classification; surface of head and pronotum always nearly smooth and shining (except as punctate in impressions or foveae), that of elytra finely alutaceous. Under high power the alutaceous micro-sculpture of the elytra is seen to consist of very fine reticulations which are strongly transverse in *longicornis*, more weakly or not transverse in other species. Head: eyes moderately prominent, but sometimes variable in individuals; front between eyes not or slightly transversely impressed (variation individual in all species); basal transverse constriction deep, more or less punctate; antennae uniform in general structure, variable in stoutness in different species (third segment 4 or more times long as wide in *longicornis*, between 2 and 3 times in *foveocollis*, intermediate in other species); maxillary palpi slender, apical segment longer

has very kindly checked this for me), the name was not published until it was listed in the "Catalogue de la Collection des Coléoptères de M. le Baron Dejean," 1821, p. 10. Five species were listed under *Patrobus* in this catalogue: *rufipes* [Fab.], *excavatus* Payk., *foveocollis* Esch., *rufipennis* Hoff., and *americanus* Dej. The last three were at that time unpublished manuscript names, but the first two were previously described species, and their citation validates *Patrobus* Dej., 1821. One of these two previously described species must be taken as the genotype of *Patrobus*, and Curtis (1827, p. 192) has fixed the genotype as the first, *Carabus rufipes* Fab. All this would be simple enough except that *Carabus rufipes* Fab. turns out to have been misidentified by Dejean and Curtis and to be not what we call *Patrobus* at all, but a species of *Calathus*. Nevertheless, *Patrobus* has invariably been applied to the insects now known by that name, and its meaning ought not to be changed by a technicality. I shall, therefore, follow Curtis and Andrewes (1935) in considering as the genotype of *Patrobus* the insect which Dejean and Curtis *incorrectly* called *Carabus rufipes* Fab., which is the insect now known as *Patrobus atrorufus* (Stroem). If this is not quite in accord with the rules for fixation of genotypes set forth by the International Committee on Zoölogical Nomenclature, it is to be hoped that a suspension of the rules may be obtained and the name *Patrobus* preserved in the sense in which it has always been used.

than subapical ($\frac{1}{4}$ or less longer in *longicornis*, about $\frac{1}{2}$ longer in other species); frontal foveae moderate, except subobsolete in *foveocollis*; sides of neck below punctate; single coarse gular puncture (concealed by prosternum if head depressed) present, except usually absent in *septentrionis*. *Prothorax* cordate or subcordate, often individually variable; median groove of pronotum very coarse basally; basal foveae large, deep, punctate; punctation of anterior transverse impression variable, as described for species below; basal angles finely carinate; lateral margins narrow (narrowest in *foveocollis*). *Elytra* with humeri always moderately prominent (never so narrowed as in some European species); striae entire, except usually obsolete at extreme apex in *foveocollis*, slightly impressed on disk (most impressed in *longicornis*), rather finely punctate (most coarsely so in *longicornis*); outer edge each third interval 3-punctate, rarely 4-punctate.⁹ Inner wings (Pl. 1, figs. 10-17) full, vestigial, or simply and asexually dimorphic; when vestigial, wing is narrow, strap-shaped, unfolded, reaching to or beyond middle of elytra in all species except *longicornis*, in which vestiges are much shorter. Punctuation of prosternum varies as described in species below; meso-, metasternum, and first ventral more or less lightly punctate at sides; abdomen otherwise impunctate, alutaceous; metepisterna always elongate, never so shortened as in some European species; last ventral segment with apex not or slightly emarginate;¹⁰ legs uniform in general structure, most slender in *longicornis*, stoutest in *foveocollis*. Males slightly smaller and slightly narrower (average) than females; anterior femora slightly stouter; first two segments each front tarsus moderately dilated, biseriately squammulose; 1 submarginal puncture each side last ventral (2 in ♀); copulatory organs as described and figured, varying as described in following key.

⁹ There are 4 setigerous punctures on the left, 3 on the right third interval in Leconte's type of *rufipes* (= *lecontei*); 4 on each side in a specimen of *foveocollis* from Russian America, although 3 is the normal number in the species. There are several published records of 4-punctate *Patrobus*; such individuals are probably to be expected occasionally in all species.

¹⁰ In *longicornis*, *lecontei*, and *fossifrons* the last ventral is usually emarginate, uncommonly not (both sexes); in *septentrionis* the reverse is true; in *foveocollis* the last ventral seems always to be entire.

KEY TO AMERICAN¹¹ SUBGENERA AND SPECIES OF *PATROBUS*¹²

1. Anterior transverse impression of pronotum, and middle of prosternum anteriorly, without distinct coarse punctures; (δ) genitalia with phallobase angulate, denticulate, or hooked on left side near apex; eversible sac twisted to left when within phallobase, long; apical plate moderate; accessory spine single, simple, deeply withdrawn into phallobase, not hinged to latter)..... (*Neopatrobis* subgen. n.) 2

¹¹ A key to the European species of *Patrobis*, which are distinguished by very different characters from the American ones, has been published by Roubal and Schaeferger (1928, p. 86). All the European species (about 5, all seen by me) belong to *Patrobis* s. s. and are closely related to *septentrionis*.

¹² Besides the living *Patrobis*, the following four fossil species have been described from the Pleistocene interglacial deposits of Ontario and Illinois.

Patrobis gelatus Scudder (1890, p. 530, Pl. 1, fig. 48) from the interglacial clays of Scarboro, Ontario. Known from a single pronotum (the type) in good condition, Scudder number 14,586, now in the M. C. Z. I have examined this specimen and find it represents a species extremely close to and possibly identical with the living *Patrobis fossifrons stygicus* Chd. which is widely distributed in northeastern North America to-day.

Patrobis decessus Scudder (1900, p. 73, Pl. 7, fig. 4) from interglacial deposits at Reservoir Park (Toronto) and Scarboro, Ontario. Known from 10 elytra: the type (by present designation) is the specimen figured by Scudder (his number 16,782), now in the M. C. Z. This species was supposed by Scudder to be related to the living *Patrobis* (= *Platidius*) *rugicollis* Rand. However, I have examined the fossil type and find that the humerus is formed as in typical *Patrobis*, much less prominent than in *Platidius*, and various details of sculpture (including the presence of a conspicuous ocellate puncture at base of elytron between the first and scutellar striae) show that this fossil species, like the preceding, was really similar to the living *Patrobis fossifrons stygicus*.

Patrobis frigidus Scudder (1900, p. 74, Pl. 7, fig. 6), also from Reservoir Park, Toronto. The type is a single elytron, Scudder number 16,793, and is in the M. C. Z. It is distorted, but is certainly a true *Patrobis*, not related to *Platidius rugicollis* as supposed by Scudder, and is in all probability the same species as the preceding. The profuse red speckling of the elytron is probably not natural but due to some accident of preservation.

Patrobis henshawi Wickham (1917, p. 140, no fig.) from the interglacial Sangamon Peat near Mahomet, Illinois. Known from the head, prothorax, and part of an elytron of one individual, the

- Pronotum anteriorly and/or prosternum at middle anteriorly with coarse punctuation;¹³ (left side of apex of phallobase neither angulate, dentate, nor hooked)¹⁴ 4
 - 2. Anterior transverse impression of pronotum very deep, sharply defined; legs strikingly pale 1. *longicornis* (Say)
 - This impression shallow and poorly defined 3
 - 3. Legs rufous; base of prothorax usually $\frac{1}{10}$ or more wider than head across eyes (by measurement) 2. *lecontei* Chd.
 - Legs dark; base of prothorax usually about equal to width of head across eyes¹⁵ 3. *fossifrons* (Esch.)
 - 4. Frontal foveae normal; wings full;¹⁶ (apex of phallobase beyond orifice short, not strongly sinuate; eversible sac not twisted when within phallobase, short; apical plate short; accessory spine single but with dilated base, hinged to phallo-
-

type, formerly in the museum of the University of Illinois, but said now to be lost. I can say nothing about the true relationships of the species. It comes from about the same horizon as Scudder's species and is about the same size.

In my opinion, Scudder's three fossil *Patrobus* are all based on fragments of a single species which was very similar to, and perhaps the same as, the living *P. fossifrons stygicus*. The true position of Wickham's species is unknown. I therefore propose the following tentative synonymy of North American fossil *Patrobus*:

1. *Patrobus gelatus* Scudder
(*decessus* Scudder)
(*frigidus* Scudder)
(?*fossifrons stygicus* Chd. (Recent))

2. (?)*Patrobus henshawi* Wickham

¹³ In American *septentrionis* the front of the pronotum in the region of the anterior transverse impression is usually rather closely punctate, the middle of the prosternum anteriorly often less so; in *foveocollis* the front of the pronotum is rarely almost impunctate, but the middle of the prosternum anteriorly is almost always conspicuously punctate. The punctuation character used in the key is not quite infallible, but it fails in probably less than 1% of American specimens of *Patrobus*.

¹⁴ In some European relatives of *septentrionis* (*Patrobus s. s.*) the phallobase is angulate or hooked on left side at apex.

¹⁵ The relative widths of head and of base of prothorax do not quite always separate *fossifrons* and *lecontei*—rare individuals of both species are intermediate—but the measurements are very helpful in most cases.

¹⁶ In some European relatives of *septentrionis* (*Patrobus s. s.*) the wings are vestigial.

- base by a lightly chitinized plate visible only when sac is everted, never deeply withdrawn into phallobase) (*Patrobus s. s.*) 4. *septentrionis* Dej.
- Frontal foveae more or less obsolete; wings vestigial in American specimens; (apex of phallobase long, sinuate; eversible sac not twisted within phallobase, long; apical plate very long and complex; two simple accessory spines more or less hinged to phallobase, not deeply withdrawn into latter) (**Geopatrobus** subgen. n.) 5. *foveocollis* (Esch.)

GENOTYPES OF SUBGENERA: for **Neopatrobus**, *longicornis* as here defined; for **Geopatrobus**, *foveocollis* as here defined; for *Patrobus s. s.*, same as for genus (the genotype, *atrorufus* Stroem, has the male genitalia almost identical in general structure with those of *septentrionis*).

The essential characters of the subgenera are in the armament of the eversible sac of the male genitalia. They can be seen most clearly in Pl. 1, figs. 2-4.

1. *Patrobus (Neopatrobus) longicornis* (Say)

(Wings, Pl. 1, figs. 11-12; male genitalia, Pl. 2,
figs. 18-27; range, Pl. 5, map C)

Feronia longicornis Say 1825, p. 40; 1859, p. 466: *Patrobus americanus* Dej. 1828, p. 34: *Patrobus longicornis* Chd. 1871, p. 48; Horn 1875, p. 130; Schaupp 1882, p. 56; 1882a, Pl. 1, figs. 2, 2a-d; Blatchley 1910, p. 87, fig. 55; Csy. 1918, p. 395; Darl. 1936, p. 143, Pl. 1, figs. 12a, b.

Description: Rather broad, elytra rather broadly oval, not distinctly ventricose; body black or piceous, legs rufous to testaceous; head and pronotum exceptionally shining. Head $\frac{4}{5}$ (slightly \pm) width prothorax; frontal sulci normal, impunctate; basal constriction slightly or not distinctly punctate at bottom; antennae of maximum length for genus, 3rd segment 4 or more times long as wide; maxillary palpi long, but apical segment only $\frac{1}{4}$ or less longer than subapical. Prothorax coriaceous, $\frac{1}{3}$ (slightly \pm) wider than long; base slightly narrower than head; sides more or less strongly sinuate before right or slightly obtuse basal angles; anterior impression very deep, groove-like, impunctate. Elytra $\frac{3}{7}$ (\pm) wider than prothorax; humeri broadly rounded but not much narrowed; striae more impressed and more coarsely punctate than in other species; intervals finely, strongly transversely alutaceous. Inner wings

dimorphic, vestigial form shorter than in other species. Prosternum punctate only at sides anteriorly. Legs of maximum slenderness for genus. Male copulatory organs as described in key above; phallobase relatively longer than in other *Neopatrobis*, with subapical tooth or angulation submarginal rather than marginal; eversible sac with variable dark spot beside accessory spine, caused by a scaly thickening and patch of bristles.

Measurements: ♂ 9.2 (exceptional)-13 by 3.3-5.0; ♀ 10.6-14.3 by 4.2-5.4 mm.

Types: Say's type locality is not exactly specified, nor is Dejean's, but their specimens probably came from eastern United States. Say's type is probably lost; Dejean's should be in the Oberthür Collection. To replace Say's type I have labeled and here designate as neotype of *Patrobis longicornis* (Say) a ♂ from Arlington, Mass., type no. 22,982 in the M. C. Z.

Distribution: Newfoundland (several localities in south and west) to southern British Columbia (many localities, but none quite coastal), south to Florida (Jacksonville) and Arizona (foot of Pinal Mts.). Not at high altitudes (probably not regularly above 2,000 ft.) in either the White or Appalachian Mts.; four Colorado localities with definite altitudes range from 4,800 to 8,000 ft., which is low for that region. The species is already known from every province of southern Canada and it is not unlikely that it occurs in some part of every one of the United States, being absent only in a narrow coastal strip around the Gulf of Mexico and in a small area in the south and southwest. It is not yet recorded, however, from California, Nevada, Louisiana, Mississippi, nor Alabama. Common; usually under cover (by day) on the upper banks of rivers or ponds, or in damp woods away from water.

Discussion: A distinct and universally recognized species, although not so isolated phylogenetically as some of the species lumped by Horn under *septentrionis*. Unique in appearance, slenderness of appendages, depth of anterior pronotal impression, depth of elytral striae and coarseness of strial punctures, strongly transverse elytral microsculpture, small size of vestigial wings in short winged individuals, minor details of male genitalia, and temperate rather than arctic or subarctic distribution. There is no significant geographical variation in size, although Colorado specimens run rather small. In southeastern specimens the basal angles of the prothorax tend to be a little more prominent than usual, but the difference is slight and inconstant. As I have shown recently

(1936, p. 143), the wings are vestigial in more than 90% of individuals, but fully winged specimens (about 9%) occur probably throughout the species' range. (See also Pl. 5, map C, below.) In the male genitalia the apex of the phallobase (examined in about 60 specimens) varies geographically; northern and western specimens have the apex strongly toothed about as in Pl. 2, figs. 20 or 23, but with some variation; males from central New England to Iowa have it about rectangularly, but also somewhat variably, denticulate or angulate; those from the southeast have it obtusely and inconspicuously angulate (fig. 26). The transition is gradual, however, and variation prevents the separation of distinct subspecies. On the whole, and in spite of what has just been said, there is distinctly less individual variation in this species than in any of those which follow.

2. *Patrobus (Neopatrobus) lecontei* Chd.

(Wings, Pl. 1, figs. 13–14; male genitalia, Pl. 2, figs. 28–37; range, Pl. 5, map C)

(a) *P. l. lecontei* Chd.

Patrobus rufipes Lec. 1863, p. 18 (not Duft.) : *lecontei* Chd. 1871, p. 47 (part) : *septentrionis* Horn 1875, p. 130, and others (part) : *canadensis* Csy. 1924, p. 67.

(b) *P. l. gravidus* subsp. n.

Patrobus lecontei Chd., l. c. (part).

Description (species as a whole) : Form average, not distinctly ventricose except in extreme females; black or piceous, legs rufous to testaceous. Head $\frac{3}{4}$ or slightly less width prothorax; frontal sulci normal, with bottoms somewhat irregular but not distinctly punctate; basal constriction slightly punctate at bottom. Prothorax relatively large, $\frac{1}{3}$ (slightly \pm) wider than long; base slightly wider than head; sides arcuate anteriorly, usually only slightly or faintly sinuate before nearly right or slightly obtuse basal angles; anterior transverse impression shallow, indefinite, usually impunctate, rarely with slight fine punctuation. Elytra $\frac{3}{7}$ wider than prothorax in ventricose females, slightly narrower in other specimens; humeri broadly rounded but not much narrowed except in ventricose females. Inner wings dimorphic. Prosternum obsoletely punctate, but only at sides anteriorly. Male copulatory organs as described for subgenus; scarcely distinguishable from some *fossifrons* (especially subsp. *dimorphicus*) except that accessory spine of eversible sac is twisted in *lecontei* and not in *fossifrons*; sac without dark spot in specimens examined.

2a. *P. (N.) lecontei lecontei* Chd.

Average size smaller; basal foveae of prothorax less punctate; elytra slightly less dull in female. Wings dimorphic: vestigial in about $\frac{3}{4}$ or more of individuals, full in $\frac{1}{4}$ or less.

Measurements: 27 ♂♂ 8.5–10.8 by 3.2–4.0; 25 ♀♀ 9.5–11.5 by 3.7–4.2 mm.

Types: *Patrobus lecontei* is expressly stated by Chaudoir to be a new name for the preoccupied *rufipes* Lec. Leconte's type (M. C. Z. no. 5,592) is a ♀ from the North Red River (southern Manitoba or the Minnesota-Dakota line), and this must be considered the type locality of *lecontei* in spite of the fact that Chaudoir's specimens were from Newfoundland. Casey's types (U. S. N. M.) were from Edmonton, Alberta; I have seen them.

Distribution: Typical *lecontei* occurs in the north-central region, from Colorado (Gunnison, 7,500; Poncha Springs, 7,400 ft.) to Alberta (Edmonton and other localities), western Lake Superior, and "Hudson Bay." Mr. J. B. Wallis writes that specimens of *lecontei* which he took at Roche Percee, Saskatchewan, were under logs and other cover near ponds, often in company with *Dytiscus* pupae.

2b. *P. (N.) lecontei gravidus* subsp. n.

Larger than typical *lecontei*; basal foveae of prothorax a little more closely and coarsely punctate; elytra slightly duller in female. Wings vestigial in all specimens seen.

Measurements: 5 ♂♂ 10.2–11.2 by 3.8–4.2; 2 ♀♀ 11.5–12.5 by 4.5–4.7 mm. (Chaudoir: both sexes, 11–12 mm.).

Types and distribution: Newfoundland, holotype ♂ (M. C. Z. no. 21,782) and 4 ♂♂, 2 ♀♀ paratypes (M. C. Z., 1 ♂ in Canadian National Collection) all from Little River, southwest Newfoundland, July 10–18, 1905 & 1907, collected by the late Percy Gardner Bolster. Chaudoir's specimens were from St. Pierre Island, south coast of Newfoundland.

Discussion: The relationship of *lecontei* (both subspecies) and *fossifrons* (below) is closer than that of any two other American *Patrobus*. The color of the legs is diagnostic in clean, mature specimens. Upon comparison, *lecontei* is seen to be a distinctly stouter species, with relatively narrower head and more ample prothorax, the sides of which are usually less sinuate before the base. The form of the tip of the phallobase in *lecontei* males is almost exactly like that of *Patrobus fossifrons dimorphicus* of western North America, but is much less barbed than in *fossifrons stygicus*, the subspecies

of *fossifrons* with which *lecontei* occurs over most of its range except Colorado. The size difference between the two subspecies of *lecontei* is, *on an average*, more than 10% of the total length in each sex, but extremes of the two subspecies overlap in size. The other characters are of minimum subspecific value in this variable genus.

3. *Patrobus (Neopatrobus) fossifrons* (Esch.)

(Wings, Pl. 1, figs. 15–16; male genitalia, Pl. 1, fig. 2 &
Pl. 2, figs. 38–54; range, Pl. 5, map C)

(a) *P. f. fossifrons* (Esch.)

Platysma fossifrons Esch. 1823, p. 104; Fisch. 1823, p. 128, Pl. 19, fig. 4: *Patrobus fossifrons* Mann. 1843, p. 194 (not Dej. 1828, p. 31; not Chd. 1871, p. 44): *longiventris* Mann. 1853, p. 145: *fulvus* Mann, 1853, p. 145: *latiusculus* Chd. 1871, p. 46: *septentrionis* Horn 1875, p. 130, and others (part).

(b) *P. f. dimorphicus* subsp. n.

Patrobus latiusculus Chd. 1871, p. 46 (part) : *septentrionis* Horn 1875, p. 130, and others (part).

(c) *P. f. stygicus* Chd.

Patrobus stygicus Chd. 1871, p. 46: *septentrionis* Horn 1875, p. 130, and others (part) : *tenuis* Csy. 1920, p. 186 (not Lec., not Csy. 1918, p. 396).

Description (species as a whole) : Form average to slender, sometimes distinctly ventricose in female, sometimes not; black or pieaceous, rufo-pieaceous below, legs not or not much paler. Head $\frac{2}{3}$ (slightly \pm) width prothorax; frontal sulci normal, usually impunctate; basal constriction finely punctate at bottom. Prothorax rather variable, $\frac{1}{4}$ to $\frac{2}{3}$ wider than long; base as wide as or slightly narrower, or rarely wider, than head; sides arcuate anteriorly, broadly but usually not strongly (sometimes scarcely) sinuate before right or slightly obtuse posterior angles; anterior transverse impression shallow or obliterated, usually impunctate, rarely with some fine punctation. Elytra $\frac{1}{2}$ (considerably \pm) wider than prothorax; humeri moderately rounded, not much narrowed except in ventricose females. Prosternum below with sides anteriorly (almost entire sides in some individuals) more or less superficially and finely punctate. Male copulatory organs as described for subgenus; dark spot beside accessory spine of eversible sac variable, sometimes nearly absent.

3a. *P. (N.) fossifrons fossifrons* (Esch.)

Of maximum size and stoutness for species, with prothorax of about maximum width. Wings uniformly vestigial in all specimens (about 60) seen. Male with phallobase usually only obtusely angulate on left side near apex.

Measurements: (Unalaska) ♂ 10–11 by 3.6–3.9; ♀ 10.3–11 by 3.9–4.2 mm.: (Kodiak Is.) ♂ 9.5–10.7; ♀ 10–10.7 mm. (One smaller male seen from Kodiak Is.)

Types: Eschscholtz described *fossifrons* from Unalaska Island and Kamchatka; I here designate Unalaska the type locality; the types should be in the Moscow Museum. Mannerheim described both *longiventris* and *fulvus* from Kodiak Island; the types should be at the University of Helsingfors, or possibly with Chaudoir's specimens in the Oberthür Collection; there is a probable eotype of *longiventris* from Mannerheim in the Leconte Collection (M. C. Z. no. 5,591). Chaudoir's *latiusculus* was from Kodiak Island and Oregon; I here designate Kodiak Island as the type locality; the types should be in the Oberthür Collection.

Distribution: Islands of the Bering Sea and adjacent regions, and Kodiak Island. Seen by me from Unalaska (19 ♂♂, 19 ♀♀, most collected by Dr. E. C. Van Dyke), Kodiak Is. (16 ♂♂, 7 ♀♀, from various sources), St. Paul's Is. in the Pribilof group (1 ♂), and R(ussian) A(merica) (several specimens); the species is recorded also from Kamchatka in Asia. Dr. Van Dyke writes that his Unalaskan *fossifrons* were generally taken in old, dried up ponds or bogs, as contrasted with the higher and somewhat less water saturated habitat of *foveocollis*.

Discussion: The works of Eschscholtz and Fischer appeared in the same year, each referring to the other, but Fischer's description is quoted from Eschscholtz, who is to be considered the authority. The original description is good, and I can find no justification for Chaudoir's statement that Fischer's description applies partly to some other species. Dejean's *fossifrons* is, according to the very definite description, Eschscholtz' *foveocollis*; Chaudoir's *fossifrons* is equally unmistakably *septentrionis*. The fact that all three of these species occur on Unalaska probably led to the confusion. Mannerheim apparently recognized *fossifrons* correctly, but described *longiventris* and *fulvus* on differences of no taxonomic importance. Chaudoir, misidentifying *fossifrons* and overlooking the name *longiventris*, renamed the species *latiusculus* because it seemed to him that *fulvus*, based on an immature specimen, was not appropriate!

3b. *P. (N.) fossifrons dimorphicus* subsp. n.

Very variable in size and form. Specimens from the Pacific coastal region run smaller than typical *fossifrons*. Specimens from Utah, Colorado, and Idaho are as large as or rarely even slightly larger than typical *fossifrons*, but frequently have the prothorax narrower. Wings are vestigial in about $\frac{3}{4}$, full in about $\frac{1}{4}$ of individuals; the fully winged as well as the vestigial form occurs probably throughout the range of the subspecies (Pl. 5, map C), in every region from which adequate series have been seen. The vestigial wings are unusually variable in this subspecies, varying from somewhat smaller to considerably larger than the example figured (Pl. 1, fig. 15).¹⁷ In male genitalia the phallobase varies from obtusely to acutely angulate on left side near apex, more or less bridging the gap between the obtuse angulation of true *fossifrons* and the very acute barb of the following subspecies (*stygicus*), but usually nearer the former.

Measurements: ♂ 8.3–10.5 by 3.0–3.7; ♀ 9–11.5 by 3.2–4.3 mm.

Types: Holotype ♂ (M. C. Z. no. 22, 983) and 12 paratypes (in M. C. Z., Canadian National Coll., and my own collection) from near Victoria, Vancouver Island, British Columbia; collected by myself Aug. 11, 1927. Also 6 paratypes from the same locality from the Hubbard and Schwarz Collection in the U. S. N. M., and 1 from the same locality in the F. S. Carr Collection. The holotype has full wings, but some other specimens of the type lot have vestigial wings. Because of the variability of this subspecies, I have confined the type series to specimens from a single locality.

Distribution: South coast of Alaska to northern California (Tallic, Bridgeport, and Eagle L.), east to Colorado (Ouray, 7,500–8,000; Hesperus, 8,300 ft.). I have seen more than 160 specimens; the species is especially common in southern British Columbia. The specimens (types) which I found near Victoria were in coarse gravel and among stones near the edge of a river.

Discussion: Under the description of *latiusculus*, Chaudoir made it plain that the name was to apply to Kodiak Island specimens; a single specimen from Oregon was identified with reservations, and cannot very well be designated as the type. The western mainland

¹⁷ The vestigial wings of typical *fossifrons* are more constant, and are usually about the size of the smallest wing vestiges found in *dimorphicus*, but individual variation in the latter is so great that the size of the wing vestige can hardly be used as a subspecific character.

subspecies of *fossifrons*, therefore, has been without a name until now. This variable subspecies would not be worth separating from typical *fossifrons* except for the state of the wings. However, the existence of a considerable proportion of fully winged individuals on the mainland and the apparent complete absence of such individuals on the islands seems to me sufficiently interesting and important to justify the separation, even though no single character can be depended upon to distinguish every individual.

3c. *P. (N.) fossifrons stygicus* Chd.

Form, as compared with subspecies *dimorphicus*, usually slightly more slender and less often ventricose. Wings always full. Male genitalia with apex of phallobase produced, strongly and acutely barbed or hooked on left side near apex.

Measurements: ♂ 8.3–11.1 by 3.0–3.9; ♀ 9–12 by 3.4–4.4 mm.

Type: Chaudoir's type was from the south side of Newfoundland, and should be in the Oberthür Collection. Casey's specimens of "tenuis" (1920) were from Marquette, Michigan.

Distribution: Boreal America from the interior of Alaska ("?nr. Ruby?") to the coast of Labrador and Newfoundland; south to extreme southeastern British Columbia, southern Alberta and Manitoba, and Lake Superior; not in the mountains of New England; limit of range in north unknown. Mr. W. J. Brown writes that the large series of specimens which he collected along the north shore of the Gulf of St. Lawrence were, "Under drift on the seashore and under old boards resting on moss covered rocks near the houses of the fishermen. The country is granitic rock covered in part by moss, *Empetrum*, etc., with no trees except stunted spruce and willows in protected places."

Discussion: The ranges of this subspecies and of *fossifrons dimorphicus* are essentially complementary, but there is some intergradation (or possibly overlapping) in southern British Columbia and Alberta. For example, I have seen two female specimens from as far east as Crow's Nest, southwestern Alberta (F. S. Carr Coll.) which look like *dimorphicus* and have the wings vestigial, and a winged male from Cypress Hills, north of Medicine Hat, Alberta (also Carr Coll.) has the left side of apex of phallobase only rectangularly angulate like *dimorphicus*, although another winged male from the same locality has the phallobase acutely barbed. On the other hand, I have examined 5 males, 10 females from Copper Mt., southern British Columbia (collected by Mr. G. Stace Smith, one labeled "meadow; 4,300 ft.") which are typical *stygicus* in form of male phallobase and which are fully winged except that one female

has vestigial wings. Copper Mt. is well within the gross range of *dimorphicus*. Whether *stygicus* and *dimorphicus* are really subspecies as I suppose, or whether they are closely related full species, is very hard to decide from museum specimens. Perhaps field observation of the behavior and habitat of the insects will settle the matter eventually. The possibility that mutation and dimorphism occur in the genitalia of these forms has been discussed earlier in this paper. The wings are full in every one of the 93 specimens of *stygicus* which I have examined—this is not including the doubtful series from Copper Mt., of course. Specimens of *stygicus* from Newfoundland (11 ♂♂, 6 ♀♀) average larger than those from the mainland, even than those from just across the Straits of Belle Isle (17 ♂♂, 10 ♀♀), but extremes overlap.

4. *Patrobus (s. s.) septentrionis* Dej.

(Wing, Pl. 1, fig. 10; male genitalia, Pl. 1, fig. 4 & Pl. 3,
figs. 55–69; range, Pl. 4, map B)

? *Tenebrio fossor* O. Fab. 1780, p. 190 (not L.) : *Patrobus septentrionis* Dej. 1828, p. 29; Dej. & Boisd. 1837, p. 266, Pl. 106, fig. 2; Chd. 1871, p. 43; Horn 1875, p. 130, and others (part) : *hyperboreus* Dej. 1828, p. 30 : *fossifrons* Chd. 1871, p. 44 (not Esch.) : *labradorinus* Csy. 1918, p. 395 : *minuens* Csy. 1918, p. 396 : *tenuis* Csy. 1918, p. 396 (not Lec., not Csy. 1920) : *tritus* Csy. 1920, p. 186.

Description: Form average, not distinctly ventricose; black, sometimes piceous or rufescent, especially on elytra; legs not distinctly paler. Head $\frac{4}{5}$ to $\frac{5}{6}$ width prothorax; eyes varying from very prominent to much less so; frontal sulci normal, not distinctly to (especially in large ♀♀) distinctly punctate; basal constriction moderately to strongly punctate; gular puncture usually weak or obliterated. Prothorax $\frac{1}{3}$ to $\frac{2}{7}$ wider than long; base wide as head (slightly ±); sides arcuate anteriorly, usually strongly (individually less strongly) sinuate before usually very prominent right (slightly ±) posterior angles; anterior transverse impression indefinite, almost always conspicuously punctate, rarely only slightly or not punctate. Elytra $\frac{1}{2}$ or somewhat less wider than prothorax; humeri moderately rounded but more prominent than usual in genus. Wings always full. Prosternum coarsely and conspicuously punctate, especially latero-basally, but almost always with some coarse punctures at middle anteriorly (I have seen no specimen with punctures lacking both at front of pronotum and at middle

of prosternum anteriorly); sides of meso- and metasterna rather variably but usually more strongly punctate than in other species. Male copulatory organs as described in key.

Measurements: ♂ 8.2–9.5 by 2.9–3.5; ♀ 9–11 by 3.2–4.0 mm.

Types: *Tenebrio fossor* was described from Greenland; like the rest of the O. Fabricius Collection, the type is probably no longer in existence. Dejean's types of *septentrionis* were from Lapland, northern Sweden, and Siberia; I here designate Lapland as the type locality; the types should be in the Oberthür Collection. *P. hyperboreus* Dej. was from Greenland, and also should be in the Oberthür Collection. Of Casey's species, *labradorinus* and *minuens* were from West St. Modest, Labrador; *tritus*, from Marquette, Michigan; the types of all are in the U. S. N. M., where I have seen them.

Distribution: Circumpolar. In America, on the Aleutian Islands including Unalaska; St. Paul and St. George in the Pribilof Islands; and from Alaska to Labrador and Newfoundland, south to Colorado, the Great Lakes and northern Maine (Greenville), but not in the White Mts.; northern limit of range unknown. The only Colorado locality with altitude given is Leavenworth Valley, 10–11,000 ft., but the species ranges down to sea level in the north. Widely distributed also in northern Europe and Asia. Besides 98 American specimens I have seen 3 ♂♂, 2 ♀♀ from Europe (including Lapland); several from Iceland; a pair from Greenland; and a male from Copper Island, off Kamchatka. I do not know the habits of the species in America, but in Europe it is said to occur in both northern wooded and high alpine regions, and the records suggest that it has the same range of habitat here. In Iceland it favors damp meadows below 300 meters (Lindroth 1931, p. 172).

Discussion: *Tenebrio fossor*, if it is a *Patrobus*, is probably the earliest name for this species, for the black color with fulvescent elytra and abdomen, and the presence of obvious inner wings (which are mentioned in the description) are practically diagnostic. However, the name is not available because of an earlier, different *Tenebrio fossor* L. The name *hyperboreus* Dej. is applied by Chaudoir to the form of *septentrionis* with rufous elytra, which he calls a variety. It is, however, no more than an individual variation. In Iceland it has been observed copulating with typical black specimens (Lindroth, *l. c.*). If Chaudoir's application of the name is correct, Dejean's statement that *hyperboreus* is apterous requires confirmation. Casey's three species are all within the rather wide range of individual variation of *septentrionis*. American specimens usually have the front of the pronotum more punctate and the basal angles

more prominent than European ones, although there are many exceptions. The most coarsely punctate series I have seen is from the Aleutian Islands; the least punctate specimens, oddly enough, are among a series from the neighboring Pribilof Islands; mainland specimens, however, also show nearly the whole range of variation. There is a little individual variation in the form of the apex of the phallobase and much variation in the form of the accessory spine of the eversible sac of the male genitalia. Series from single localities often have the accessory spine of a form recognizably different from that in series from other localities not very far away, but some of the variation is individual and it is quite impossible to use the spine to define useful subspecies. There is no significant geographical variation in size. The wings are full in the 98 American specimens I have examined and are said always to be full in European specimens too.

5. *Patrobus (Geopatrobus) foveocollis* (Esch.)

(Wing, Pl. 1, fig. 17; male genitalia, Pl. 1, fig. 3 & Pl. 3,
figs. 70-76; range, Pl. 4, map B)

(a) *P. (G.) foveocollis foveocollis* (Esch.)

Platysma foveocollis Esch. 1823, p. 105; Fisch. 1823, p. 129,
Pl. 19, fig. 5: *Patrobus foveocollis* Dej. 1828, p. 30; Mann.
1843, p. 194; *fossifrons* Dej. 1828, p. 31 (not Esch.): *fovei-*
collis Chd. 1871, p. 45 (part): *septentrionis* Horn 1875, p.
130, and others (part).

(b) *P. (G.) foveocollis tenuis* (Lec.)

Pterostichus tenuis Lec. 1850, p. 207: *Patrobus angusticollis*
Mann. 1853, p. 146: *foveicollis* Chd. 1871, p. 45 (part):
tenuis Chd. 1871, p. 46 (not Csy. 1918 nor 1920): ? *ob-*
tusiusculus Chd. 1871, p. 43: *septentrionis* Horn 1875, p.
130, and others (part): *laeviceps* Csy. 1918, p. 397: *insularis*
Csy. 1918, p. 397.

Description (species as a whole): Form average to slender, not or slightly ventricose, more convex than usual; dark piceous to (more commonly) rufescent to strongly rufous, legs not or slightly paler. Head $\frac{3}{4}$ to $\frac{4}{5}$ (slightly \pm) width prothorax; eyes noticeably variable in prominence; frontal sulci rather variable, relatively shallow and poorly defined, partly obliterated posteriorly, not or slightly punctate; basal constriction punctate; gular puncture distinct. Prothorax $\frac{1}{4}$ (slightly \pm) wider than long; base wide as head (slightly \pm); sides arcuate anteriorly, moderately to strongly (rarely only faintly) sinuate

before obtuse or nearly right basal angles; side margins finer than in other species; anterior transverse impression indefinite or obsolete, variably punctate, rarely almost impunctate. *Elytra* $\frac{1}{3}$ (slightly \pm) or rarely $\frac{1}{2}$ wider than prothorax; humeri moderately rounded, slightly narrowed; striae usually briefly obliterated at extreme apex. Wings always vestigial in American specimens.¹⁸ Prosternum anteriorly coarsely and conspicuously punctate at sides, varying from equally to much less closely, but still usually distinctly, punctate at middle anteriorly. Legs of maximum stoutness for genus. Last ventral never emarginate at apex. Male copulatory organs as described in key.

5a. *P. (G.) foveocollis foveocollis* (Esch.)

Larger than following subspecies.

Measurements: 4 ♂♂ 9.7–10 by 3.6; 2 ♀♀ 10.3–10.7 by 3.7–3.9 mm.

Type and distribution: Confined to Unalaska and probably other islands in the Aleutian group; the type was from Unalaska and should be in the Moscow Museum. I have seen 3 ♂♂, 1 ♀ from Unalaska and 1 ♂, 1 ♀ labeled merely R(ussian) A(merica). Dr. Van Dyke writes that he found this species on Unalaska in the hills, in drier habitats than *fossifrons*.

5b. *P. (G.) foveocollis tenuis* (Lec.)

Smaller than the preceding.

Measurements: ♂ 8–9.5 by 2.9–3.3; ♀ 8–10 by 3.0–3.6 mm.

Types: Leconte's type is a ♀ from Lake Superior; it is in the M. Z. C. (no. 5,590). The type of *angusticollis* was from Kenai, Alaska; it should be at the University of Helsingfors. *P. obtusiusculus* Chd. was from Rupert Land near Hudson Bay, and should be in the Oberthür Collection. *P. laeviceps* Csny. was from West St.

¹⁸ All specimens (about 90) which I have seen from the continent of North America and from the American Aleutian and Pribilof Islands in the Bering Sea have the wings vestigial. However, 7 males and 3 females in the U. S. N. M. from Copper and Bering Islands at the Asiatic end of the Aleutian chain are all fully winged, although they cannot otherwise be distinguished from *foveocollis tenuis* Lee. of North America by either external or genitalic characters. This winged form will very likely be found to range widely in northern Asia. It is certainly entitled to rank as a distinct subspecies of *foveocollis*, but I do not know enough about previously described Asiatic *Patrobus* to name it.

Modest, Labrador; *insularis*, from St. Paul Island, Pribilof group, in the Bering Sea; the types of both are in the U. S. N. M., where I have seen them.

Distribution: Pribilof Islands and Alaska to Labrador and Newfoundland, south to Colorado and the Great Lakes, and isolated on the higher mountains of New York and New England; northern limit of range unknown. In the north the species evidently descends to sea level; on Mt. Katahdin, Maine, it occurs between 3,000 and 4,000 ft. altitude; in the White Mts., New Hampshire, usually between 4,000 and 5,000; in Colorado the two localities are both given as 10–11,000 ft. The numerous specimens which I have collected in the White Mts. were in rotten logs or under cover on the ground in forest or slightly above tree line, usually not near water.

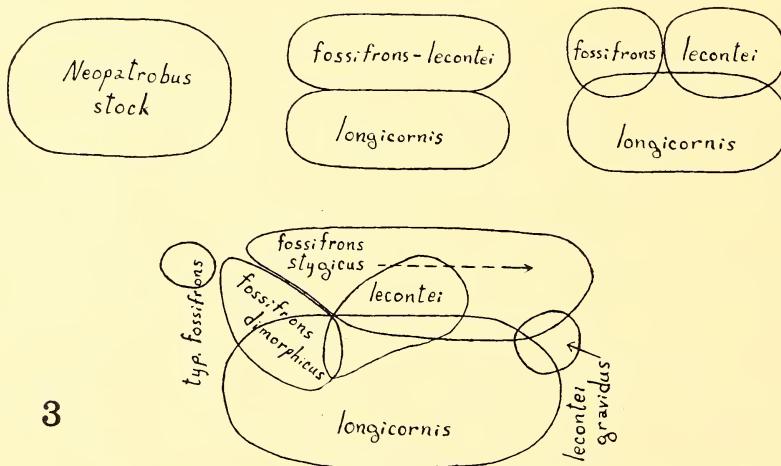
Discussion: *Foveocollis* was originally described by Eschscholtz as 10 mm. long. Dejean gives a slightly smaller size, but may have had a mixed series; his *fossifrons* (not Esch.), which is from Unalaska, 10 mm. long, is obviously from description the present species. This large form is evidently very local, for a ♂ from Mt. Pavlof, Alaskan Peninsula, is scarcely over 8 mm., and a ♂ from Atlin, northern British Columbia, is only 8.7, while the type of *angusticollis* from Kenai is described as 8.4. Casey's 13 specimens (types of *insularis*) from St. Paul Island, in the Pribilof group not far north of the Aleutians, also are small, 8 to 9 mm. On the eastern coast of America, specimens from Newfoundland (1 ♂, 2 ♀♀) are slightly larger than most mainland specimens, but not significantly so. I can find absolutely no constant character except size to separate *foveocollis* and *tenuis*; the former is really a local insular subspecies of the latter, but rules of nomenclature demand that the insular form be considered typical in this case. The citation of *angusticollis* as a *Platidius* or *Diplous* in the Leng and Junk Catalogues is inexplicable; the original description is reasonably good and the name has been declared a synonym of *foveocollis* (which it is, as a species) by Chaudoir, who had Mannerheim's type. *P. obtusiusculus* (type a 9 mm. ♀) seems from the description to be probably an aberrant *tenuis* with the punctures at the front of the pronotum obliterated (as they are in two Hudson Bay specimens I have seen) and basal angles of prothorax exceptionally obtuse. Chaudoir compares the species with the European *assimilis* which I have seen and which is superficially very like *tenuis*, although it belongs to a different subgenus, *Patrobus s. s.* Casey's species are plain *tenuis*, which Casey twice misidentified.

ZOÖGEOGRAPHY OF PATROBUS

I should like to stress the fact that the following brief account of the history of *Patrobus* in America is only one of several possible explanations of the present distribution of the genus, but it is the one which seems to me most probable.

The present center of abundance of *Patrobus* is in Asia. All three American subgenera extend into Asia, and there are one or two additional Asiatic forms which may be entitled to subgeneric rank. Europe, in contrast, possesses only a few closely related species of a single subgenus, *Patrobus s. s.* It does not necessarily follow from this that *Patrobus* originated in Asia, but it may very well have done so. The fact that all American subgenera of *Patrobus* are primarily boreal in their distribution agrees very well with the idea that their ancestors migrated into America through the north. The Asiatic *Patrobus* fauna appears to include a larger proportion of temperate forms, although I must admit that I do not know the Asiatic fauna very thoroughly.

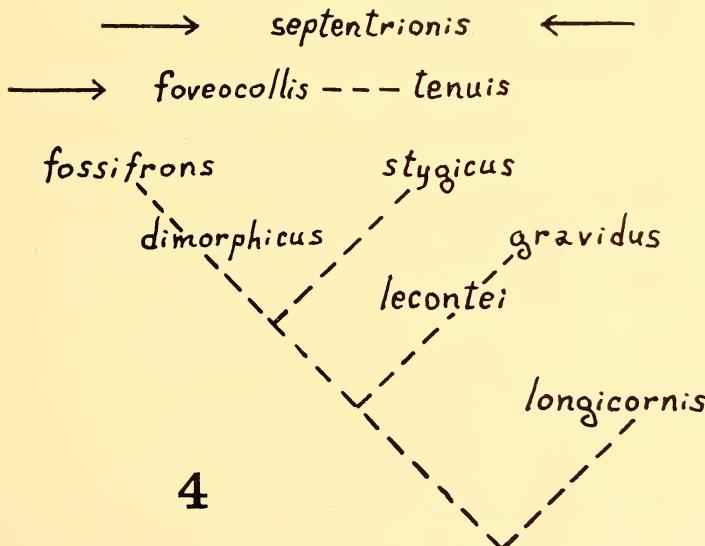
The ancestor of subgenus *Neopatrobus* was probably the first to reach America. After the original ancestor had spread (1), it may be guessed that (2) the original stock divided first into a boreal stock (*fossifrons-lecontei*) and a temperate stock (*longicornis*); that (3) the boreal stock then divided into a western species (*fossifrons*) and an eastern species (*lecontei*); that after the differentiation of species



Text Fig. 3. Diagrams of four hypothetical stages in the evolution of the species and subspecies of *Neopatrobus*.

had occurred, there was some overlapping of ranges; and that (4) finally *fossifrons* and *lecontei* set off geographical subspecies, and that subspecies *fossifrons stygicus* migrated eastward into and entirely across the range of *lecontei*. Both the fact that *stygicus* ranges more widely than any other *Neopatrobis* over recently glaciated country and the fact that it is the only form of *Neopatrobis* with uniformly full wings point to its being a recent migrant. Four hypothetical steps in the evolution of the species of *Neopatrobis* are illustrated in Text Figure 3.

Patrobis (Geopatrobis) foveocollis and *P. (s. s.) septentrionis* are probably relatively recent arrivals in America. *Foveocollis* apparently came from Asia across the region of the Bering Sea. The species has no relatives in Europe. The fact that *foveocollis* and its subspecies *tenuis* are always flightless in America and the fact that *tenuis* is the only one of four eastern boreal *Patrobis* which has isolated colonies in the mountains of New York and New England seem at first to suggest that the species is an old inhabitant, but I believe that this is incorrect. It seems to me more likely that the habitat of the species, in higher and somewhat drier places than



Text Fig. 4. Diagram to show probable origin of American *Patrobis* fauna. Dotted lines indicate evolution of subgenus *Neopatrobis*. Arrows indicate probable direction of immigration of *foveocollis* and *septentrionis*.

other *Patrobus*, accounts sufficiently both for the atrophy of the wings and for the persistence of isolated colonies on mountain slopes. Winged individuals may have disappeared recently, perhaps within the last few thousand years. Remember that specimens from islands in the western part of the Bering Sea are still winged. Winged individuals may originally have effected the spread of *tenuis* across America.

Finally, *septentrionis* has a circumpolar range which includes Iceland, Greenland, and islands in the Bering Sea; its closest relatives are in Europe; and it seems always to be fully winged. These facts suggest that it is a recent immigrant in America and that it may have come either from the west, or from the east, or (perhaps most likely) from both directions.

I have attempted to condense this hypothetical history of the American species of *Patrobus* into a single diagram, Text Figure 4.

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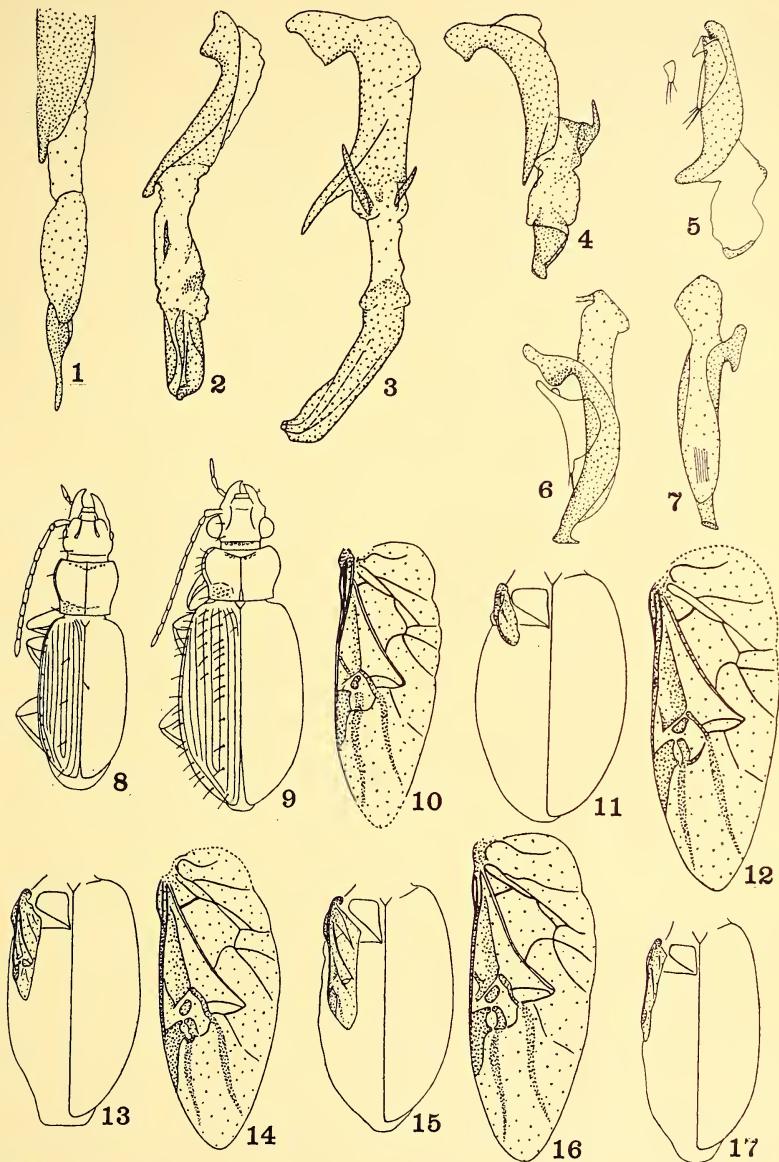
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EXPLANATION OF PLATES

(All figures outlined with camera-lucida)

PLATE VI

- Fig. 1. *Platidius rugicollis* (Rand.). Middle lobe male genitalia: apex of phallobase, with eversible sac and apical plate extended. (Mt. Washington, N. H.)
- Fig. 2. *Patrobus (Neopatrobus) fossifrons dimorphicus* Darl. Middle lobe male genitalia, extended. (Composite: phallobase and eversible sac from specimen from Tacoma, Wash.; apical plate, from Sugar L., B. C. The apical plate may not be quite correctly oriented. I have been unable properly to evert the genitalia of any single specimen of *Neopatrobus*.)
- Fig. 3. *Patrobus (Geopatrobus) foveocollis tenuis* (Lec.). Middle lobe male genitalia, extended. (Mt. Garfield, N. H.)
- Fig. 4. *Patrobus (s. s.) septentrionis* Dej. Middle lobe male genitalia, extended. (Aleutian Islands.)
- Fig. 5. *Thalassotrechus barbareae* (Horn). Male genitalia, with eversible sac extended; left paramere outlined *in situ*, minute right paramere detached. (Sta. Barbara, Cal.)
- Fig. 6. *Patroboidea rufa* Van Dyke. Male genitalia: middle lobe and outline of left paramere. (Spious Cr., B. C.)
- Fig. 7. Same. Dorsal view middle lobe same individual.
- Fig. 8. Same. External characters same individual.
- Fig. 9. *Platypatrobus lacustris* Darl. External characters. (Female, type.)
- Fig. 10. *Patrobus septentrionis* Dej. Left wing. (Male, W. St. Modest, Lab.)
- Fig. 11. *Patrobus longicornis* (Say). Vestigial wing, with outline of hind body and right elytron. (Male, Arlington, Mass.)
- Fig. 12. Same. Full wing, to same scale. (Female, Arlington, Mass.)
- Fig. 13. *Patrobus l. lecontei* Chd. Vestigial wing. (Female, Edmonton, Alta.).
- Fig. 14. Same. Full wing to same scale. (Female, Tofield, Alta.).
- Fig. 15. *Patrobus fossifrons dimorphicus* Darl. Vestigial wing. (Male, Victoria, B. C.).
- Fig. 16. Same. Full wing, to same scale. (Male, Victoria, B. C.).
- Fig. 17. *Patrobus foveocollis tenuis* (Lec.). Vestigial wing. (Female, Mt. Washington, N. H.).



Darlington: Patrobiini .

PLATE VII

- Fig. 18. *Patrobus (Neopatrobus) longicornis* (Say) (Edgewood, B. C.). Male genitalia from left.
- Fig. 19. Same individual. Middle lobe from above.
- Fig. 20. Same individual. Apex of phallobase from right.
- Fig. 21. Same individual. Accessory spine and pigmented area of eversible sac.
- Figs. 22–24. Same (Little R., Nfld.). Apex of phallobase from above, and from right, and accessory spine and pigmented area of eversible sac.
- Figs. 25–27. Same (Andrews, N. C.).
- Fig. 28. *Patrobus (Neopatrobus) l. lecontei* Chd. (Edmonton, Alta.). Male genitalia from left.
- Fig. 29. Same individual. Middle lobe from above.
- Figs. 30–32. Same (Gunnison, Col.). Apex phallobase from above, from above-right to show greatest prominence of subapical tooth, and accessory spine of eversible sac.
- Figs. 33–34. Same (type *canadensis* Csny., Edmonton, Alta.). Apex of phallobase from above, and from above-right.
- Figs. 35–37. *Patrobus (N.) l. gravidus* Darl. (Little R., Nfld.). Explanation as for Figs. 30–32.
- Figs. 38–41. *Patrobus (Neopatrobus) fossifrons dimorphicus* Darl. (West Bank, B. C.). Explanation as for Figs. 18–21.
- Figs. 42–44. Same (Yellowstone Park, Wyo.). Apex of phallobase from above, from above-right to show greatest prominence of subapical tooth, and accessory spine and pigmented area of eversible sac.
- Figs. 45–47. *Patrobus (N.) f. fossifrons* (Esch.) (Unalaska Island). Same explanation.
- Figs. 48–49. *Patrobus (N.) f. stygicus* Chd. (Copper Mt., B. C.). Apex of phallobase from above, and from above-right.
- Figs. 50–51. Same (Winnipeg, Man.).
- Figs. 52–54. Same (Flowers Cove, Nfld.). Explanation as for Figs. 42–44.

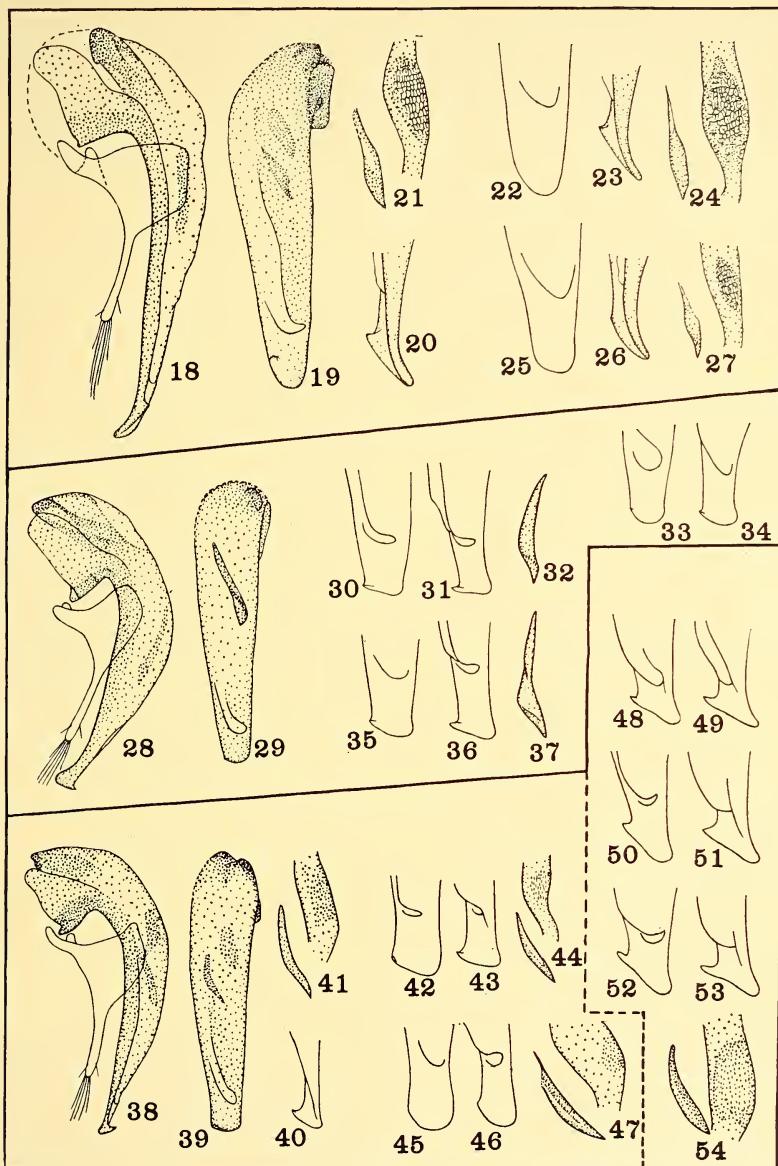
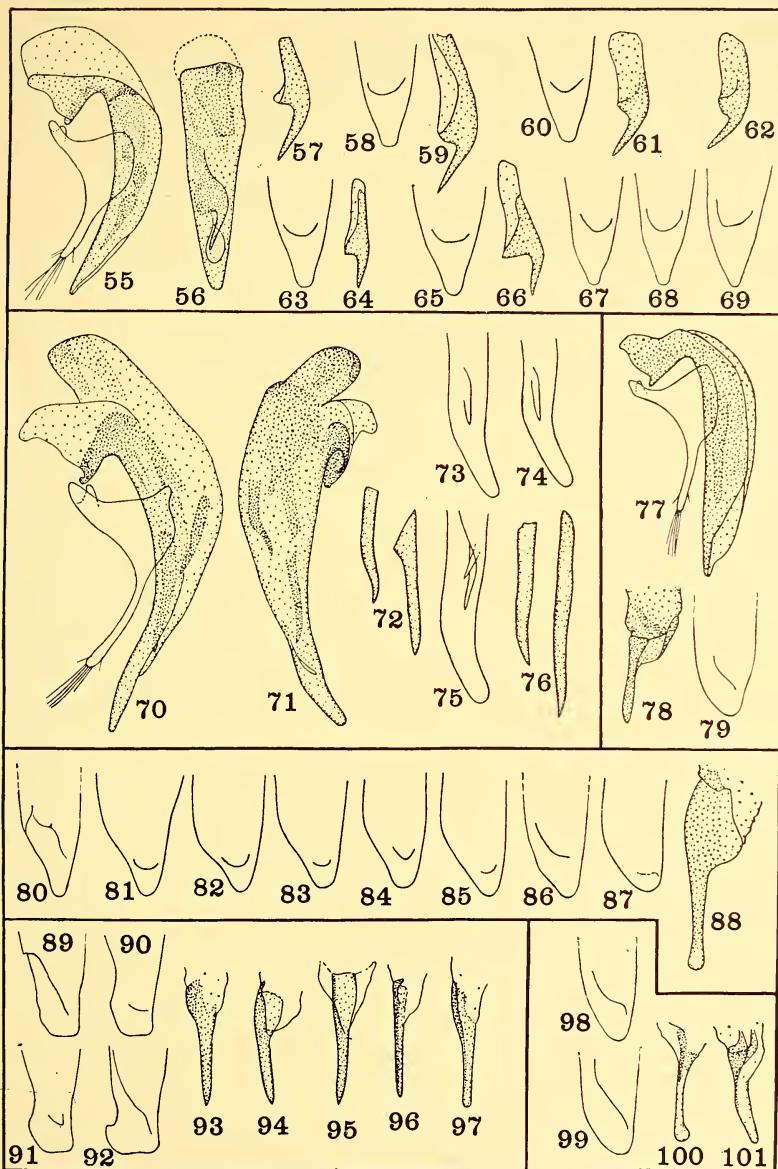


PLATE VIII

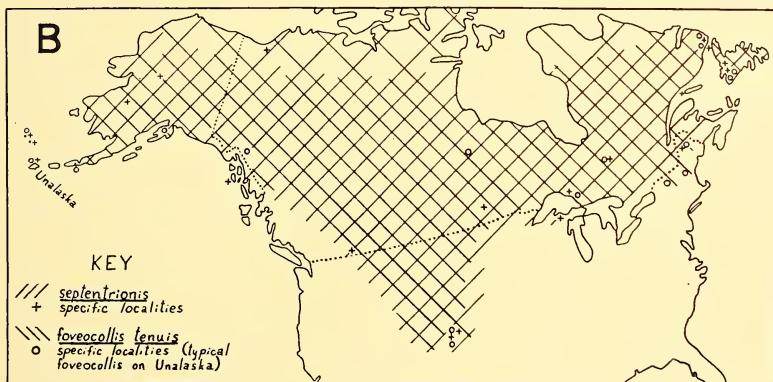
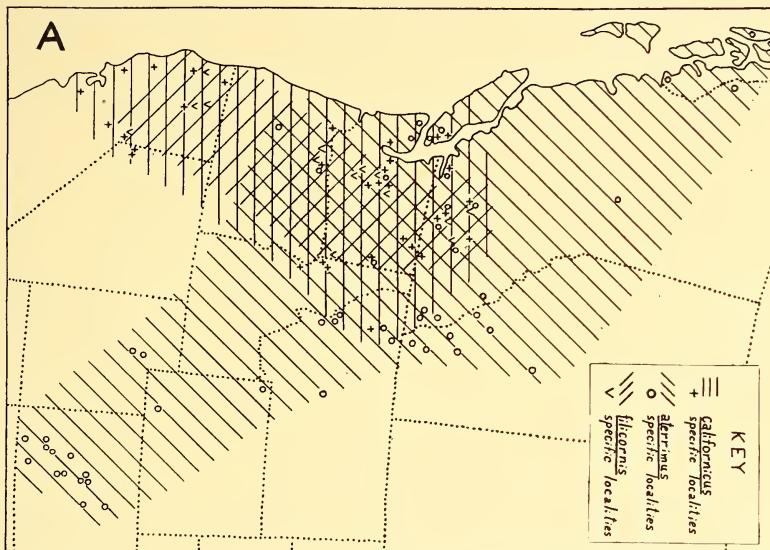
- Figs. 55–57. *Patrobus (s. s.) septentrionis* Dej. (Aleutian Islands). Male genitalia from left, middle lobe from above, and accessory spine of eversible sac.
- Figs. 58–59. Same (another individual from Aleutian Islands). Apex of phallobase from above, and accessory spine of eversible sac.
- Figs. 60–61. Same (W. St. Modest, Lab.).
- Fig. 62. Same (Paroquet Is., Lab.). Accessory spine only.
- Figs. 63–64. Same (Swedish Lapland).
- Figs. 65–66. Same (Iceland).
- Fig. 67. Same (type *minuens* Csy., W. St. Modest, Lab.). Apex of phallobase from above.
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- Fig. 69. Same (type *tritus* Csy., Marquette, Mich.).
- Figs. 70–72. *Patrobus (Geopatrobus) foveocollis tenuis* (Lec.) (White Mts., N. H.). Male genitalia from left, middle lobe from above, and the two accessory spines of eversible sac.
- Fig. 73. Same (type *laeviceps* Csy., W. St. Modest, Lab.). Apex of phallobase from above.
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- Figs. 75–76. *Patrobus (G.) f. foveocollis* (Esch.) (Russian America). Apex of phallobase from above, and the two accessory spines of eversible sac.
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- Fig. 81. Same (paratype *incisus* Csy., south of San Francisco, Cal.).
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- Fig. 84. Same ("californicus 4" in Casey Coll., Soda Springs, Mendocino Co., Cal.).
- Fig. 85. Same (type *sierranus* Csy., Mokelumne Hill, Cal.).
- Fig. 86. Same (Duncan, Victoria Is., B. C.).
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- Fig. 88. Same (Indian R., B. C.). Apical spine of eversible sac.



- Fig. 89. *Platidius aterrimus* (Dej.) (Sitka, Alaska). Apex of phallobase from above.
- Fig. 90. Same (type *tenuitarsis* Csy., Colorado).
- Fig. 91. Same (type *coloradensis* Csy., Red Cliff, Col.).
- Fig. 92. Same (Mts. between Hope & Okanagan, B. C.).
- Fig. 93. Same (Sitka, Alaska). Apical spine of eversible sac.
- Fig. 94. Same (S. Fork, San Miguel, Col.).
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- Fig. 101. Same (Sisson, Cal.).
-

PLATE IX

- Map A. Ranges of western American species of *Platidius*.
- Map B. Ranges of *Patrobus* (s. s.) *septentrionis* Dej. and *Patrobus* (*Geopatrobus*) *foveocollis* (Esch.) in America.

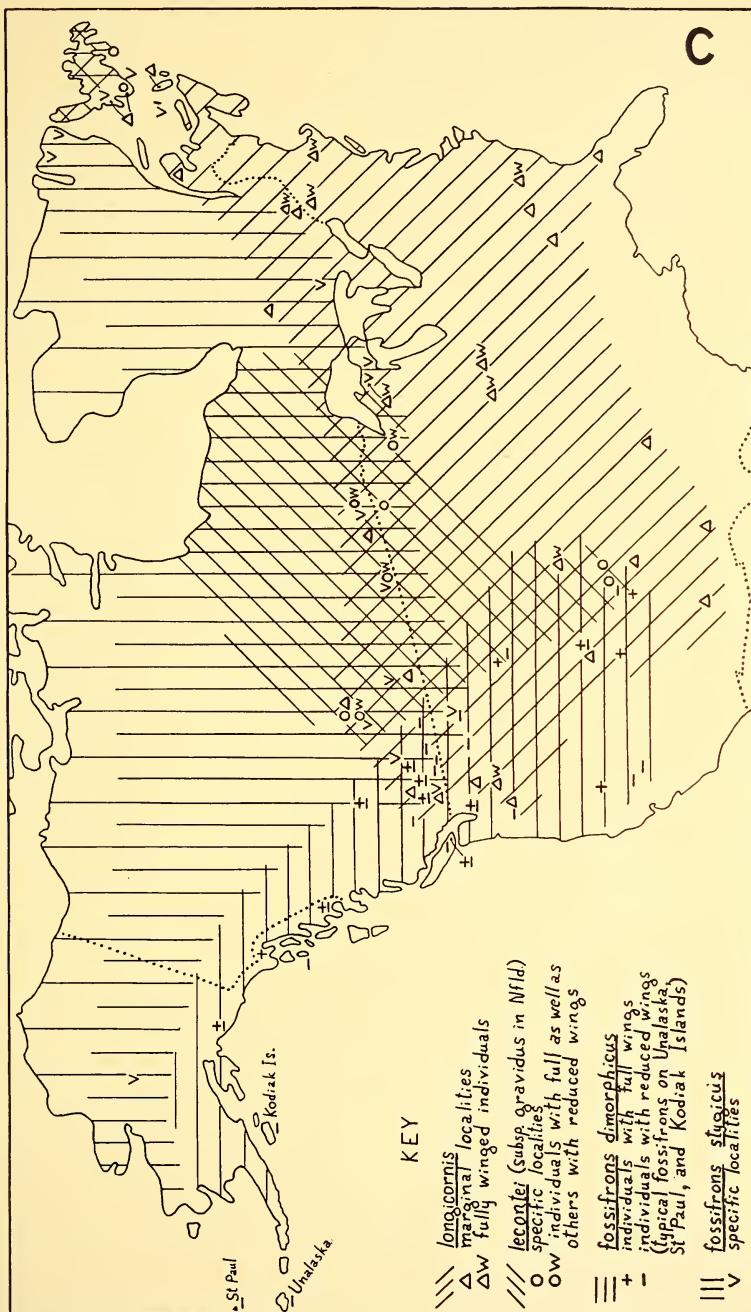


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PLATE X

Map C. Ranges of species and subspecies of *Patrobus*, subgenus
Neopatrobus, in America.



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Roman letters indicate valid species; **bold face**, new forms and genera; *Italics*, synonyms; * indicates plants.

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