

S. 320.

44

NOVITATES ZOOLOGICAE

A JOURNAL OF ZOOLOGY

Founded by

LIONEL WALTER, LORD ROTHSCHILD

and continued by

THE TRUSTEES OF THE BRITISH MUSEUM

VOL. 42, 1940-1948

LONDON :

PRINTED BY ORDER OF THE TRUSTEES
BRITISH MUSEUM (NATURAL HISTORY)

CROMWELL ROAD, LONDON, S.W. 7

1940—1948

NOVITATES ZOOLOGICAE

VOL. 42, 1940-1948

The parts of Volume 42 were issued as follows : -

Part I, containing pages 1-216 and 13 plates, issued 26 April, 1940.

Part II, containing pages 217-390, issued 25th October, 1940.

Part III, containing pages 397-508 and 4 plates, issued 20th March, 1948.

ERRATUM.

Page 93. "METRACRINIA gen. nov." should read "METACRINIA gen. nov."

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22 JUN 1940
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VOL. 42

PART I, pp. 1-216

WITH THIRTEEN PLATES

26 April, 1940

LONDON :

PRINTED BY ORDER OF THE TRUSTEES
BRITISH MUSEUM (NATURAL HISTORY)

CROMWELL ROAD, LONDON, S.W. 7

1940

Price Fifteen Shillings

NOTICE

The Journal, *Novitates Zoologicae*, was founded in 1894 by the late Lord Rothschild as the official publication of his Museum at Tring, and Lord Rothschild himself was joint editor until his death in 1937. In September, 1938, the Trustees of the British Museum assumed control of the Tring Museum, which had been bequeathed to them by Lord Rothschild. In the meantime the Journal was carried on under the joint editorship of the Hon. Miriam Rothschild and Dr. K. Jordan until the close of Vol. 41.

Beginning with this part, the first of Vol. 42, the Trustees of the British Museum have undertaken the publication of *Novitates Zoologicae*, and the Journal will be edited at the British Museum (Natural History), Cromwell Road, London, S.W. 7.

C. FORSTER-COOPER,

Director.

BRITISH MUSEUM (NATURAL HISTORY),

LONDON, S.W. 7:

12 April, 1940.

22 JUN 1940
PRESENTED

NOVITATES ZOOLOGICAE

Vol. 42

APRIL, 1940

No. 1

THE AUSTRALASIAN FROGS OF THE FAMILY LEPTODACTYLIDAE

By H. W. PARKER, M.A.,

Department of Zoology, British Museum (Natural History).

(With one plate and twenty text-figures.)

THE first frog of this family to be named and described was the *Rana australiaca* of Shaw, which was renamed *Rana spinipes* by Schneider a few years later. The first to be referred to a definite family was *Crinia georgiana* Tschudi, described in 1838 and placed by its describer in the family Cystignathi. As additional species were discovered in later years they were referred to an ever-increasing number of families according to the views of the times, and it was not until 1865 and 1868 when Cope published his papers on the classification of the Anura that our present system began to take shape. Cope's disposition of the genera known to him (1865, 1866*a* and *b*) was :—

Bufonidae		<i>Chelydobatrachus</i> (= <i>Myobatrachus</i>).
		<i>Pseudophryne</i>
Asterophrynidae		<i>Cryptotis</i> (= <i>Adelotus</i>)
Cystignathi	Pseudes	<i>Mixophyes</i>
	Ceratophydes	<i>Chiroleptes</i> (= <i>Cyclorana</i>)
	Crinia	<i>Crinia</i>
		<i>Hyperolia</i> (= <i>Uperoleia</i>)
		<i>Helioporus</i>
		<i>Neobatrachus</i> (= <i>Helioporus</i>)
		<i>Borborocactes</i> (inc. <i>Limnodynastes</i>)

Boulenger's classification in the Catalogue (1882) differed but slightly from this; the various subfamilies of Cystignathi were dropped and *Cryptotis* was also included in this family, renamed Cystignathidae; *Notaden* was added to the Bufonidae and the newly described *Batrachopsis* (= *Lechriodus*) was referred to the family Pelobatidae. The propriety of retaining the toothless forms in a family (Bufonidae) distinct from the toothed genera (Cystignathidae) was criticized from time to time, but Boulenger's arrangement persisted until 1922 when Noble, following up an earlier piece of work by Nicholls (1916), advocated the union of the Cystignathidae and Bufonidae under the latter name and the transference of *Lechriodus* to this family from the Pelobatidae. Later (1931) the same author modified this arrangement by subdividing the Bufonidae into a number of subfamilies, to one of which, the Criniinae, all the Australasian genera were referred.

It was admitted that this subfamily was but poorly defined, and could hardly be satisfactorily differentiated from some of the Neotropical groups of the same family.

Noble's conception of the "Bufonidae" has not met with universal approval, and herpetologists in general have shown a tendency to subdivide it into two, Bufonidae (corresponding to Noble's subfamily Bufoninae) and Leptodactylidae (s. Cystignathidae or Ceratophryidae), containing his subfamilies Criniainae, Heleophryninae, Rhinophryninae, Pseudinae (= Ceratophryinae Parker, 1935), Elosiinae and Leptodactylinae. But the principle of brigading the Australasian genera with others from the Neotropical region and from South Africa as one large family has not been seriously criticized.

It has long been realized that the limits and mutual relationships of the Australian genera were very inadequately understood, and the present work is an attempt to remedy this deficiency in so far as it is at present possible. More and larger collections are still required and much more detailed anatomical work is still necessary. But a larger amount of material has been available to the present author than to any other previous worker (nearly 1300 specimens, including types of 59 names), and its study has emphasized the necessity for a reconsideration of a number of previously accepted beliefs. As far as the family and subfamily status is concerned, it has become clear that the Australasian genera fall into two groups, not absolutely differentiated, but tending to grade into one another and confined to that zoogeographical region. They have been given subfamily status and are referred to in the following notes as the Cycloraninae and Myobatrachinae. These names have been selected in accordance with the principles laid down in Articles 4 and 5 of the International Rules of Zoological Nomenclature (cf. Parker, 1934 : 15). The first genus of the former subfamily whose name was made the basis of a family or subfamily name was *Chiroleptes* (*Chiroleptina* Mivart, 1869); this generic name unfortunately has to be displaced by *Cyclorana* and the subfamily name must be changed accordingly (Art. 5). The name Myobatrachinae, from *Myobatrachina* Bonaparte, 1850, long antedates the name Criniainae used by Noble (from *Crinia* Cope, 1866).

The relationships of these two Australian subfamilies to the South African and Neotropical members of the Leptodactylidae cannot be satisfactorily discussed until a comparative survey of the whole family has been completed. Their mutual relationships can best be considered after a brief survey of the various anatomical and morphological characters by which they are characterized.

Internal Cranial Morphology.—This has only been studied in a single species, *Crinia georgiana* (du Toit, 1934). During recent years a good deal of attention has been directed by morphologists and anatomists to the cranial morphology of the Anura and attempts have been made to modify the existing scheme of classification on their findings. But it must be stressed that far too few species have yet been examined for any satisfactory generalizations to be possible and the variability of many of the characters has not been investigated. Du Toit gives the following summary of characters noticed in *Crinia georgiana* :—

- (1) The alary forms the lateral support of the entire lateral wall of the apertura externa and vestibulum.
- (2) The crista subnasalis is absent.
- (3) The anterior undivided part of the crista intermedia is much bigger than in *Rana*.
- (4) The posterior vestibular "wulst" is absent.
- (5) The plica obliqua is suspended from the tectum nasi.

- (6) The infundibulum possesses an extra antero-ventral extension.
- (7) A well developed recessus sacciformis is present.
- (8) The cavum medium, being more posteriorly situated than in the European *Rana*, does not share in the formation of the recessus sacciformis.
- (9) The ductus nasolacrimalis opens into the roof of the horizontal part of the infundibulum.
- (10) The recessus lateralis attains an enormous size.
- (11) The plica isthmi is absent.
- (12) The intermaxillary gland opens into the buccal cavity by two main ducts only.
- (13) The septomaxillary consists of an anterior unpaired portion which has two posteriorly-directed processes.
- (14) The connective tissue between the latter bone and the lamina inferior tends to disappear.
- (15) The vomer (prevomer) is divided, consisting of an anterior edentulous and a posterior dentigerous portion.
- (16) The os en ceinture is paired.
- (17) The foramen for the IVth nerve is situated in front of the foramen opticum.
- (18) The arteria carotis cerebialis enters the skull through a separate foramen.
- (19) The foramen perilymphaticum superius does not communicate with the jugular foramen.
- (20) The fronto-parietal fontanelle is large.
- (21) There is only one dorsal fenestra in the chondrocranium.
- (22) The annulus tympanicus is sickle shaped.
- (23) The hyomandibular branch of the trigeminal nerve is ventrally situated to the plectrum.
- (24) The posterior part of the operculum is weakly perichondrally ossified.
- (25) The articular region differs from that of *Rana*.
- (26) *Crinia* possesses a bursa angularis oris.
- (27) The hyale is confluent with the otic capsule.

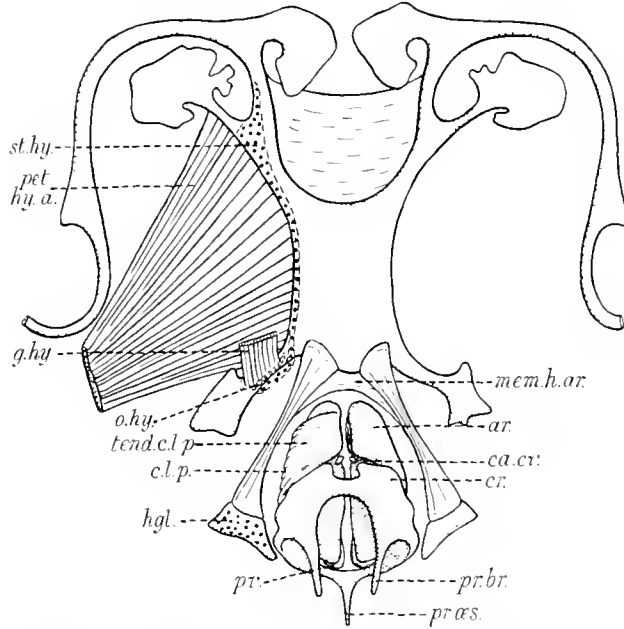
Many of these characters are of widespread occurrence throughout the Anura and can have little or no taxonomic importance, but others again (e.g. 23) may be peculiar to the species or genus. Those which have been investigated in more than one species of the subfamilies under consideration will be considered separately.

Premaxillae.—These show no great diversity of structure; they are dentigerous in the Cycloraniinae except *Notaden*, but are edentulous in *Uperoleia* (part), *Metacrinia*, *Glauertia* (part), *Pseudophryne* and *Myobatrachus* of the other subfamily. In males of *Adelotus* the teeth are somewhat enlarged.

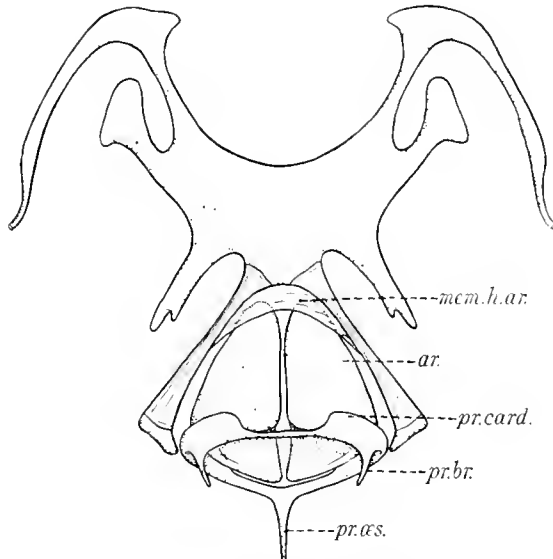
Maxilla.—This bone is usually deeper than normal in the Cycloraniinae where it is dentigerous except in *Notaden*; in some species of *Cyclorana*, notably *C. australis*, its outer face is heavily sculptured. In the Myobatrachinae the bone is relatively less deep and is toothless in those genera where the premaxilla is also edentulous (*q.v.*).

Septomaxillary.—Apparently present in all genera of both subfamilies; its variation has not been investigated.

Prevomer.—In the Cycloraniinae this bone is large and entire with a strong posterior portion bearing teeth (text-figs. 4-9). In the Myobatrachinae, however,

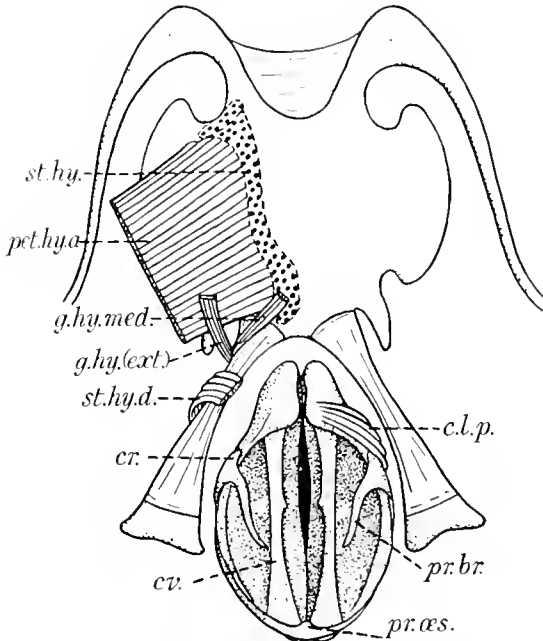


TEXT-FIG. 1.—Hyoid and larynx of *Heleioporus albopunctatus* (after Trewavas). *ar.* = arytaenoid; *ca.cv.* = cartilage of vocal chord; *c.l.p.* = posterior constrictor laryngis; *cr.* = cricoid; *g.hy.* = genio-hyoid muscle; *hgl.* = hyoglossus muscle; *mem.h.a.* = hyo-arytaenoid membrane; *o.hy.* = omohyoid muscle; *pet.hy.a.* = anterior petrohyoid muscle; *pr.br.* = bronchial process; *pr.oes.* = oesophageal process; *p.v.* = pulvinar vocale; *st.hy.* = sternohyoid muscle; *tend.c.l.p.* = tendon of posterior constrictor laryngis.



TEXT-FIG. 2.—Hyoid and larynx of *Limnodynastes peronii* (♀) (after Trewavas). *pr.card.* = cardiac process. Other abbreviations as in text-fig. 1.

it is greatly reduced in size, is often divided into two, with the posterior, primitively dentigerous, portion disappearing and teeth vestigial or entirely absent (text-figs. 13-15). In this latter subfamily a transitional series can be traced from species such as *Crinia laevis*, in which vomerine teeth are still present and the bone is entire (text-fig. 14), to forms such as *Pseudophryne*, in which both the anterior and posterior portions may be completely lost. But in no member of this subfamily is the bone as large, or the teeth as numerous, as in any member of the Cyclorantinae. There is no absolute correlation between loss of maxillary and vomerine teeth. In the Cyclorantinae maxillary teeth are lost only by *Notaden*, where vomerine



TEXT-FIG. 31.—Hyoid and larynx of *Crinia signifera* ♂. Membranous wall of larynx removed, but vocal chords left in place. (After Trewavas.) *cr.* = vocal chord; *g.hy.med.* = median geniohyoid muscle; *st.hy.d.* = dorsal part of sternohyoid muscle. Other abbreviations as in text-fig. 1.

teeth persist; in the Myobatrachinae vomerine teeth are absent in *Uperoleia rugosa* whilst maxillaries still persist. There does appear, however, to be a correlation between the vomerine condition and the tongue, with which also the hyoid and intermaxillary glands are related (*q.v.*). Teeth, in order to function, need a firm surface to bite on. In the case of the vomers this surface is the tongue, and consequently it is not surprising to find that where the tongue is large and broad, as in the Cyclorantinae, the vomers are well developed, whereas in the Myobatrachinae, which all have a much smaller, narrow tongue, the vomerine teeth are obsolescent. It has been noticed in the Microhylidae (Parker, 1934 : 6) that there is a similar correlation between the presence of a large broad tongue and an unreduced prevomer.

Palatine.—This bone is present throughout both subfamilies and shows no important variation.

Ethmoid.—This bone is entire in the Cyclorantinae, but may be divided, as in

¹ Text-figs. 1-3 reproduced by permission of the Royal Society of London.

the family Microhylidae, in some members of the Myobatrachinae, e. g. *Uperoleia*, *Pseudophryne* and *Crinia*. Not infrequently it is continued forwards as a perichondral ossification in the tectum, solum and septum nasi (cf. *Cyclorana australis*, text-fig. 5).

Fronto-parietals.—In the majority of the genera of both subfamilies these bones are very small, laterally disposed and widely separated from one another. In *Cyclorana*, *Lechriodus*, *Mixophyes* and *Adelotus* of the one subfamily they form a median suture, but in the Myobatrachinae the genus *Uperoleia* alone lacks a fronto-parietal foramen.

The Lower Jaw.—Shows no important modifications except in the genus *Adelotus* where a pair of very large, tusk-like odontoids are developed anteriorly in the male sex. The function of these structures is not known, but it is interesting to note that a similar development has occurred in certain African Ranids (*Dimorphognathus*, *Petropedetes* and *Phrynodon*) and in some Asiatic species of the genus *Rana*.

Hyoid and Larynx.—These structures have been fully investigated by Trewavas (1933), but in only a limited number of species—*Heleioporus albopunctatus*, *Limnodynastes peronii*, *Crinia signifera* and *Mixophyes fasciolatus*. When due allowance is made for the fact that the only specimen of the latter species which was examined was a juvenile, it appears that these four species fall into two clearly-definable groups, corresponding to the two subfamilies, and characterized thus :

A. Cyclorantinae (*Heleioporus*, *Limnodynastes* and *Mixophyes*).

- (1) Alary process narrow proximally, but expanded distally (text-figs. 1 and 2).
- (2) Cricoid complete.
- (3) Oesophageal process of the cricoid more or less slender.
- (4) M. omohyoideus present.
- (5) Mm. sternohyoideus and petrohyoidei attached at the lateral edges of the hyoid plate.

B. Myobatrachinae (*Crinia*).

- (1) Alary process of the hyoid a wing-like expansion of almost the whole lateral margin of the hyoid plate, without narrow stalk (text-fig. 3).
- (2) Cricoid incomplete.
- (3) Oesophageal process of the cricoid broad and short, or almost absent.
- (4) M. omohyoideus absent.
- (5) Mm. sternohyoideus and petrohyoideus anterior inserted on the ventral surface of the hyoid, reaching the middle line in the posterior part of this insertion.

Certain of these characters, notably the loss of the omohyoideus and the division of the cricoid, are believed to have little taxonomic significance for they occur many times in the Anura in completely unrelated forms, but the shape of the alary processes and the attachment of the sternohyoideus and petrohyoidei appear to be correlated with other characters and may have considerable taxonomic value. Thus the broad wing-like, sessile alary process is found in all the Myobatrachinae (*Uperoleia*, *Crinia*, *Metacrinia*, *Glauertia*, *Pseudophryne* and *Myobatrachus* examined), whilst the pedunculate type is common to all the Cyclorantinae (*Cyclorana*, *Lechriodus*, *Mixophyes*, *Limnodynastes*, *Heleioporus*, *Philoria*, *Adelotus* and *Notaden* examined).

All the genera appear to lack the apical cartilage which is a characteristic feature of most Ranids and Rhacophorids.

Ear.—This organ is present and well developed in all the genera of both subfamilies except *Pseudophryne*, where the tympanum, annulus tympanicus, cavum tympani, columella (plectrum) and Eustachian tube are absent. This condition of the auditory apparatus occurs in many unrelated genera of the Anura so that too great reliance cannot be placed upon it as a guide to phylogeny. The facts that this condition is normal in the Urodela and that the fully-developed anuran ear passes through a similar stage in its ontogeny¹ suggest that the condition may be a primitive one, and it is possible that its sporadic reappearance in so many unrelated Anuran genera is a manifestation of a neotenic tendency.

The external and middle ear show some variations in different genera. The annulus tympanicus is generally incomplete dorsally; in the highly modified burrowing genera there is a tendency for the extra-plectal (columellar) cartilage to increase in size, and in *Myobatrachus* it forms a large thickened pad, as large as, and closely apposed to, the whole of the tympanum. The size and distinctness externally (due to thinning of the overlying skin) of this latter organ are very variable, the general tendency being towards smaller tympana, more deeply seated (partly covered by the m. depressor max. inf.) and protected by thickened skin in cryptozoic forms.

Tongue.—This organ is either subcircular or very broadly oval in the Cyclorhinae, or relatively long and narrow, sometimes quite small, in the Myobatrachinae. These two types of tongue are associated with a different disposition of the openings of the intermaxillary glands (*q.v.*), and also with those differences in the hyoid and prevomer which have already been mentioned. It seems highly probable that all these differences are intimately correlated and that they are concerned with the method of feeding. There appear to be no essential differences in the nature of the food taken by the two subfamilies; in fact the most specialized genera of each, *Notaden* and *Myobatrachus* respectively, parallel one another closely, for both are essentially myrmecophagous and specially adapted for life in termitaria. Yet *Notaden* has a broad, subcircular tongue, vomerine teeth, a long series of ducts from the intermaxillary gland, long, pedunculate alary processes of the hyoid and sternohyoideus and petrohyoideus muscles attached laterally to the hyoid plate, whereas in *Myobatrachus* the tongue is a small, narrow organ, and all the associated structures of the hyoid region and intermaxillary gland are concentrated towards the middle line, and vomerine teeth are wanting. The prey appears to be the same in both genera, yet the mechanism by which it is captured is very different.

Intermaxillary Gland.—E. Müller (1932) has given a general account of the disposition of these glands and their ducts in the Anura and has classified them into five main groups. Representatives of only three genera of the present subfamilies were examined by him, *Pseudophryne*, *Limnodynastes* and *Uperoleia*, and he notes that these three fall into two groups. In *Uperoleia* and *Pseudophryne* the openings of the gland are concentrated near the centre line into two ducts, whereas in *Limnodynastes* the openings of the gland are numerous (14) and form an irregular, transversely oval patch, occupying a space almost equal to the inter-choanal width. A survey of the gland in almost every species of the two Australian subfamilies lends no support to Müller's classification into five main categories, but shows that there is, as might have been expected, a distinct correlation between

¹ du Toit and de Villiers, 1932, *S. Afr. J. Sci.*, 29: 449-495.

the disposition of the ducts and the shape of the tongue. The function of the gland being to furnish the sticky secretion which enables the tongue to pick up food, a broad tongue will need a widely spread series of ducts for the even distribution of the secretion over its tip, whilst with a narrow tongue a corresponding concentration of the ducts towards the centre-line is essential for efficiency. This is what obtains in fact. In the broad-tongued Cyclorantinae there are numerous ducts arranged in a more or less regular transverse series over a width almost, or quite, equal to the interchoanal space. Sometimes they form a regular, continuous linear series which may even open under a single long fold of the mucous membrane; more frequently, however, they are arranged in three groups on a transverse line, but every gradation between the two extremes can be found. In the Myobatrachinae there are never more than two ducts, opening close together near the middle line, and not infrequently the two open under a common fold which results in the opening appearing single; both conditions may be found within the one species.

Shoulder Girdle.—This structure is relatively stable in the arciferal families, as compared with the firmisternal, where reduction or loss of the clavicle and procoracoid has taken place on numerous occasions. In the Australian Leptodactylidae very few important structural differences have been noticed. Clavicles, procoracoids and coracoids are invariably present and well developed; the omosternum may be absent, but when present is always small and cartilaginous; the sternum also is never ossified, though in old individuals of some of the larger forms there may be some degree of calcification. *Myobatrachus* alone shows any great divergence from the normal, and here there seems to have been a strengthening of the girdle against lateral compression by a broadening of the clavicles and the procoracoid region, whilst the coracoids have assumed a more oblique position and are scarcely larger or stouter than the clavicles (text-fig. 20). The modification recalls, though to a less extent, the conditions to be found in the African Ranid *Hemisus* which is also a cryptozoic genus. A secondary result of the widening of the mesial ends of the clavicles and procoracoids is that the epicoracoids meet edge to edge for about a third of their length and so approach an arcifero-firmisternal condition.

In *Crinia*, and especially in *Crinia haswelli* (text-fig. 15a), the procoracoids extend anteriorly beyond the clavicles, and their form strongly suggests that the omosternum is homologous with the anterior portion of these cartilages. Anatomists cannot agree as to the homologies of this structure in the Anura (de Vos, 1938 : 56), but it seems highly improbable that they are correct in believing it to be of different origin in various species of the same genus.

Vertebral Column.—As in most of the arcifera the vertebrae are pro-coelous, but a peculiar and primitive feature of both subfamilies is the incomplete fusion of the intervertebral condyle with the vertebra and the partial persistence of the notochord; in *Cyclorana* and *Lechriodus* only is the notochord completely lost and the condyle firmly ankylosed to the vertebra. The normal number of 8 presacral vertebrae is found throughout the Myobatrachinae, but in the Cyclorantinae fusion of the first and second vertebrae occurs in five genera—*Limnodynastes*, *Heleioporus*, *Philoria*, *Adelotus* and *Notaden*. The sacral diapophyses are somewhat dilated in all the genera examined, except *Mixophyes*, and the urostyle articulates by two condyles.

Thigh Muscles.—The disposition of the muscles of the thigh, and particularly the relation of the distal tendon of the m. semitendinosus to the mm. graciles, has been shown (Noble, 1922) to be of considerable assistance in elucidating

anuran relationships. In all the Procoela it has been claimed that the semitendinosus is separate from the sartorius and that its distal tendon is either ventral to, or very rarely pierces, the gracilis major and g. minor. It is within the present subfamilies that the rarer condition has been reported. In *Limnodynastes ornatus* the tendon of the semitendinosus pierces the actual gracilis major and minor muscles, and in *Pseudophryne australis* a further stage in the inward migration of the tendon is found, where it perforates, not the muscles themselves, but their ligamentous head. The examination of further material reveals that the inward migration of the tendon of the semitendinosus progresses ever further, and that in the final stages it has passed dorsal to the gracilis entirely, and so attained the condition hitherto regarded as characteristic of the diplasiocoelus firmisternia. In the two subfamilies a complete gradation from one extreme to the other can be traced, but the ventral, presumably more primitive, condition is only found in the Cycloraminae, whilst the dorsal condition is confined to the Myobatrachinae. The various conditions can be roughly subdivided and classed into four groups thus :

	Genus.	Species.	Subfamily.		
I. Distal tendon of the semitendinosus passing ventral to the graciles	<i>Heleioporus</i>	<i>pictus</i> <i>australis</i>	Cycloraminae.		
	<i>Mixophyes</i>	<i>fasciolatus</i>			
	<i>Cyclorana</i>	<i>albopunctatus</i> <i>australis</i> <i>platycephalus</i>			
	<i>Limnodynastes</i>	<i>dorsalis</i> <i>olivaceus</i> <i>peronii</i> <i>salmi</i> <i>tasmaniensis</i>			
	<i>Notaden</i>	<i>bennetti</i> <i>nichollsi</i>			
	II. Distal tendon of the semitendinosus perforating the gracilis complex	<i>Limnodynastes</i>		<i>ornatus</i>	Myobatrachinae.
		<i>Lechriodus</i>		<i>melanopyga</i> <i>platyceps</i> <i>fletcheri</i>	
		<i>Adelotus</i> ¹		<i>brevis</i>	
		<i>Uperoleia</i>		<i>marmorata</i>	
		<i>Crinia</i>		<i>georgiana</i> <i>signifera</i> <i>lacvis</i> <i>tasmaniensis</i>	
III. Distal tendon of the semitendinosus perforating the ligamentous head of the graciles		<i>Pseudophryne</i>	<i>australis</i> <i>bibroni</i> <i>coriacea</i>	Myobatrachinae.	
	<i>Glauertia</i>	<i>orientalis</i>			
	IV. Distal tendon of the semitendinosus passing dorsal to the graciles	<i>Glauertia</i>	<i>russelli</i>		
		<i>Metacrinia</i>	<i>nichollsi</i>		
	<i>Myobatrachus</i>	<i>gouldii</i>			

¹ Noble, 1922, classes this species under the following section, but the examples examined by the author show it to have a thigh-muscle complex very similar to that of *Uperoleia*.

Pectoral Muscles.—Jones (1933) has investigated the pectoral musculature of *Cyclorana australis*, *Limnodynastes tasmaniensis*, *L. peronii* and *Uperoleia marmorata* in a survey of the pectoral myology of the Salientia. He finds that the supracoracoideus profundus, found in all these four species, is characteristic of the arcifera. The episternohumeralis, a variable muscle in the firmisternia, is also present in the four Australian species as well as in all the other arcifera except the genera *Bufo* and *Rhinophrynus*. The sternoepicoracoideus, a new muscle, is found in *Cyclorana* and *Limnodynastes* but is absent from *Uperoleia*. In *Cyclorana* it arises from the antero-lateral edge of the sternum and is inserted by a narrow tendon into the dorsal surface of the epicoracoid; similar conditions are reported in the Discoglossidae and South American Leptodactylidae (*Pleurodema*). In the two species of *Limnodynastes* it arises partly from the first myocomma of the rectus abdominis as well as the sternum and so approaches the condition noted in the genus *Hyla* (*H. arborea* and *H. rubra*), where the muscle arises from the myocomma only.

Pupil.—A good deal of confusion has been caused at various times through incorrect descriptions of pupil-shape. This is usually to be accounted for by preservation, the degree of contraction, or distortion having masked the true shape. In the majority of genera of both subfamilies the shape appears to be ∇ , but irregularities of contraction may result in either the ventral or lateral angles becoming unduly emphasized. In *Mixophyes* alone is it truly a vertical ellipse.

Viscera.—Hoffman (1931) has described certain features of the viscera, e.g. disposition of lungs, liver-lobes, relations of stomach to duodenum, and the arrangement of the rugae of the lining of the intestinal canal in *Crinia georgiana*. An attempt is made to utilize some of these characters in distinguishing the South African genus *Heleophryne* from the Cystignathidae (Leptodactylidae), but too little is at present known of the variability of these organs for it to be possible to assess their taxonomic value.

Consideration of these facts makes it evident that the two subfamilies are clearly differentiated by the tongue and the associated structures such as prevomers, vomerine teeth, the hyoid apparatus and intermaxillary glands. Other associated characters, such as the vertebral condition and the thigh muscles, also lend support to the view that the two groups represent different evolutionary lines. But in these latter characters and in others, there is a complete intergradation between the two, suggesting a not very remote common ancestry. It is, of course, conceivable that the Myobatrachinae are not a natural assemblage, but are a group of forms derived from the Cycloraninae by the evolution of the same type of feeding-mechanism on more than one occasion. If the feeding-mechanisms of the two were intimately associated with different foods such a view might have something to recommend it; but in fact no such difference appears to exist and, as has already been pointed out, representatives of each group (*Notaden* and *Myobatrachus*) appear to live under very similar conditions. Unfortunately there is no evidence other than the morphological which will assist in elucidating the relationships of the two subfamilies to one another and to the rest of the Anura. The only fossils known which might throw any light on the subject are the Eocene frogs of the Intertrappean beds of Bombay which have been variously referred to *Rana*, *Oxyglossus* and *Indobatrachus*. If Noble's interpretation (1930) be correct, then *Indobatrachus* should be referred to the Myobatrachinae; it appears to have 8 presacral vertebrae, with the notochord persistent, and vomerine teeth in very small groups, arguing a reduced prevomer. Unfortunately, as in most fossil frogs,

the difficulties of correct interpretation are very great, so that the reference of this fossil genus to the Myobatrachinae must be regarded as somewhat uncertain, and it provides no clue to the relationship of this subfamily with the Cycloraniinae. If correctly referred it indicates that the subfamily persisted in the Oriental region long after the Australian members of the same group had become isolated, and provides additional evidence, if such be necessary, that the whole family Leptodactylidae at one time had a more northerly distribution.

The descriptive methods and terminology used in the following pages conform to standard practice. The dimensions given are for the most part maxima, since, with animals which continue to grow after the attainment of sexual maturity, it is not practicable to give the actual range of adult size with any accuracy. Only when size has been invoked as a specific or subspecific criterion has an attempt been made to give ranges and means. In these instances the ranges are based on obvious adults, i.e. females with distended ovaries containing pigmented ova and males with secondary sex-characters. Such a series will naturally contain a greater proportion of old individuals than of those which have only just reached maturity, and consequently both the range and mean will err on the large side.

Only very approximate geographical ranges are given, though no doubt much interesting information would be forthcoming were the geographical ranges of the various species to be plotted and compared with maps showing climatological, botanical, physiographical, geological and other data. But such maps, to be of value, must be accurate and reasonably complete—criteria which cannot at present be fulfilled even approximately.

During the course of this work so many herpetologists have assisted with advice, information or material that to thank them all individually would need too great a space, whilst to select a few would be invidious. It is, however, essential to proffer thanks to Professor G. E. Nicholls, to whom modern amphibian taxonomy owes so much. The collections he made in West Australia and presented to the British Museum provided the focal point for much of the work, and arguments and discussions with him have given the author numerous pointers and saved him from many egregious errors. The bulk of the material, other than that in the British Museum, has been received from the Museums in Amsterdam, Harvard, Leiden, Perth (W.A.), Stockholm and Sydney; to the authorities in these institutions the author wishes to express his great indebtedness.

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Subfamily CYCLORANINAE.

- RANIFORMES (part) Duméril & Bibron, 1841, *Erpét. Gén.*, 8 : 317.
 RANAE (part) Fitzinger, 1843, *Syst. Rept.* : 31.
 CYSTIGNATHIDAE (part) + DISCOGLOSSIDAE (part) + ALYTIIDAE (part) Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 26, 34, 37.
 ASTEROPHRYDIDAE (part) + SCAPHIOPODIDAE (part) + CYSTIGNATHIDAE (part) Cope, 1865, *Nat. Hist. Rev.*, n.s. 5 : 97-120.
 ASTEROPHRYDIDAE (part) + CYSTIGNATHIDAE, PSEUDES (part) + CYSTIGNATHIDAE, CERATOPHRYDES (part) + CYSTIGNATHIDAE, CRINIAE (part) Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), 6 : 67-97.
 RANIDAE (part) + DISCOGLOSSIDAE (part) + ALYTIIDAE (part) Steindachner, 1867, *Reise Novara, Zool., Amph.* : 7-34.
 CYSTIGNATHIDAE (part) Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, 18 : 343.
 CYSTIGNATHIDAE (part) + DISCOGLOSSIDAE + ALYTIIDAE (part) Keferstein, 1868, *Arch. Naturgesch.*, 34 : 251-273.
 ALYTIIDAE, UPEROLIINA (part) + RANIDAE, CYSTIGNATHINA (part) + DISCOGLOSSIDAE, CHIROLEPTINA (part) and ASTEROPHRYDINA (part) Mivart, 1869, *Proc. zool. Soc. Lond.* : 288-294.
 CYSTIGNATHIDAE (part) + BUFONIDAE (part) + PELOBATIDAE (part) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 183-432.
 BUFONIDAE (part) Noble, 1922, *Bull. Amer. Mus. nat. Hist.*, 46 : 1-87.
 CERATOPHRYDIDAE (part) + BUFONIDAE (part) Waite, 1929, *Rept. Amph. S. Australia* : 244-266.
 BUFONIDAE, CRINIINAE (part) Noble, 1931, *Biol. Amph.* : 496.
 LEPTODACTYLIDAE (part) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 8.

Tongue broadly oval or subcircular, large. Intermaxillary glands with numerous ducts arranged either in a long, transverse, linear series or in a transversely oval patch or in three groups on a transverse line. Prevomer always present, entire and well developed, with its posterior process bearing a long series of teeth (text-figs. 4-9). Alary processes of the hyoid pedunculate (text-figs. 1-2); sternohyoid and petrohyoid muscles attached to the lateral edges of the hyoid plate. Distal tendon of the m. semitendinosus usually passing ventral to the mm. gracilis, more rarely perforating them. Sternopectoracoidens present (*Cyclorana*, *Limnodynastes*). First and second vertebrae fused in genera where the notochord is persistent, free where the notochord is lost.

KEY TO GENERA.

I. Maxillary teeth present.

- A. Pupil vertical; no fronto-parietal foramen; 8 presacral vertebrae; sacral diapophyses not dilated. Toes webbed, the membrane penetrating between the outer metatarsals *Mixophyes*.
- B. Pupil horizontal; digital webbing not penetrating between the outer metatarsals.
- (1) No fronto-parietal foramen in adults.
- (a) First finger opposed to the remainder, the second very short; vomerine teeth between the choanae; 8 presacral vertebrae *Cyclorana*.
- (b) First finger not opposable to the remainder; vomerine teeth behind the level of the choanae.
- (i) Toes with small terminal discs; no dentary pseudo-teeth; 8 presacral vertebrae *Lechriodus*.
- (ii) Toes without terminal discs; male with 2 large, fang-like, dentary pseudo-teeth; first and second vertebrae fused *Adelotus*.

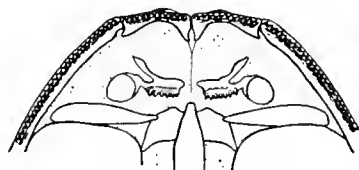
- (2) A large fronto-parietal foramen ; 1st and 2nd vertebrae fused
 - (a) Vomerine teeth between the choanae *Heleioporus*.
 - (b) Vomerine teeth behind the level of the choanae
 - (i) Vomerine series moderately extensive, extending laterally beyond the inner borders of the choanae . . . *Limnodynastes*.
 - (ii) Vomerine series short and oblique, not extending laterally beyond the inner borders of the choanae *Philoria*.

H. Maxillary teeth absent ; a large fronto-parietal foramen ; 1st and 2nd vertebrae fused ; vomerine teeth small *Notaden*.

MIXOPHYES Günther.

Mixophyes Günther, 1864, *Proc. zool. Soc. Lond.* : 46 (Type species—*Mixophyes fasciolatus*); *idem*, 1864, *Ann. Mag. nat. Hist.*, (3), **14** : 311; Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 80, 93; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 10; Kefzersten, 1868, *Arch. Naturgesch.*, **34** : 254; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 188; Cope, 1889, *Bull. U.S. nat. Mus.*, **34** : 311; Nieden, 1923, *Das Tierreich, Anura* **1** : 518; Noble, 1931, *Biol. Amph.* : 497.
Myxophyes Cope, 1865, *Nat. Hist. Rev.*, n.s., **5** : 111.
Hyla de Vis, 1884, *Proc. roy. Soc. Queensland*, **1** : 128.

Maxillary teeth present. Prevomer entire, bounding the choana anteriorly and laterally with an anterior projection towards the maxilla and a mesially-directed, dentigerous branch which does not reach the palatine ; fronto-parietals large, forming a median suture. Ear fully developed. Vertebrae procoelous ; 8 presacrals ; sacral diapophyses cylindrical ; coccyx articulating by two condyles.



TEXT-FIG. 4.—Anterior cranial elements of *Mixophyes fasciolatus* juv. $\times 5$. (From beneath.)

Omosternum cartilaginous ; sternum cartilaginous, entire posteriorly. Terminal phalanges simple.

Distal tendon of the m. semitendinosus passing ventral to the tendon of the m. gracilis. The hyolaryngeal apparatus has only been examined in a juvenile specimen and Trewavas (1933 : 512) considers such material unsuitable for comparison ; nevertheless it is apparent that the apparatus is *Heleioporus*-like, rather than *Crinia*-like, with a complete cricoid, m. omohyoideus present, and the mm. sternohyoideus and petrohyoidei attached at, or close to, the lateral edges of the hyoid plate.

Pupil vertical. Tongue subcircular, entire or emarginate, and scarcely free behind. Toes webbed, the membrane penetrating between the outer metatarsals.

Mixophyes fasciolatus fasciolatus Günther.

Mixophyes fasciolatus Günther, 1864, *Proc. zool. Soc. Lond.* : 46, pl. 7, fig. 1 (Type locality : —Clarence River, N.S.W.); *idem*, 1864, *Ann. Mag. nat. Hist.*, (3), **14** : 312. Krefft, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107; Steindachner, 1867, *Reise Novara, Zool., Amph.*

10; Günther, 1868, *Proc. zool. Soc. Lond.* : 479; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 255, pl. 5, fig. 6; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 188; *idem*, 1885, *Ann. Mag. nat. Hist.*, (5), **16** : 387; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 372; *idem*, 1890, *op. cit.*, (2), **5** : 669-671; *idem*, 1892, *op. cit.*, (2), **7** : 18; *idem*, 1894, *op. cit.*, (2), **8** : 529; Lucas and le Souef, 1900, *Anim. Austral.* : 267, fig. ; Harrison, 1922, *Aust. Zool.*, **3**, **1** : 34; Nieden, 1923, *Das Tierreich*, Anura I : 518, fig. 350; Trewavas, 1933, *Phil. Trans. roy. Soc. London*, **222**, **B** : 438, fig. 28.

Myxophyes fasciolatus Krettt, 1865, *Pap. Proc. roy. Soc. Tasmania* : 16.

Mixophyes fasciolatus fasciolatus Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 10.

Hyla fenestrata de Vis, 1884, *Proc. roy. Soc. Queensland*, **1** : 128 (Type locality:—Tweed River).

Head broader than long. Snout rounded, not prominent, 1.4 to 1.5 times as long as the eye with obtusely angular canthus rostralis and oblique, slightly concave loreal region; nostril equidistant from the eye and the end of the snout; interorbital space equal to, or a little broader than, the width of an upper eyelid; tympanum very distinct, vertically oval, its horizontal diameter $\frac{1}{2}$ to $\frac{2}{3}$ that of the eye. Fingers slender, the first a trifle longer than the second, which is shorter than the fourth; subarticular tubercles well developed on the metacarpophalangeal joints only, with a smaller supernumerary tubercle proximal to each; two metacarpal tubercles. Toes two-thirds webbed, the edge of the membrane midway between the third and fourth toes being level with the distal subarticular tubercle of the third; three phalanges of the fourth toe free from web; subarticular tubercles moderate; an elongate, oval inner, but no outer, metatarsal tubercle. Tibio-tarsal articulation reaching the nostril or beyond the tip of the snout.

Skin smooth above and beneath; a curved supratympanic fold; anal region feebly granular.

Brown or olive above, the dorsum usually with scattered, irregular polygonal darker markings; a curved dark line from the tip of the snout, through the nostril, along the canthus rostralis and along the supratympanic fold, often spreading over the tympanum; a dark interorbital bar which may be prolonged backwards as a triangular or T-shaped marking. Flanks dark-spotted. Limbs with numerous narrow dark cross-bars which are most defined on the concealed surfaces; hinder side of the thighs dark-mottled. Lower surfaces white, the gular region of the male dotted and stippled close to the lower jaw.

Length from snout to vent : ♂ 63 mm.; ♀ 97 mm.

Male with a diffuse nuptial pad on the dorso-lateral surface of the first finger and edge of the inner metacarpal tubercle; a vocal sac. Embrace axillary; spawning apparently in spring or autumn in New South Wales (embrace in April, Harrison; tadpoles in advanced stage of development December, Fletcher).

The species is diurnal, frequenting the banks of creeks in deep, shady gullies and taking readily to the water when alarmed.

DISTRIBUTION: New South Wales east of the dividing range and southern Queensland.

SPECIMENS EXAMINED.

B.M. 62.10.26.3	♂	Clarence River	Krettt. COTYPE.
94.1.17.39	♀	" "	" "
88.7.3.1-2	♀, juv.	Mt. Wilson	Fletcher.
88.7.3.3	♂	Springwood, N.S.W.	" "
1931.10.19.1	juv. (cleared)	Upper Maring River, N.S.W.	Hill.

Mixophyes fasciolatus schevilli Loveridge.

Mixophyes fasciolatus Andersson, 1916, *K. Svenska Vetensk. Akad. Handl.*, **52**, 9: 7.
Mixophyes fasciolatus schevilli Loveridge, 1933, *Oec. Pap. Boston Soc. nat. Hist.*, **8**: 55.
 (Type localities:—Millaa Millaa and Lake Barrine, Atherton Tableland, and 4000 ft. Bellenden Ker Range, Queensland); *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 11.

Similar in general characters to the typical form, but with the toes $\frac{3}{4}$ webbed, (only two phalanges of the fourth and none of the fifth being free) and with the bars on the limbs tending to coalesce to form fewer, broader, bands.

Length from snout to vent: ♂ 61 mm.; ♀ 83 mm.

DISTRIBUTION: Atherton Tableland, Bellenden Ker Range, and Malanda, Queensland. Intermediates showing intergradation with the typical form are said to occur in the area from the Richmond River, N.S.W., to the Bunya Mountains of southern Queensland.

CYCLORANA¹ Steindachner.

Alytes Gray, 1842, *Zool. Misc.*, **2**: 50.
Chiroleptes (non Kirby, 1831) Gunther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 34 (Type species:—*Alytes australis* Gray); Cope, 1865, *Nat. Hist. Rev.*, n.s., **5**: 108; *idem*, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6**: 80, 93; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 297; Cope, 1889, *Bull. U.S. nat. Mus.*, **34**: 312; Noble, 1931, *Biol. Amph.*: 407.
Chiroleptes (emend.) Spencer, 1901, *Proc. roy Soc. Victoria*, (2), **13**: 176.
Cyclorana Steindachner, 1867, *Reise Novara, Zool., Amph.*: 29. (Type species:—*Cyclorana novae-hollandiae*).
Phraetops Peters, 1867, *Mber. Akad. Berlin*: 30 (Type species:—*Phraetops alutaceus*); Ogilby, 1907, *Proc. roy Soc. Queensland*, **20**: 32; Nieden, 1923, *Das Tierreich, Anura I*: 520; Waite, 1929, *Rep. Amph. S. Austral.*: 245.
Mitrolysis Cope, 1889, *Bull. U.S. nat. Mus.*, **34**: 312 (Type species:—*Chiroleptes albugutlatus* Gunther); Nieden, 1923, *Das Tierreich, Anura I*: 524; Noble, 1931, *Biol. Amph.*: 947.

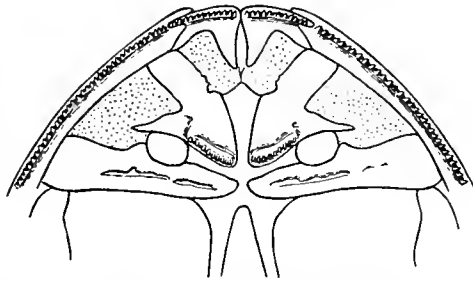
Maxillary teeth present. Prevomere large, bounding the choanae anteriorly, with an anterior process which may meet the premaxilla, and a short, posterior, dentigerous portion between the choanae, not overlying the palatine. Fronto-parietals forming a median suture, their lateral borders raised to form a distinct ridge. Ear fully developed. In adult individuals the dorsal surfaces of the skull are often somewhat rugose and in *P. australis* a considerable amount of secondary rugose bone is present on the nasals, premaxillae, maxillae, fronto-parietals and squamosals, the zygomatic process being greatly enlarged and forming a broad arcade across to the maxilla. Palatines with more or less distinctly raised ridges and prominences ventrally. Vertebrae procœlous, the condyle completely ankylosed and the notochord not persistent; sacral diapophyses slightly dilated; urostyle articulating by two condyles; 8 presacral vertebrae. Omosternum well developed; sternum large, cartilaginous, bifid posteriorly; clavicles strongly curved. Terminal phalanges simple.

¹ As Ogilby (1907, *loc. cit.*) has pointed out, the name *Chiroleptes*, so frequently used for this genus, is a homonym and must be dropped. But his selection of *Phraetops* to replace it cannot be maintained. This name was proposed by Peters at a sitting of the Prussian Academy of Science on January 10, 1867, and was not published until later in that year, the January Heft of the *Monatsbericht* was actually not received at the Library of Göttingen University until May. But Steindachner's account of the Amphibia of the Novara collection, in which appears the name *Cyclorana*, was actually published and laid on the table of the Vienna Academy on the same day that Peters read his paper (January 10) (*cf. Anz. Akad. wiss. Wien*, **4**: 11).

Distal tendon of the m. semitendinosus passing ventral to the mm. graciles. Alary processes of the hyoid expanded distally, but arising as narrow stalks proximally, similar to those of *Heleioporus*.

Pupil horizontal but with a downwardly-directed ventral angle. Tongue subcircular, partly free behind. Toes more or less webbed. Second finger short, the first opposable to the remainder.

The species of this genus fall into two clearly-marked groups as regards their general habitus. First there are slender species with thin digital webbing of the type usually associated with "grass-frogs" or aquatic species. Of these *inermis* shows very little trace of the opposable inner digit and has two metatarsal tubercles; *dahlia* has the digital characteristic of the genus well developed and has lost the outer metatarsal tubercle whilst *alboguttatus* has the inner metatarsal



TEXT-FIG. 5.—Anterior cranial elements of *Cyclorana australis*. $\times 2$. (From beneath.)

tubercle strongly compressed and so approaches the second group of species, which are all of more or less globose habitus, and are typical fossorial species with a shovel-shaped metatarsal tubercle and webbing, when present, of a thick fleshy nature.

SYNOPSIS OF THE SPECIES.

- I. Inner metatarsal tubercle not shovel-shaped; habitus slender.
 - A. Toes $\frac{3}{4}$ webbed; two metatarsal tubercles *C. inermis*.
 - B. Toes fully webbed; a single metatarsal tubercle *C. dahlia*.
- II. Inner metatarsal tubercle shovel-shaped.
 - A. A straight dorso-lateral fold on each side of the back
 - (1) Zygomatic process of the squamosal heavily sculptured and forming a broad suture with the maxilla. Habitus stout *C. australis*.
 - (2) Zygomatic process not sculptured and separated from the maxilla or only very narrowly in contact with it. Habitus slender *C. alboguttatus*.
 - B. No definite dorso-lateral fold.
 - (1) Toes less than half webbed.
 - (a) Web midway between the 3rd and 4th toes not extending beyond the proximal subarticular tubercle of the fourth toe; metatarsal tubercle shorter than its distance from the tip of the inner toe; a strongly marked colour-pattern *C. brevipes*.

(b) Web midway between the 3rd and 4th toes reaching nearly to the level of the distal subarticular tubercle of the third; metatarsal tubercle as long as, or longer than its distance from the tip of the inner toe; colour pattern indistinct

C. cultripes.

(2) Toes $\frac{3}{4}$ webbed, or more *C. platycephalus*.

Cyclorana inermis (Peters).

Chivoleptes inermis Peters, 1867, *Mber. Akad. Berlin* : 30 (Type locality:—Rockhampton); Keferstein, 1868, *Arch. Naturgesch.*, **34** : 267; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 271; Andersson, 1913, *K. Svenska Vetensk.Akad. Handl.*, **52**, 4 : 16; *idem*, 1919, *K. Svenska Vetensk.Akad. Handl.*, **52**, 9 : 12.
Phractops inermis Nieden, 1923, *Das Tierreich, Anura I* : 524.

Habitus slender; head as long as broad. Snout pointed, slightly prominent, 1.5 to 1.6 times as long as the eye, with rounded canthus rostralis and slightly oblique, feebly concave loreal region; nostril midway between the eye and the end of the snout; interorbital space as broad as, or a little narrower than the upper eyelid; tympanum very distinct, $\frac{2}{3}$ to $\frac{3}{4}$ the diameter of the eye. Fingers moderately long, free, the first distinctly longer than the second, but the latter is better developed than in the other members of the genus, and the opposition of the first digit to the remainder is not well marked; subarticular tubercles very prominent; two large metacarpal tubercles and rows of smaller tubercles on the palm. Toes $\frac{3}{4}$ webbed, the membrane midway between the third and fourth extending beyond the distal tubercle of the third but not to the middle tubercle of the fourth; subarticular tubercles prominent; a prominent oval inner, and a smaller rounded outer, metatarsal tubercle; a dermal fold or slight fringe along the inner side of the inner digit and tarsus. Tibio-tarsal articulation reaching the centre of the eye or between this point and a little beyond the tip of the snout.

Skin with scattered warts above; belly and hinder side of thighs finely granular; throat and chest smooth.

Greyish brown above with scattered, indistinct darker mottlings; edge of the upper lip with white flecks; hinder side of the thighs spotted or marbled with dark brown and white; tibiae cross-banded; lower surfaces immaculate white except the throat of the male, which is marbled with brown.

Male with a vocal sac and a diffuse nuptial pad on the inner side of the first finger.

Length from snout to vent : ♂ 35 mm.

DISTRIBUTION : Queensland (Rockhampton, Kimberley, Torrens Creek).

SPECIMENS EXAMINED.

B.M. 1924.3.3.3	juv.	Torrens Creek, 1600 ft.	Coll. : G. H. Wilkins.
Mus. Leiden, 1888	♂	Rockhampton	Mus. Godeffroy. (PARATYPE).

Cyclorana dahlia (Boulenger).

Chivoleptes dahlia Boulenger, 1896, *Proc. zool. Soc. Lond.* : 867, pl. 49, fig. 2 (Type locality:—Daly River, N. Australia); Fletcher, 1868, *Proc. Linn. Soc. N.S.W.*, **22** : 682, 684.
Phractops dahlia Nieden, 1923, *Das Tierreich, Anura I* : 522; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 11.

Habitus slender; head as long as broad. Snout rounded, not prominent, 1.5 times as long as the eye,¹ with rounded canthus rostralis and very oblique, slightly concave loreal region; nostril equidistant from the eye and the end of the snout; interorbital space narrower than the upper eyelid; tympanum very distinct, its horizontal diameter $\frac{3}{4}$ that of the eye. Fingers moderate, the first much longer than the second and opposed to the remainder; subarticular tubercles moderately distinct, but the two metacarpals not well defined. Toes fully webbed, the membrane extending to some extent between the metatarsals; subarticular tubercles not well marked; an oval inner, but no outer, metatarsal tubercle; a slight fold along the inner edge of the metatarsus. Tibio-tarsal articulation reaching the loreal region.

Skin feebly shagreened above; a distinct curved supratympanic fold and a median nuchal furrow; lower surfaces smooth, except the hinder side of the thighs, which are feebly granular.

Brownish-olive above, with a very faint, lighter, dorsal streak; a dark canthal stripe; flanks and hinder side of the thighs spotted and marbled with white. Lower surfaces immaculate white, except the sides of the throat and the limbs, which are dotted with dark brown.

Male with a vocal sac.

Length from snout to vent: ♂ 70 mm.; ♀ 67 mm.

DISTRIBUTION: Northern Territory.

SPECIMEN EXAMINED.

B.M. 95.11.14.24

♀

Daly River, N.T.

Dahl. COTYPE.

Cyclorana australis (Gray).

- Alytes australis* Gray, 1842, *Zool. Misc.*, 2: 56 (Type locality:—North coast of Australia).
Chiropletes australis Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 34; Krefft, 1865, *Pap. Proc. roy. Soc. Tasmania*: 17; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.*: 107; Günther, 1867, *Ann. Mag. nat. Hist.*, (3), 20: 54; *idem*, 1868, *Zool. Rec.*, 4 (1867): 145; Keferstein, 1868, *Arch. Naturgesch.*, 34: 267; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 269; Boettger, 1894, *Denkschr. med.-naturw. Ges. Jena*, 8: 109; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22: 678; Andersson, 1913, *K. Svenska Vetensk. Akad. Handl.*, 52, 4: 15; Harrison, 1922, *Aust. Zool.*, 3, 1: 34.
Phractops australis Fry, 1914, *Rec. W. Aust. Mus.*, 1: 204; Nieden, 1923, *Das Tierreich, Anura I*: 523, fig. 355; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 13.
Cyclorana novaehollandiae Steindachner, 1867, *Reise Novara, Zool., Amph.*: 29, pl. 2, figs. 7-10 (Type locality:—Rockhampton); Keferstein, 1868, *Arch. Naturgesch.*, 34: 267.
Phractops alutaceus Peters, 1867, *Mber. Akad. Berlin*: 31 (Type locality:—Rockhampton).
Mitrolysis alboguttatus (part) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 13.

Upper surfaces of the premaxillae, maxillae, fronto-parietals and squamosals strongly sculptured, the zygomatic process of the latter forming a broad suture with the maxilla. Habitus stout; head depressed, as broad as long in juveniles, but increasing in breadth with age so that in adults it is very much broader than long, more so in females than in males. Snout depressed, not prominent, 1.75 (adults) to twice (juveniles) as long as the eye, with rounded canthus rostralis and very oblique, concave loreal region; nostril equidistant from the eye and the end of the snout or, more usually, a little nearer the latter; interorbital space equal to, or a little narrower than, the upper eyelid; tympanum distinct, slightly more than half, rarely $\frac{3}{8}$, the diameter of the eye. Fingers moderate;

¹ Loveridge's (1935: 13) contention that Boulenger measured the snout from the nostril appears to be without foundation, and his assertion that the first finger may, in this species, be shorter than the second may indicate a traumatic condition or confusion of species.

the first much longer than the second and opposed to the remainder; subarticular tubercles prominent; palm with small circular tubercles; two metacarpal tubercles. Toes $\frac{1}{3}$ webbed, the edge of the membrane midway between the third and fourth normally reaching halfway between the distal subarticular tubercle of the third toe and the proximal tubercle of the fourth; rarely it may reach almost to the former of these points or only just beyond the latter; subarticular tubercles distinct; a very large, shovel-shaped inner metatarsal tubercle, but no outer; a slight fold along the inner edge of the tarsus. Tibio-tarsal articulation reaching the eye, or, in larger specimens, the tympanic region.

Skin regularly shagreened above, often with larger scattered warts; a distinct median occipito-nuchal groove; a strong, curved, supradympnic fold from which a short, straight lateral fold may branch; a distinct dorso-lateral fold on each side of the back; sometimes a distinct gland between the angle of the mouth and the insertion of the fore-limb. Belly and hinder side of the thighs finely granular; throat almost smooth in females, but distinctly granular in males.

Brown or grey above with some darker markings, of which the most constant are a cantho-temporal streak, a vertical bar beneath the eye and darker smudges along the sides of the dorso-lateral folds which are themselves white in juveniles. Flanks and hindside of the thighs dusky with lighter mottlings (not circular spots as in *albuguttatus*). Lower surfaces white, the chin and throat blotched with brown in females and juveniles, uniformly infusate in breeding males.

Male with a vocal sac, and, at the breeding season, diffuse nuptial asperities on the dorso-lateral surface of the inner finger and a small, but distinct, button-like prominence where the columella auris abuts against the tympanum. Breeding in West Australia appears to take place about midsummer.

Length from snout to vent: ♂ 87 mm.¹; ♀ 97 mm.

Juveniles at metamorphosis, 27 mm.

DISTRIBUTION: Northern West Australia, Northern Territory and Queensland.

SPECIMENS EXAMINED.

B.M.	67.2.19.56	♂	Nicol Bay, W.A.	du Boulay.
	96.7.2.17-18	♂♀	Roebuck Bay, W.A.	Dahl.
	84.9.13.26	♀	Port Darwin.	Buckland.
	42.2.24.14-15	♀, juv.	Port Essington, N.T.	Gilbert. COTYPES.
	1998.2.25.29-30	♂♀	Alexandria Sta., N.T.	Stalker.
	79.11.39.72	♀	Queensland.	Thomson.
	67.5.6.86	♂	Rockhampton.	Dämel.
	67.5.6.96	juv.	" "	" "
	67.5.6.95	♂	" "	" "
	1924.10.25.4	juv.	Westwood, nr. Rockhampton.	Wilkins.
	1993.10.19.36-37	♂♀	Cooktown, Q.	Bellenden Ker.
	94.10.27.58	♀	Port Denison, Q.	Krefft.
	67.5.6.80	juv.	Port Denison.	Dämel.
	67.5.6.81	juv.	" " "	" "
	64.7.22.5	♀ skel.	" " " "	Krefft.
	1906.11.2.6	♀ skel.	Alexandria Sta., N.T.	Stalker.
Mus. Leiden	3867	♀	Rockhampton, Q.	(Godtfroy Mus.) (Co-type of <i>Phractopsalutacus</i> Peters.)
" "	1237	♂	Queensland.	(Godtfroy Mus.)
Swedish Mus.	1562	juv.	Mowla Down, Kimberley Div., W.A.	Soderberg.

¹ The " male " 27 mm. long reported by Andersson (1913) proves on re-examination to be a juvenile just through metamorphosis, with an incompletely resorbed tail.

Cyclorana albo guttatus (Günther).

- Chiroleptes albo guttatus* Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 54 (Type locality :— Port Denison, Cape York); *idem*, 1868, *Proc. zool. Soc. Lond.* : 480; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 270, pl. 18, fig. 1; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22**, 1897 : 078.
- Chiroleptes albopunctatus* (? lapsus calami) Fletcher, 1894, *Proc. Linn. Soc. N.S.W.*, 1893, (2), **8** : 525, footnote.
- Mitrololysis albo guttatus* Cope, 1880, *Bull. U.S. nat. Mus.*, **34** : 312; Nieden, 1923, *Das Tierreich, Amura I* : 524, fig. 356; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 13 (part).

Habitus slender; head as long as broad or only slightly broader than long. Snout conical, slightly prominent, 1.8 to 2.0 times as long as the eye, with rounded canthus rostralis and very oblique loreal region; nostril equidistant from the eye and the end of the snout; interorbital space as broad as, or a little narrower than the upper eyelid; tympanum distinct $\frac{2}{3}$ to $\frac{3}{4}$ the horizontal diameter of the eye. Fingers slightly depressed, with lateral "seams," the first much longer than the second and opposed to the remainder; subarticular tubercles prominent; palm with small circular tubercles and two moderately well-developed metacarpal tubercles. Toes nearly half webbed, the edge of the membrane midway between the 3rd and 4th toes, reaching nearly to the level of the distal tubercle of the 3rd; subarticular tubercles moderately prominent; a moderately large compressed inner, but no outer, metatarsal tubercle; a slight tarsal fold. Tibio-tarsal articulation reaching the eye or the nostril.

Skin with some scattered warts above; a curved supratympanic fold and a distinct straight dorso-lateral fold on each side of the back; a more or less distinct median occipito-nuchal furrow. Belly and hinder side of the thighs finely granular; throat and chest smooth.

Olive or brown above, with some obscure black mottlings; a dark canthal streak; flanks and hinder side of the thighs with numerous, closely set, circular white spots; edge of the upper lip brown, dotted with white. Lower surfaces white, the throat and chest usually marbled and freckled with brown.

Male with a vocal sac opening by a slit on each side of the tongue and a diffuse nuptial pad on the dorso-lateral aspect of the first finger and inner metacarpal tubercle.

Length from snout to vent : ♂ 59 mm. ; ♀ 65 mm.

DISTRIBUTION : Northern Territory?, Queensland, and Northern New South Wales. Loveridge (1935) has recorded this species from Alexandria, N.T., but another specimen from the same locality obtained at the same time by the same collector is preserved as a skeleton in the British Museum; it has the zygomatic process of the squamosal heavily sculptured and forming a broad suture with the maxilla as in *P. australis*, whereas in *P. albo guttatus* the two fail to meet, or only just make contact at a narrow point, and the squamosal is not sculptured.

SPECIMENS EXAMINED.

B.M. RR. 1936.12.	2 ♀♀	Port Denison.	Dämel. COTYPES.
3.125-126			
64.10.27.40	♂	" "	Kreffit.
67.5.6.78-79	♂♀	Cape York.	Dämel. COTYPES.
64.1.17.40	♂	? Clarence River, N.S.W.	Kreffit.
Mus. Leiden 4263	♀	Queensland.	(Godeffroy Mus.)

Cyclorana brevipes (Peters).

- Chivoleptes brevipes* Peters, 1871, *Mber. Akad. Berlin* : 648 (Type locality —Fort Bowen, Queensland); Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 260.
Phractops brevipes Nieden, 1923, *Das Tierreich, Anura* I : 523.
Chivoleptes brevipalmatus Günther, 1876, *J. Mus. Godeffroy*, 12 : 47 (Type localities:—Port Denison, Gayndah and Peak Downs, Queensland); Boulenger, 1882, *op. cit.* : 260, pl. 17, fig. 5.
Phractops brevipalmatus Fry, 1915, *Proc. roy. Soc. Queensland*, 27 : 70 (part); Nieden, 1923, *Das Tierreich, Anura* I : 522.

Habitus moderate; head a little broader than long. Snout rounded, scarcely prominent, 1.25 to 1.5 times as long as the eye, with obtusely angular canthus rostralis and oblique, scarcely concave, loreal region; nostril midway between the eye and the end of the snout; interorbital space narrower than the upper eyelid; tympanum distinct, its horizontal diameter half, or very slightly more than half, that of the eye. Fingers moderate, the first much longer than the second, and opposed to the remainder; subarticular tubercles well developed; palm tubercular; two distinct metacarpal tubercles. Toes less than $\frac{1}{4}$ webbed, the membrane midway between the third and fourth not extending beyond the proximal subarticular tubercle of the latter; subarticular tubercles prominent; a large shovel-shaped metatarsal tubercle which is, however, distinctly shorter than its distance from the tip of the inner toe. Tibio-tarsal articulation reaching the tympanum or the posterior corner of the eye.

Back somewhat warty; a distinct curved supratympanic fold; belly and lower surfaces of the thighs finely granular; throat smooth in females, granular in males.

Pale olive or brown above with dark brown markings arranged as follows: a curved cantho-temporal streak; edge of upper lip spotted; a large, subtriangular interorbital blotch, the apex directed forwards; back with sharply defined vermiculations, which may have a general longitudinal arrangement. Usually a fine white mid-dorsal line. Upper surfaces of the limbs olive-brown, spotted irregularly with lighter; hinder side of the thighs dark brown, uniform or with a few white flecks. Lower surfaces dirty white or pale brown; the gular region of the female with or without brown spots, that of the male infusate.

Male with a vocal sac and diffuse nuptial asperities on the dorso-lateral surface of the first finger and metacarpal tubercle.

Length from snout to vent: ♂ 37 mm.; ♀ 42 mm.

DISTRIBUTION: Eastern Queensland.

It seems probable that Loveridge (1935 : 12) is correct in regarding *brevipalmatus* as a synonym of *brevipes*, but it also seems highly probable that records of both species from West Australia, South Australia, and the west of Queensland and New South Wales refer to a species distinct from either (*C. cultripes*), differing in its stouter habitus, shorter digits, more extensive webbing, larger metatarsal tubercle, more coarsely granular skin and obscure colour-pattern.

SPECIMENS EXAMINED.

B.M.	64.10.27.41	♂	Port Denison.	Damel	} Cotypes of <i>C. brevipalmatus</i> Günther.
	67.3.4.37	♀	Peak Downs.	"	
	79.3.4.55	♀	Gayndah.	"	
	1926.2.25.1	♀	Coorooman, nr. Rockhampton.	Wilkins.	

Cyclorana cultripes sp. n.

Chiropletes brevipalmatus (non Günther) Spencer, 1896, *Rep. Horn Exped. C. Austral.*, (2), (Zoology) : 165; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22 : 678-682; Lucas & le Souef, 1909, *Anim. Australia* : 277.
Phractops brevipalmatus Fry, 1914, *Rec. W. Aust. Mus.*, 1 : 200; *idem*, 1915, *Proc. roy. Soc. Queensland*, 27 : 70 (part); Waite, 1929, *Rep. Amph. S. Australia* : 248.
Phractops brevipes (non Peters) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.* 78 : 12.

Habitus moderately stout; head a little broader than long. Snout rounded, scarcely prominent, 1.4 to 1.5 times as long as the eye, with obtusely angular canthus rostralis and oblique, slightly concave loreal region; nostril very slightly nearer the tip of the snout than the eye; interorbital space a little narrower than the upper eyelid; tympanum $\frac{1}{2}$ to $\frac{2}{3}$ the diameter of the eye. Fingers rather short, somewhat depressed, the first longer than the second and opposed to the remainder; subarticular tubercles prominent; palm slightly tubercular; two large flat metacarpal tubercles. Toes $\frac{1}{2}$ webbed, the edge of the membrane midway between the third and fourth reaching nearly to the level of the distal subarticular tubercle of the third; subarticular tubercles moderate; a very large, shovel-shaped inner metatarsal tubercle, as long as, or longer than, its distance from the tip of the inner toe; no outer. Tibio-tarsal articulation reaching the tympanum.

Skin distinctly warty above; a slight occipito-nuchal furrow; a strong, curved, supratympanic fold. Belly and lower surfaces of the thighs coarsely granular; chin slightly granular in males, smooth in females.

Dull yellow- or grey-brown above with some indistinct darker markings in the form of a cantho-temporal streak, some labial spotting, a dark blotch on the top of the head from the level of the posterior corner of the eyes forwards, and a transverse bar just behind the occiput; the area between the latter and the head-marking lighter. Remainder of the back with very indistinct darker spots and a fine white vertebral line. Groins and hinder side of the thighs brown, mottled with lighter. Lower surfaces white, the chin dappled with brown in females and infusate in males.

Male with a vocal sac and 2 diffuse nuptial pads, one on the dorso-lateral surface of the inner finger and the other on the inner metacarpal tubercle. Inner 2 fingers of breeding females slightly spatulate.

Length from snout to vent : ♂ 46 mm. ; ♀ 50 mm.

DISTRIBUTION : Western New South Wales, Northern Territory and northern West Australia; probably northern South Australia also.

This form has hitherto been confused with *P. brevipes* (q.v.); the two are closely allied and may ultimately prove to be only racially distinct.

SPECIMENS EXAMINED.

B.M. 1908.2.25.33	♂	Alexandria, N.T.	Stalker.	HOLOTYPE.
1908.2.25.31-32	♂♀	" "	" "	} PARATYPES.
1911.3.28.1	♀	Wilcannia, Darling River, N.S.W.	Helms.	

Cyclorana platycephalus (Günther).

Chiropletes platycephalus Günther, 1873, *Ann. Mag. nat. Hist.*, (4), 11 : 350 (Type locality :— Fort Bourke); Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 268, pl. 17, fig. 4; Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2), 5 : 675, 675; *idem*, 1891, *op. cit.*, (2), 6 : 265, 269, 271; *idem*, 1892, *op. cit.*, (2), 7 : 12; Spencer, 1896, *Rep. Horn. Exped. C. Austral.*, 2, (Zool.) : 160, pl. 13, fig. 1, pl. 14, figs. 5-9; Lucas & le Souef, 1909, *Anim. Austral.* : 278, fig. 1; Harrison, 1922, *Aust. Zool.*, 3, 1 : 34.

Cheiroleptes platycephalus Spencer & Gillen, 1912, *Across Australia*, 1: 59, pl. I, fig. a.
Phractops platycephalus; Nieden, 1923, *Das Tierreich, Anno I*: 529, figs. 352-354; Waite,
 1929, *Rep. Amph. S. Austral.*: 246, fig. 176; Loveridge, 1935, *Bull. Mus. comp. Zool.*
Harv., 78: 12.

Habitus stout. Head broader than long, proportionately broader in older individuals, and generally broader in eastern than in western specimens. Snout rounded in eastern districts, more acuminate and prominent in the west, 1.6 to 2.0 times as long as the eye, with indistinct canthus rostralis and very oblique, rounded loreal region; nostril equidistant from the eye and the end of the snout or a little nearer the former; interorbital space as broad as, or a little broader than, the upper eyelid; tympanum distinct $\frac{2}{3}$ to $\frac{3}{4}$ the diameter of the eye and varying in its proximity to the latter. Fingers moderate, depressed, the first much longer than the second and opposed to the remainder; subarticular tubercles small but prominent; two metacarpal tubercles, the outer sometimes rather indistinct. Toes fully webbed, the membrane rather fleshy; subarticular tubercles small; a large, shovel-shaped metatarsal tubercle much longer than its distance from the tip of the inner toe; a slight fold along the inner edge of the tarsus. Tibio-tarsal articulation reaching the shoulder or the tympanum.¹

Skin smooth or, more usually, with scattered warts, the condition varying with the degree of distension on account of stored fluids in the body; a curved supra-tympanic fold; lower surfaces granular.

In spirit, or when alive during the dry season the colour is olive-grey, grey-brown or yellowish, freckled with indistinct darker spots and blotches not arranged after any definite pattern; lower surfaces dirty white, the throat of the male dotted with brown or blue-black. After leaving their burrows at the onset of rain the colour of juveniles and half-grown individuals changes to yellow with bright green markings, older specimens being duller, with more diffuse green patches. The iris is golden with dark flecks, tympanum yellowish-brown, the sides of the body and limbs orange brown and the digital webbing often distinctly pink.

Length from snout to vent: ♂ 56 mm.; ♀ 68 mm.

Male with a vocal sac and a diffuse nuptial pad on the metacarpo-phalangeal knuckle of the first finger and extending on to the inner metacarpal tubercle.

DISTRIBUTION: Arid districts of the interior of Australia from Murchison in the west to the western districts of New South Wales, including the southern parts of the Northern Territory and northern South Australia.

This species is essentially cryptozoic, frequenting arid regions and aestivating through the dry season in burrows about a foot deep on the banks of creeks and near water-holes; impervious clay soils appear to be preferred, and during the period of aestivation the frog is greatly distended with water stored in the urinary bladder, the lymph spaces and body cavity. Breeding takes place on the advent of rain (January to February in Central Australia) and development is very rapid, possibly not more than two weeks elapsing from the laying of the eggs to metamorphosis. The tadpole reaches a length of 60 mm. and has the following characters: Body 1.5 times as long as wide and $\frac{2}{3}$ the length of the tail, ovoid, with eyes and nostrils directed upwards, the nostril nearer the tip of the snout than the centre of the eye; spiraculum sinistral; anus dextral, near the edge of the lower caudal crest; tail acutely pointed, three times as long as deep, the lower crest deeper than the upper, but not as deep as the muscular portion

¹ It is the tibio-tarsal articulation which reaches the tympanum in the type as originally described, and not the tarso-metatarsal as suggested by Loveridge (1935: 12).

at its base. Mouth, except the median third anteriorly, surrounded by papillae which form a double row and invade the oral cone at the corners; horny mandibles strong and serrated; labial teeth in series $\frac{2}{3}$, the innermost both above and below divided, the outermost shortest. Body and muscular part of the tail dull yellow, with faint blotches of darker; caudal crests with dark mottling.

Length from snout to vent at metamorphosis: 31 mm.

SPECIMENS EXAMINED.

B.M. 1937.7.22.1-2	♂♀	Dalgaranger Sta., near Yalgoo, W.A.	Nicholls.
1908.5.28.62- 64	♂, 2 ♀♀	Central Australia.	(Gerrard.)
97.1.20.29-30	Larvae.	" "	Horn.
97.1.20.28	♀	Charlotte Waters.	"
1905.10.31.46	♀	100 miles east of Lake Eyre.	Hillier.
92.9.16.11	♀	Euroka, N.S.W.	Rose.
73.4.30.18	♀	Fort Bourke, N.S.W.	(Sydney Mus.) TYPE.

LECHRIODUS Boulenger.

Asterophys (non Tschudi) Doria, 1875, *Ann. Mus. Stor. nat. Genova*, **6**: 355; Peters & Doria, 1878, *Ann. Mus. Stor. nat. Genova*, **13**: 417.

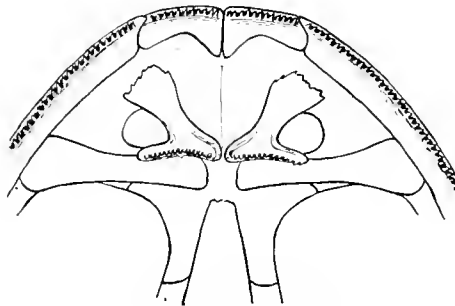
Batrachopsis (non Fitzinger) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 439 (Type species:—*Asterophys melanopyga* Doria); van Kampen, 1923, *Amph. Indo-Austr. Archip.*: 16.

Lechriodus Boulenger, 1882, *Cat. Batr. Grad. Brit. Mus.*: 116 (substitute name for *Batrachopsis* Boulenger); Noble, 1922, *Bull. Amer. Mus. nat. Hist.*, **46**: 73; Nieden, 1923, *Das Tierreich, Anura I*: 49; Noble, 1924, *Amer. Mus. Novit.*, **132**: 11; *idem*, 1931, *Biol. Amph.*: 497; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 22.

Phanerotis Boulenger, 1890, *Proc. Linn. Soc. N.S.W.*, (2), **5**: 593 (Type species:—*Phanerotis fletcheri*).

Ranaster (part) Nieden, 1923, *Das Tierreich, Anura I*: 535.

Maxillary teeth present. Prevomer present, entire, its post-choanal portion large, overlying at least the mesial half of the palatine, denticerous; fronto-parietals well developed, forming a median suture. Ear fully developed.





TEXT-FIG. 6. Anterior cranial elements of *Lechriodus platyceps*. $\times 2$. (From beneath.)

Vertebrae procoelous with very long transverse processes; 8 presacrals; sacral diapophyses strongly dilated; coccyx articulating by two condyles. Omosternum cartilaginous; sternum bifid posteriorly, cartilaginous. Terminal phalanges simple.

Distal tendon of the m. semitendinosus perforating the gracilis complex. Alary processes of the hyoid expanded distally but with a narrow stalk proximally as in *Limnodynastes* and *Heleioporus*.

Pupil horizontal. Tongue subcircular, slightly free behind. Toes with a rudiment of web and very small terminal discs.

SYNOPSIS OF THE SPECIES.

- I. Head not broader than long ; first finger as long as or longer than the second ; small species of which the females have normal digits and the nuptial pad of the male is composed of minute spines.
- A. Snout more than once and a half as long as the eye ; first finger longer than the second *L. melanopyga*.
- B. Snout less than once and a half as long as the eye ; first finger equal to, or a little shorter than, the second
- (1) A small -shaped fold on the scapular region *L. fletcheri*.
- (2) A small -shaped fold on the interorbit and a pair of curved, convergent dorso-lateral folds or rows of plicae *L. papuanus*.
- II. Head much broader than long ; first finger shorter than the second ; large species, of which the females have the first and second fingers strongly fringed and males have nuptial pads composed of closely set, but relatively large spines *L. platyceps*.

***Lechriodus melanopyga* (Doria).**

Asterophrys melanopyga Doria, 1875, *Ann. Mus. Stor. nat. Genova*, 6 (1874) : 355, pl. xii, fig. k (Type locality :—Wokan, Aru Islands).

Batrachopsis melanopyga (part) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 430, van Kampen, 1923, *Amph. Indo-Austr. Archip.* : 17.

Lechriodus melanopyga (part) Nieden, 1923, *Das Tierreich, Annuaire* 1 : 49; Noble, 1924, *Amer. Mus. Novit.*, 132 : figs. 5, 7 (myology).

Vomerine teeth in long, curved series extending laterally a little beyond the choanae. Head longer than broad ; its width contained more than 2.5 times in the total length ; snout rounded, not prominent, 1.6 times as long as the eye ; canthus rostralis angular ; loreal region oblique, not concave ; nostril nearly twice as far distant from the eye as from the tip of the snout ; interorbital space narrower than the upper eyelid ; tympanum distinct, vertically oval, its vertical diameter $\frac{3}{4}$ the horizontal diameter of the eye. Fingers free, slender, the first a little longer than the second ; subarticular tubercles large and prominent ; a smaller supernumerary tubercle proximal to the base of each finger ; a prominent oval inner, and a rather indistinct outer, metacarpal tubercle. Toes slender, with a rudiment of web and small terminal dilatations ; subarticular tubercles prominent ; an elongate oval inner, but no outer, metatarsal tubercle. Tibio-tarsal articulation extending a little beyond the end of the snout.

Skin almost smooth above, though minute pustules are present more especially on the upper eyelid, about the ear and on the flanks. Two folds arise from the posterior corner of the upper eyelid, the one running above the tympanum to the flanks, and the other, somewhat indistinct and interrupted, composed of a row of pustules, curves towards its fellow on the middle of the back and then runs parallel with it on to the coccygeal region. Lower surfaces smooth. A very small papilla on the heel.

Brownish grey above, a light line connects the upper eyelids and may extend forwards to cover the whole of the upper surface of the snout; a dark bar runs obliquely forwards from beneath the eye to the edge of the upper lip and may be broadened anteriorly to cover the whole loreal region; a deep black marking may border the supratympanic fold inferiorly, its lower margin irregular and crossing the tympanum; other black spots may be present on the flanks, and sometimes there are large, indefinite lighter areas on the back. Hind limbs with alternating broader and narrower cross-bars above; concealed surfaces of the thighs and tibiae, as well as the lower surfaces of the forearms, tarsi and feet blackish. Lower surfaces uniform white.

Length from snout to vent: ♀ 50 mm.

DISTRIBUTION: Aru Islands.

Although the type of *melanopyga* was afterwards (Peters and Doria, 1878: 417) said to be a juvenile when larger specimens from New Guinea were obtained for comparison, the single specimen collected in the Aru Islands by the "Challenger" Expedition is of approximately the same size, and is a sexually mature female. It also differs from specimens from New Guinea in its much narrower head, longer first finger and smoother skin, so that there seems to be every probability that the *Lechriodus* of the Aru Islands is not conspecific with that from the northern and western parts of New Guinea which has hitherto been known as *melanopyga*, but which must now receive a new name. Records of a small "*melanopyga*" from S.E. New Guinea in all probability refer to *L. fletcheri* (*q.v.*).

SPECIMEN EXAMINED.

B.M. 82.7.14.31 ♀ Aru Islands. "Challenger" Exped. TOPO-
TYPE.

***Lechriodus fletcheri* (Boul.).**

Phanerotis fletcheri Boulenger, 1890, *Proc. Linn. Soc. N.S.W.*, (2), 5: 404 (Type locality:—Dunoon, Richmond River, N.S.W.); Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2) 5: 669–675; *idem*, 1894, *op. cit.*, (2), 8: 530; Lucas & le Souef, 1900, *Ann. Austral.*: 274; Andersson, 1913, *Jb. nassau. Ver. Naturk.*, 66: 75; Fry, 1915, *Proc. roy. Soc. Queensland*, 27: 69, fig. 1, pl. i, fig. 2; Andersson, 1916, *K. Svenska Vetensk.Akad. Handl.*, 52, 9: 10, pl. i, fig. 3; van Kampen, 1923, *Amph. Indo-Austr. Archip.*: 18.

Ranaster fletcheri Nieden, 1923, *Das Tierreich, Amura I*: 536.

Lechriodus fletcheri Noble, 1931, *Biol. Amph.*: 497; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 22.

? *Batrachopsis melanopyga* Boulenger, 1898, *Ann. Mus. Stor. nat. Genova*, 18: 17.

Vomerine teeth in slightly curved series which do not extend laterally beyond the choanae. Head as long as broad. Snout rounded, not prominent, 1.4 times as long as the eye, with angular canthus rostralis and oblique, slightly concave loreal region; nostril 1.3 times as far from the eye as from the tip of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, vertically oval, its vertical diameter $\frac{3}{4}$ the length of the eye. Fingers moderate, the first equal to or a little shorter than the second; subarticular tubercles large and prominent; a slight, fleshy, tubercle-like webbing between the fingers; a prominent oval inner, and a longitudinally cleft outer metatarsal tubercle. Toes slightly dilated terminally and with a distinct rudiment of webbing; subarticular tubercles prominent; an oval inner, but no outer metatarsal tubercle. Tibio-tarsal articulation reaching beyond the tip of the snout.

Skin almost smooth or finely granulate above, with some larger pustules on

the upper eyelid and about the ear; a strong narrow fold from the posterior corner of the eye above the ear to about the middle of the flanks; a small \wedge -shaped fold in the middle of the back; smooth beneath; a small papilla on the heel.

Pale brown above, with some very small darker spots; a narrow, dark, transverse bar from eye to eye; loreal and temporal regions darker with obscure markings in the form of oblique lighter (reddish) bars radiating from the posterior half of the eye; sometimes a dark brown patch on the canthus rostralis and below the supratympanic fold; dorsal \wedge -shaped fold outlined with darker; limbs with alternately broader and narrower dark cross-bars; concealed surfaces of the thighs and tibia, and lower surfaces of the forearm, tarsus and foot dark brown. Lower surfaces white, the edge of the lower jaw brown.

Length from snout to vent: ♂ 42 mm.; ♀ 50 mm.

Male with a vocal sac opening by a slit on each side of the tongue, and nuptial pads of very small spines on the dorsal surface of the inner finger, except the terminal joint, on the inner metacarpal tubercle and along the inner dorsal side of the second finger; the pad on the first finger must contain many hundreds of spines. Mature females with the two inner fingers dilated as in *Limnodynastes*.

DISTRIBUTION: New South Wales, Queensland, Southern New Guinea.

SPECIMENS EXAMINED.

B.M. 90.7.28.1	imm. ♀.	Dunoon, Richmond River, N.S.W.	Helms. TYPE.
97.12.10.104	♂	Vikaiku, Brit. N. Guinea.	Loria.

***Lechriodus papuanus* (Roux).**

Phanerotis fletcheri papuana Roux, 1927, *Rev. suisse Zool.*, **34**, 4: 122, fig. 1 (Type locality:—Lake Sentani district, Dutch New Guinea).

Vomerine teeth in two long transverse series behind the choanae. Head as long as broad, moderately high. Snout blunt, slightly longer than the diameter of the eye; nostril quite close to the tip of the snout; canthus rostralis distinct; loreal region high, oblique, slightly concave; interorbital space narrower than the upper eyelid. Tympanum distinct, oval, a little higher than long, its height a little greater than half the diameter of the eye. Fingers and toes slightly dilated at their tips, the first finger equal to the second; subarticular tubercles very prominent. Toes distinctly webbed at the base; an elongate, oval inner metatarsal tubercle, about half as long as the inner toe. Tibio-tarsal articulation reaching a little beyond the tip of the snout.

Skin smooth and beset with small, pointed pustules, larger and rounded in places, for example on the upper eyelids; a small papilla on the heel. Dorsum with prominent, short, narrow folds; some on the interorbit form a \wedge , others form a pair of curved dorso-lateral lines from behind the orbits, convergent towards the middle of the back and then running parallel to the lumbar region, where there are also some short, oblique, secondary crests. Another fold runs from the eye above the tympanum to the middle of the flanks. Lower surfaces smooth except the median posterior portions of the thighs, which are granular.

Light grey above with black or grey-black spots and patches. All the dorsal folds are outlined with darker and the orbito-tympanic fold is bordered beneath with a dark patch which covers the upper half of the tympanum; below the end

of this glandular line, behind the fore-limbs, one or two black spots. Several broad, dark grey bars on the sides of the snout, one at the tip, one beneath the eye and another, smaller, between the two. Lower surfaces immaculate whitish-grey. Fore-limb grey with some little black dots on the anterior surface of the arm; fore-arm with two broad, dark grey annuli anteriorly and behind and on the elbow with longitudinal, blackish-grey marking. Fingers annulate with blackish grey, light grey beneath. Hind-limb grey; thighs with two indistinct darker bars above, blackish brown beneath and on the anal region, this colour sharply defined above and beneath. Tibia with a faintly indicated, darker, oblique bar. Knee, a line along the outer edge of the tibia, heel and lower surface of the tarsus black; lower surfaces of the foot and toes dark grey (after Roux).

Immature ♀: 23 mm.

DISTRIBUTION: near Lake Sentani, Dutch New Guinea.

A single example of this form is the only one known and its describer thought that it was a characteristic Papuan representative of *L. fletcheri*. But the only Papuan specimen of *fletcheri* available to the present author exactly resembles the type from New South Wales and entirely lacks the dorso-lateral folds described in the type of *papuanus*. Accordingly it seems probable either that there are two distinct species, or that further material will show a much greater range of variation than is at present known; there is no evidence in favour of the recognition of subspecies.

Lechriodus platyceps sp. n.

Asterophrys melanopyga (non Doria, 1875) Peters & Doria, 1878, *Ann. Mus. Stor. nat. Genova*, **13**: 417.

Batrachopsis melanopyga Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 439 (part); Boettger, 1894, *Denkschr. med. Naturw. Ges. Jena*, **8**: 112; Lucas, 1898, *Proc. Linn. Soc. N.S.W.*, **23**: 359; van Kampen, 1923, *Amph. Indo-Austr. Archip.*: 17 (part).

Lechriodus melanopyga van Kampen, 1906, *Nova Guinea*, **5**: 163, 178; Barbour, 1912, *Mem. Mus. comp. Zool. Harv.*, **44**: 177; Fry, 1913, *Mem. Queensland Mus.*, **2**: 48; *idem*, 1915, *Proc. roy. Soc. Queensland*, **27**, 4: 73, pl. i, figs. 1, 2; Nieden, 1923, *Das Tierreich, Anura I*: 49 (part), figs. 105, 106; Noble, 1931, *Biol. Amphib.*: 113, fig. 38.

Holotype a female, number 76.7.18.6 in the British Museum, from Arfak, Dutch New Guinea; collected by A. A. Bruijn.

Vomerine teeth in curved series which do not extend laterally beyond the choanae. Head broad and flat, considerably broader than long, its width contained less than 2.5 times in the length from snout to vent. Snout rounded, not prominent, 1.6 times as long as the eye, with angular canthus rostralis and oblique, very slightly concave loreal region; nostril 1.2 times as far distant from the eye as from the tip of the snout; upper eyelid 1.5 times the width of the inter-orbit; tympanum distinct, vertically oval, its vertical diameter $\frac{3}{4}$ the length of the eye. Fingers moderately long, the first a little shorter than the second and both with strong lateral fringes which do not continue proximally beyond the subarticular tubercles; the latter are well developed but the supernumerary tubercles at the base of each finger are merely indicated; a large, prominent inner metacarpal tubercle, containing a cartilaginous prepollex, and a small indistinct outer. Toes with small terminal discs and a rudiment of webbing; subarticular tubercles well developed; a small oval inner, but no outer metatarsal tubercle. Tibio-tarsal articulation reaching the tip of the snout.

Skin regularly and profusely beset with small round pustules which may

form bead-like chains especially on the flanks; some larger papillae on the upper eyelid, about the ear and one on each heel. A straight dermal fold from the posterior corner of the eye above the tympanum to the flanks, and a narrow linear fold from the upper eyelid convergent towards the middle line about the middle of the back and then slightly divergent and forming a sinuous line to the end of the coccyx; a slight curved fold across the interorbit. Smooth beneath.

Pale brown above; upper surface of the snout to the inter-orbital fold lighter, the fold itself dark-edged. An irregular dark brown band beneath the canthus rostralis and supratympanic fold; a few dark spots beneath the eye and on the flanks, especially in the axillae and groins; a faint, light marking on each side of the back in the angles where the dorso-lateral folds approach one another and then diverge. Limbs with narrow transverse cross-bars. Concealed surfaces of thighs and tibiae and lower surfaces of the fore-arms, tarsi and feet dark brown. Lower surfaces whitish, the edge of the lower jaw and gular region freckled with brown.

Length from snout to vent: 79 mm.

PARATYPES.

B.M. 78.2.11.5	♂	New Guinea.	(Boucard.)
1920.12.21.1-2	♂, ♀	South of Geelvink Bay, 3700 ft.	Pratt.
Mus. Amsterdam	juv.	Upper Tor River, Northern New Guinea.	Gjellerup.
Mus. Leiden 4234	♂	Haddam (Hatam), Arfak Mts.	Beccari.

These specimens agree with the holotype in general morphological characters and colour with the exception of one or two details. The pustules are usually more numerous and prominent, often forming lines, especially on the legs, where they outline the transverse bars of colour; the tibio-tarsal articulation usually extends a little beyond the tip of the snout, the prepollex may be ossified, and the dark colour of the concealed surfaces of the hind-limbs is broken up into spots and dots. The first and second fingers of females are spatulate as described but those of the males are cylindrical, but with nuptial pads composed of relatively large spines; one such pad occupies the dorsal surface of the inner finger, except the terminal joint, a smaller one is situated on the end of the inner metacarpal tubercle and a third on the inner edge of the second finger at its base; the largest patch does not contain more than about 180 spines. Male with a vocal sac.

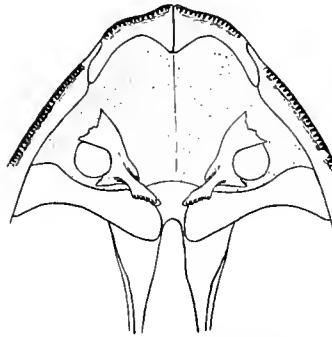
Largest ♂ 70 mm.; ♀ 96 mm.

Fry (1915: 74) draws attention to the fact that specimens from New Guinea had a much broader head than the type of *melanopyga*, and this difference, together with some others already noted, suggests that the two are not conspecific. The width of the head cannot be an age-character, for two of Fry's specimens measuring only 45 and 47 mm. characterized by the broad head are no larger than the narrow-headed examples of true *melanopyga* recorded from the Aru Islands, and the juvenile specimen from the Tor River, measuring only 21.5 mm. from snout to vent, has a relatively broader head than an adult *melanopyga*. The species *platyceps* has been recorded from the following localities in New Guinea: Arfak Mts.; south of Geelvink Bay; Mansinam; Hatam; Mamberamo River; Idenburg River; Tor River; St. Joseph's River; Fife Bay.

ADELOTUS Ogilby.

- Cryptotis* (nec Pomel, 1848, nec Dana, 1852) Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 27 (Type species:—*Cryptotis brevis*); Cope, 1865, *Nat. Hist. Rev.*, n.s., **5** : 107; *idem*, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 80; Steindachner, 1867, *Reise Novara, Amph.* : 30; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 267; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 262; Cope, 1889, *Bull. U.S. nat. Mus.*, **34** : 295; Noble, 1931, *Biol. Amph.* 498.
- Adelotus* (substitute name for *Cryptotis* Günther) Ogilby, 1907, *Proc. roy. Soc. Queensland*, **20** : 32; Nieden, 1923, *Das Tierreich, Anura I* : 538; Noble, 1931, *Biol. Amph.* : 498; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 23.

Skull elongate, the pars facialis of the maxilla forming a long edentulous suture with the pre-maxilla (text-fig. 7). Maxillary teeth present. Prevomer bounding the choana anteriorly and mesially, with a short, oblique process directed backwards bearing a short row of teeth and partially overlying the mesial end of the palatine. Dentary with a pseudo-tooth at its anterior end, small in females, very large and tusk-like in adult males. Fronto-parietals forming a



TEXT-FIG. 7.—Anterior cranial elements of *Adelotus brevis*. $\times 3$. (From beneath.)

median suture. Ear fully developed. Vertebrae procoelous, the condyle incompletely ankylosed and the notochord persistent; sacral diapophyses slightly dilated; urostyle articulating by 2 condyles; 7 pre-sacral vertebrae (1 + 2 fused). Omosternum well developed, cartilaginous; sternum broad, cartilaginous, notched but not bifid posteriorly; procoracoids broad. Terminal phalanges simple.

Distal tendon of the m. semitendinosus perforating the gracilis complex distally. Alary processes of the hyoid expanded distally, narrower proximally.

Pupil horizontal with a ventral angle; tongue oval or subcircular, partly free behind. Toes not dilated distally, with a rudiment of web.

***Adelotus brevis* (Günther).**

- Cryptotis brevis* Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 27, pl. 4, fig. B (Type locality:—Clarence River, N.S.W.); Krefit, 1865, *Pap. Proc. roy. Soc. Tasmania* : 17; *idem*, 1867, *Cat. Industr. Prod. N.S.W., Add.* : 107; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 30; Günther, 1868, *Proc. zool. Soc. Lond.* : 480; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 268; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 386; *idem*, 1890, *op. cit.*, (2), **5** : 609–671; *idem*, 1892, *op. cit.*, (2), **7** : 8; *idem*, 1894, *op. cit.*, (2), **8** : 525, 527, 529; Lucas & le Souef, 1909, *Ann. Austral.* : 275; Andersson, 1913, *K. Svenska Vetensk.-Akad. Handl.*, **52**, 4 : 11.
- Adelotus brevis* Ogilby, 1907, *Proc. roy. Soc. Queensland*, **20** : 32; Nieden, 1923, *Das Tierreich, Anura I* : 538, figs. 371, 372; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 23.

Head strongly depressed and enlarged in the male, subtriangular, broader than the body; not broader than the body and more rounded in females. Vomerine teeth in two short, oblique series behind the level of the choanae. Snout rounded, slightly prominent, 1.8 to 2.0 and 1.4 to 1.6 times as long as the eye in males and females respectively; nostril a little nearer the eye than the end of the snout; interorbital space as broad as, or a little broader than the upper eyelid. Tympanum hidden, but when uncovered by dissection vertically oval, its horizontal diameter about half that of the eye. Fingers moderately long, with a faint rudiment of web; in females the first and second are strongly spatulate with a thick fleshy fringe along their preaxial margins; subarticular tubercles prominent; two prominent rounded metacarpal tubercles. Toes moderate, with a slight rudiment of web; subarticular tubercles prominent; metatarsus with rows of small pustules; a small, slightly oval inner metatarsal tubercle and a much smaller outer situated at the base of the fourth metatarsal. Tibio-tarsal articulation reaching the tympanic region or the posterior corner of the eye.

Skin more or less warty above, particularly on the upper eyelids and hind limbs; lower surfaces smooth.

Pale brown to olive or grey above with scattered darker blotches and lighter dots; synciput lighter. The most constant dark markings are a bar from the tip of the snout through the nostril to the eye, sometimes continued as a straight, oblique line from the posterior corner of the eye to the angle of the mouth and edged beneath with lighter, a vertical bar beneath the eye and a large subquadrangular or triangular blotch whose anterior edge connects the centres of the upper eyelids. Limbs regularly cross-banded above. Lower surfaces dark brown or blackish with small white (?) flecks on the gular region and bold spots on the belly and lower surfaces of the femur and tibia; groin and concealed surfaces of the tibia, metatarsus and foot with large pink or crimson spots.

Male with a vocal sac but apparently without nuptial pads. Premaxillary and anterior maxillary teeth strongly enlarged.

Length from snout to vent: ♂ 44 mm.; ♀ 37 mm.

DISTRIBUTION: New South Wales (East of the Dividing Range), and Southern Queensland.

SPECIMENS EXAMINED.

B.M. 63.6.16.95	♂, ♀	Clarence River, N.S.W.	Krefft. COYPES.
64.7.8.8	♀	Port Macquarie, N.S.W.	"
		(<i>vide</i> Fletcher).	
70.6.26.22	2 ♂♂, 6 ♀♀	Ditto.	"
70.6.26.22	♂ skel.	"	"
1935.3.1.1-4	2 ♂♂, 2 ♀♀	Dorrigo, N.S.W.	Heron.
Austr. Mus. R. 11382	♀, 3 juvs.	Comboyne, N.S.W.	

Breeding habits unknown. The inner fingers of the female suggest a foam-beating habit similar to that of *Limnodynastes*, but the apparent absence of nuptial pads in the male suggests that pairing may take place on land.

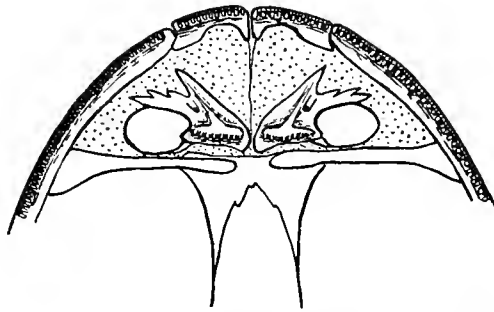
HELEIOPORUS Gray.

Rana Shaw, 1795, *Nat. Miscellany*, 6: pl. 200. Schneider, 1799, *Hist. Amphib.*, 1: 129.
¹*Heleioporus* Gray, 1841, *Ann. Mag. nat. Hist.*, 7: 91 (Type species:—*H. albopunctatus*).
 Gray, 1841, in Grey, *Journ. Exped. Austral.*, 2: pl. 1; Gunther, 1858, *Cat. Batr. Sal. Brit. Mus.*; 38; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 271.
²*Heleioporus* Gray, 1841, in Grey, *Journ. Exped. Austral.*, 2: 417; Cope, 1865, *Nat. Hist. Rev.*, n.s., 5: 198; *idem*, 1866, *J. Acad. nat. Sci. Philad.*, (2), 6: 89, 91; Kesterstem, 1868,

¹ In the specific synonymies these alternative spellings are not recorded separately.

- Arch. Naturgesch.*, **34** : 269; Cope, 1889, *Bull. U.S. nat. Mus.*, **34** : 312; Fry, 1914, *Rec. W. Aust. Mus.*, **1** : 208; Nieden, 1923, *Das Tierreich, Anura I* : 525; Waite, 1929, *Rep. Amph. S. Australia* : 240; Noble, 1931, *Biol. Amph.* : 497.
- Heleioporus* (err.) Krefft, 1895, *Mon. Not. roy. Soc. Tasmania* : 17.
- Perialia* Gray, 1845, in Eyre, *Journ. Exped. C. Austral.*, **1** : 407 (Type species:—*Perialia eyrei*); Cope, 1889, *Bull. U.S. nat. Mus.*, **34** : 312.
- Neobatrachus* Peters, 1863, *Mber. Akad. Berlin* : 234 (Type species:—*N. pictus*); Cope, 1866, *J. Acad. Nat. Sci. Philad.*, (2), **6** : 94.
- Philocryphus* Fletcher, 1893, *Proc. Linn. Soc. N.S.W.*, (2), **8** : 233. (Type species:—*P. flavoguttatus*); Fry, 1914, *Rec. W. Aust. Mus.*, **1** : 208; Noble, 1931, *Biol. Amph.* : 497.

Maxillary teeth present. Prevoomer well developed with a posterior dentigerous process which does not quite reach the palatine (text-fig. 8); a very large fronto-parietal foramen, ethmoid entire. Ear fully developed. Vertebrae procoelous, but the condyle incompletely ankylosed; notochord persistent; sacral diapophyses slightly dilated; urostyle articulating by two condyles; 7 presacral vertebrae. Omosternum small, cartilaginous, sternum undivided or notched posteriorly, cartilaginous or calcified mesially. Terminal phalanges simple.



TEXT-FIG. 8.—Anterior cranial elements of *Heleioporus albopunctatus*. $\times 2.5$.
(From beneath.)

Distal tendon of the m. semitendinosus passing ventral to the tendon of the mm. graciles. Alary processes of the hyoid expanded distally, but with a narrow stalk proximally; cricoid cartilage complete; oesophageal process of the cricoid slender; m. omohyoideus present; mm. sternohyoideus and petrohyoidei attached at the edges of the hyoid.

Pupil horizontal, but with a downwardly directed angle ventrally. Tongue large, broadly oval, half free behind. Toes more or less webbed.

The status of *Philocryphus* with regard to *Heleioporus* has been in dispute for some time. Fletcher himself (1897 : 679) was doubtful whether it could be maintained, but Fry (1914 : 206) advanced reasons for continuing to retain the two apart; Fry's views have been accepted by the latest commentator (Loveridge, 1935 : 17), but Noble (1931 : 497), though maintaining the two, can only distinguish them by the degree of distinctness of the tympanum. This can be so extremely variable and is so dependent on preservation that its value seems very problematical. Actually *albopunctatus* and *australiacus* are so closely allied that in their young stages they are almost indistinguishable, and the characters suggested by Fry for their generic separation are almost all age-characters; his skeleton of *albopunctatus* was almost certainly that of a juvenile. Fletcher himself at one time (1889 : 376) referred one of his co-types of *flavoguttatus* (= *australiacus*) to *albopunctatus*, and Boulenger (1882 : 272) was unable

to distinguish juveniles of *australiacus* from *albopunctatus*. Examination of all the material now in the British Museum suggests that some 8 forms are valid, which may be distinguished by the key given below. If any generic separation should be possible, or desirable, the division should apparently be between sections I and II. The first of these, containing small species with an undivided sternum and with diffuse nuptial pads, would then be known as *Neohatrachus* Peters, of which *N. pictus* is the genotype.

SYNOPSIS OF THE SPECIES.

- I. Sternum always cartilaginous, not bifid posteriorly. Small species, the males with a diffuse nuptial pad. Metatarsal tubercle usually edged with black or dark brown.
 - A. Toes $\frac{2}{3}$ to fully webbed.
 - (1) Eye not longer than its distance from the tip of the snout. A colour pattern of dark insuliform spots or irregular marblings on a light ground.
 - (a) Skin warty above (spinulose in breeding males); metatarsal shovel completely black *H. pictus*.
 - (b) Skin smooth or with spinules in breeding males; metatarsal shovel edged with brown or not coloured *H. centralis*.
 - (2) Eye longer than its distance from the tip of the snout. Colour pattern consisting of light bifurcating lines on a dark ground. Skin quite smooth, but thick and glandular; metatarsal shovel edged with brown *H. wilsmorei*.
 - B. Toes not more than $\frac{1}{3}$ webbed, except in males at the breeding season, when the web continues as a tapering fringe to the tip of each toe *H. pelobatoides*.
- II. Sternum of the adult calcified and bifid posteriorly. Large species, the males with large, conical, black horny spines on the dorsal surfaces of the inner fingers.
 - A. Tip of the fifth toe not reaching beyond the nostril; at most a single, conical tubercle at the anterior corner of the eye; flanks not more warty than the dorsum; a pattern of regular circular cream-coloured (white) spots on a dark ground colour *H. albopunctatus*.
 - B. Tip of the fifth toe reaching the tip of the snout or a little beyond; a fimbriated flap at the anterior corner of the eye; flanks more granular than the dorsum.
 - (1) Size large (up to 80 mm.); tympanum of adult large ($\frac{2}{3}$ - $\frac{3}{4}$ the eye) and subcircular; dorsum uniform purple-brown; flanks liberally yellow-spotted *H. australiacus*.
 - (2) Size moderate (up to 50 mm.); tympanum of adult vertically oval, rather indistinct, $\frac{1}{2}$ - $\frac{2}{3}$ the diameter of the eye; dorsum brown marbled with grey or yellowish irregular markings *H. cyr ei*.
- III. *Incertae sedis* *H. sudell*

Heleioporus pictus (Peters).

Neobatrachus pictus Peters, 1863, *Mber. Akad. Berlin*: 235 (Type locality:—near Adelaide); Keferstein, 1868, *Arch. Naturgesch.*: 262.
N. fictus (err. typ.) Krefft, 1865, *Pap. roy. Soc. Tasmania*: 17.
Helioporus pictus Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 272; Lucas, 1892, *Proc. roy. Soc. Victoria*, 4: 61; Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2), 5: 672-675; *idem*, 1891, *op. cit.*, 6: 271-273; *idem*, 1894, *op. cit.*, 8: 529, 531; *idem*, 1898, *op. cit.*, 22: 679; Lucas & le Souef, 1909, *Ann. Austral.*: 281, fig.; Fry, 1914, *Rec. W. Aust. Mus.*, 1: 207, fig. 11; Nieden, 1923, *Das Tierreich, Anura* 1: 527 (part); Waite, 1929, *Rept. Amph. S. Austral.*: 249 (part), fig. 177.

Vomerine teeth in transverse series between the choanae. Snout rounded, as long as the eye; canthus rostralis rounded; loreal region oblique, and very slightly concave; nostril equidistant from the eye and the end of the snout, or a little nearer the latter; interorbital space $\frac{3}{4}$ the width of the upper eyelid; tympanum indistinct, vertically oval, its maximum diameter about half the length of the eye. Fingers moderate, the first extending beyond the second, which extends as far as, or very slightly beyond, the fourth; the length of the third, along its mesial side, very slightly shorter than the eye. Toes $\frac{3}{4}$ or fully webbed, the membrane extending to the tips of all of them. Subarticular tubercles scarcely developed on the feet; a strongly compressed, prominent metatarsal tubercle about as long as its distance from the tip of the inner toe, covered with a black horny sheath. Tarso-metatarsal articulation reaching the eye, the tip of the outer toe reaching the tip of the snout.

Skin with irregular small warts above; smooth beneath; anal region feebly granular.

Greyish or pale brown above with numerous insuliform dark brown spots or marblings, of which the most constant are an oval canthal stripe, a triangular mark between the eyelids and a short, oval mark behind the upper eyelid; lower surfaces white except the sides of the throat and edges of the lower jaw, which may be blotched or washed with brown; anal granules white-tipped. Usually a narrow, vertebral line. In life (Fletcher, 1891: 273) there is sometimes a yellow wash about the thighs and upper arms. Iris silvery or golden, veined with black and with a dusky streak from the anterior corner to the centre of the pupil.

Breeding male with a distended throat but without definite vocal sacs, with a diffuse, brown, nuptial pad on the upper surfaces of the first and second fingers and with small, horny brown spinules scattered over the dorsal surfaces and on the outer edge of the tarsus and fifth toe.

Length from snout to vent: ♂ 36 mm.; ♀ 47 mm.

DISTRIBUTION: New South Wales, west of the dividing range; Victoria; S. Australia in the south and east; ? S. Queensland; possibly also in eastern districts of West Australia.

The records of this species from Central and N.W. Australia appear to refer to a distinct, but related, form (*vide H. centralis*). *H. sudelli* Lamb, from Warwick, S. Queensland, is usually placed as a synonym of *pictus*, but several points in the description, notably the approximation of the nostril to the eye, and the equally long first and second fingers, make this disposition seem very doubtful.

SPECIMENS EXAMINED.

B.M.	74.4.29.1283	♀	Sandhurst, Victoria.	[Beddome.]
	99.2.14.1	♀	Melbourne.	Degen.
	94.19.27.46	juv.	Ryalstone, N.S.W.	Krefft.
	92.9.16.5	♂	Urana, N.S.W.	Fletcher.
R.R.	1937.7.29.10	♂ skel.	"Australia."	Green.

Heleioporus centralis sp. n.

Heleioporus pictus (non Peters) Spencer, 1896, *Rep. Horn Exp. C. Austral.*, **2**, (Zool.): 166, pl. 13, fig. 2, pl. 14, figs. 10-13; Spencer & Gillen, 1912, *Across Australia*, **1**: 59, pl. i, fig. c; ? Andersson, 1913, *K. Svenska Vetensk. Akad. Handl.*, **52**, 4: 10; Harrison, 1922, *Aust. Zool.*, **3**, 1: 33; Nieden, 1923, *Das Tierreich, Amura I*: 527, figs. 358-361 (part); Waite, 1929, *Rept. Amph. S. Austral.*: 249 (part).

Holotype a male, number 1905.10.31.47, from 100 miles east of Lake Eyre, collected by H. J. Hillier, Esq.

Vomerine teeth in slightly oblique series between the choanae. Snout rounded, as long as the eye; canthus rostralis rounded; loreal region oblique, but not concave; nostril a little nearer the tip of the snout than the eye; inter-orbital space $\frac{3}{4}$ the width of the upper eyelid; tympanum very indistinct, vertically oval, its maximum diameter about half the length of the eye. Fingers rather short, the first extending a little beyond the second, which extends well beyond the fourth; the length of the third, along its mesial side nearly as long as the eye. Toes fully webbed, the membrane extending to the tips of all of them; subarticular tubercles very feeble; a compressed inner metatarsal tubercle as long as its distance from the tip of the inner toe. Tarso-metatarsal articulation reaching the tympanic region, the tip of the outer toe marking the anterior corner of the eye.

Skin smooth above and below, except for the secondary sex characters, which consist of a diffuse nuptial pad on the first and second fingers, and small papillae with black horny spinules scattered over the dorsum and along the outer edge of the tarsus and foot.

Pale grey above with very obscure dusky mottling and a narrow white vertebral line. Lower surfaces white.

Length from snout to vent: 42 mm.

The paratypes are a male and female from Central Australia, probably Charlotte Waters, collected by the Horn Expedition (B.M. 07.1.20.32-33) and two females from "Central Australia" (B.M. 1908.5.28.66-67).

These four specimens scarcely differ from the type in their morphological characters. The webbing of the toes may be somewhat more emarginate, giving an appearance of $\frac{3}{4}$ web only, and the hind limb may be slightly longer, so that the metatarsal tubercle almost reaches the posterior corner of the eye and the tip of the outer toe extends a little beyond the eye. Both specimens collected by the Horn Expedition have the metatarsal tubercle narrowly black-edged (this colouring is much less extensive than in *pictus*), and in all the specimens it is longer than its distance from the tip of the inner toe.

The colour pattern is more distinct than in the type, but its intensity is very variable. When fully developed it is similar to that in the coloured plate illustrating Spencer's account (1896: pl. 13, fig. 2) of the species. The largest male and female, both from Charlotte Waters, each measures 50 mm. from snout to vent.

These Central Australian frogs differ from the eastern and southern species, *pictus*, in their rounder, shorter snouts, shorter legs, smooth skin and the absence or feeble development of the pigmented sheath on the metatarsal tubercle. It seems probable that the specimens from N.W. Australia (Mowla Downs, Kimberley Division) recorded by Andersson (1913: 16) as lacking the dark metatarsal tubercle really belong to this species; Loveridge's suggestion (1935: 16) that they might be juvenile *albopunctatus* is untenable, for Andersson described the nuptial characters of the male, and these are quite unlike those of *albopunctatus*.

In addition to the above-mentioned specimens the British Museum has a series of tadpoles which accord with Spencer's description (1896); the labial teeth are in $\frac{4}{3}$ series.

Heleioporus wilsmorei sp. n.

Holotype a female, number 1937.7.22.3 from Wirarga, N.E. of Yalgoo, Murchison, W. Australia; collected by G. E. Nicholls.

Vomerine teeth in transverse series on a level with the posterior borders of the choanae. Head short and high. Snout rounded, $\frac{3}{4}$ the length of the eye; nostril slightly nearer the tip of the snout than the eye; canthus rostralis rounded; loreal region nearly vertical; interorbital space $\frac{2}{3}$ the width of the upper eyelid; tympanum quite indistinct, but when exposed by dissection, vertically oval, its maximum diameter about $\frac{1}{3}$ the length of the eye. Fingers moderate, the first extending beyond the second, which extends well beyond the very short outer; third, measured along its mesial side, as long as the eye. Toes $\frac{2}{3}$ webbed, the membrane thick and fleshy leaving the tips of the third to fifth free; no sub-articular tubercles on the feet; inner metatarsal tubercle compressed, as long as its distance from the tip of the inner toe and black-edged. Tarso-metatarsal articulation reaching the tympanic region, the tip of the outer toe marking the centre of the eye.

Skin quite smooth, but very thick and glandular above; smooth beneath; a deep furrow below the vent.

Chocolate brown above, with a series of light markings as follows: a narrow mid-dorsal line; a longitudinal row of spots down the centre of the upper eyelid to the posterior corner where they are continued as light lines which run backwards to the vent, sending off two branches on the way; the first of these arises above the tympanic region and runs obliquely backwards to the anterior part of the flanks, and the second arising vertically above the axilla runs obliquely to the groin. Lower surfaces uniform white.

Length from snout to vent: 50 mm.

The paratype is a female, in bad condition, found dead near Lakeside, Calgoorlie, October 18, 1921 (B.M. 1937.7.22.4). It agrees with the holotype in every way. Professor Nicholls has seen a third specimen from the coastal zone north of Geraldton.

This species, which appears to be confined to the eastern parts of West Australia, east of the Darling Range, is one of the *pictus* group, but is distinguished by its much deeper head, large eye, shorter outer digits and very distinctive colour pattern.

Heleioporus pelobatoides Werner.

Heleioporus albopunctatus var. *pelobatoides* Werner, 1914, *Fauna S.W. Austral.*, 4, 10, Amph.: 418 (Type localities:—Beverley and Broome Hill, W. Australia).

Heleioporus pelobatoides Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 15.

Heleioporus eyrei (non Gray) Loveridge, 1935, *loc. cit.*

Vomerine teeth in transverse or slightly oblique series between the choanae. Snout rounded, as long as the eye; nostril midway between the eye and the tip of the snout; canthus rostralis rounded; loreal region very oblique, not concave; interorbital space $\frac{3}{4}$ the width of the upper eyelid. Tympanum indistinct in non-breeding individuals, but becoming very distinct in males at the breeding season; in females and juvenile males it is vertically oval, its maximum diameter

$\frac{2}{3}$ that of the eye, but in adult males it is subcircular, though its diameter is similar. Fingers moderate, the first extending slightly beyond the second, which extends very slightly beyond the fourth; third, measured along its median side, a little longer than the eye; subarticular tubercles well developed and the palm of the hand beset with numerous small rounded tubercles. Toes in non-breeding adults about $\frac{1}{4}$ webbed, but in juveniles at metamorphosis the webbing is more extensive and males in nuptial dress have it carried to the tips of the toes as a fleshy, tapering fringe; subarticular tubercles small; a compressed inner metatarsal tubercle as long as or longer than its distance from the tip of the inner toe and edged with brown. Tarso-metatarsal articulation reaching the centre or anterior border of the eye, the tip of the outer toe extending well beyond the tip of the snout.

Skin very warty above, especially on the head; smooth beneath; anal region feebly granular.

Pale grey to dark brown above with irregular darker blotches or marblings. The most constant are a canthal blotch, a triangular interorbital mark and a pair of very large dorso-lateral blotches on each side of the middle of the back. The warts and the anal granules are frequently white-tipped and a light dorsal line may be present. Lower surfaces white or yellowish, the edges of the lower jaw and sides of the throat washed with brown and stippled with white.

Males at the breeding season, in addition to the extension of the web already described, have a diffuse nuptial pad on the first and second fingers, and scattered horny spinules over all the dorsal surfaces.

A nocturnal species, burrowing by day; normally the burrow is about 2 ft. deep, but in damp localities the frog may be found in shallow cavities beneath logs. Eggs are laid in the burrow and the embrace is lumbar (*vide* Prof. G. E. Nicholls *in litt.*).

This species appears to be confined to the wetter south-western parts of West Australia and is the analogue of the eastern *pictus*, with which it agrees in habitus, leg-length and skin texture. The species from the central, dry zone is more globular in habitus, with a shorter, blunter snout, higher head, and shorter limbs and digits; in fact it appears to be more highly modified for a cryptozoic existence.

SPECIMENS EXAMINED.

B.M.	1931.7.1.18-23	♂, 4 ♀♀	Mt. Toolbrunup.	Baldwin.
	1931.7.1.13-17	2 ♀♀, 3 juvs.	"	"
	1931.7.1.5-8	4 juvs., 1 larva	"	"
M.C.Z.	19430	♂ (breeding)	Tambellup.	
	18210	juv.	Pindawa.	Schevill.

The specimen from Pindawa is one of the series referred by Loveridge to *H. cyrei*, which he considered to be the same as the species generally known as *H. pictus*. But *cyrei* and *pictus* are certainly not conspecific, and these West Australian frogs, which are very immature, cannot be distinguished from the juveniles from Mt. Toolbrunup, which are almost certainly *pelobatoides*. Loveridge was led to believe that two species were present in his material owing to the fact that his single adult was a male in nuptial dress. With the exception of the nuptial characters of digital pads and dermal asperities, this breeding male only differs from the Mt. Toolbrunup male in the greater amount of digital webbing and more distinct tympanum; but a non-breeding male has a larger, rounder,

more distinct tympanum than females of the same collection, so that this character is obviously variable and may well be seasonal; the condition of the webbing is believed to be similarly variable.

Heleioporus albopunctatus Gray.

- Heleioporus albopunctatus* Gray, 1841 (April), *Ann. Mag. nat. Hist.*, **7** : 61 (Type locality:—Western Australia); Gray, 1841, in Grey, *Journ. Exped. W. Austral.*, **2** : 447; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 39 (part); Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 55; Krefft, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 271 (part); ?? Lucas, 1892, *Proc. roy. Soc. Victoria*, **4** : 61; Fletcher, 1893, *Proc. Linn. Soc. N.S.W.*, (2), **8** : 232; *idem*, 1898, *op. cit.*, **22** : 678; Lucas & le Souef, 1909, *Anim. Austral.* : 281; Werner, 1914, *Fauna S.W. Austral.*, **4**, 10, Amph. : 417; Fry, 1914, *Rec. W. Aust. Mus.*, **1** : 204; Harrison, 1922, *Aust. Zool.*, **3**, 1 : 32; Nieden, 1923, *Das Tierreich, Anura I* : 526; Glauert, 1929, *J. roy. Soc. W. Aust.*, **15** : 44; Trewavas, 1933, *Phil. Trans. roy. Soc. London*, **222**, B : 433, figs. 23, 24; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 14.
- Heleioporus alboguttatus* (*laps. cal.*) Gray, 1841, in Grey, *Journ. Exped. W. Austral.*, **2** : pl. 1, fig. 2; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 33 (footnote).
- Heleioforus alleopunctatus* (err. typ.) Krefft, 1865, *Mon. Not. roy. Soc. Tasmania* : 17.

Vomerine teeth in long transverse series between the choanae. Snout rounded, as long as the eye; canthus rostralis rounded; loreal region oblique, not concave; nostril equidistant from the eye and the end of the snout; interorbital space about $\frac{2}{3}$ the width of the upper eyelid; tympanum usually indistinct, vertically oval, its horizontal diameter $\frac{1}{3}$ to $\frac{1}{2}$ the length of the eye. Fingers moderate, the first longer than the second, which is longer than the fourth; subarticular tubercles well developed, and the palm with many tubercles in addition to an inner and group of three outer metacarpal tubercles; one or two tubercles between the first and second and second and third fingers. Toes with a distinct rudiment of fleshy web; third extending beyond the fifth; a large, compressed inner metatarsal tubercle; metatarsal tubercle reaching the tympanic region and the fifth toe the anterior corner of the eye or the nostril.

Skin regularly shagreened above and on the flanks; smooth beneath; anal region granular. A large parotoid gland extending posteriorly to the middle of the flanks, and a similar glandular complex on the antero-ventral surface of the thigh close to the groin.

Dark purple- or chocolate-brown above, regularly beset with circular cream-coloured spots. A light vertical bar may be present on the tip of the snout and a light diagonal stripe from below the eye to the angle of the mouth. White beneath except for the throat, which may be lightly washed with brown.

Male in the breeding season with a series of black, horny, conical spines. The longest, situated on the metacarpo-phalangeal knuckle of the first finger has a bony core, which is articulated on the distal end of the first metacarpal; a series of much smaller, horny conical spines, but apparently without bony cores, are situated distal to the above-mentioned large one on the first finger, and a few may also be present on the second finger. No vocal sac.

Length from snout to vent : ♂ 68 mm. ; ♀ 69 mm.

DISTRIBUTION : West Australia east of the Darling Range and ? N. Territory.

This species appears to be confined to the west of Australia, and various eastern records have been regarded (Fletcher, 1893 : 233) as instances of faulty labelling. Some West Australian records of *albopunctatus* are probably based on examples of *eyrei*, and the Victoria record (Lucas, 1892) is probably due to a misidentification. None of the 13 adult examples of true *albopunctatus* (including the type) which the author has examined show any preocular dermal flap.

		SPECIMENS EXAMINED.		TYPE.
B.M.	41 (2) 211	♂	West Australia.	Dr. Fleming.
	RR. 1036.12.3.128	♀	Port Essington, N.T. (?)	
	96.1.30.9-11	3 juvs.	Geraldton, Chapman River.	Saunders.
	1931.7.1.9	♂	Toolbrunup, S. W. Australia.	Baldwin.
	1937.7.22.5-6	2 ♂♂	W. Australia.	Nicholls.
	1937.7.22.7	♂	St. Ronan's Well, York, W. Austr.	"
	1937.7.22.8-9	♂♀	St. Ronan's Well, York, W. Austr.	"
	1937.7.22.10-11	♂♀	Bruce Rock, W. Aus- tralia.	"
	1937.7.22.12-13	♂♀	Waad, nr. Meckering, W. Austr.	"
	1937.7.22.14	♂	W. Australia.	"
	1907.3.13.4	♂ skel.	" Australia."	Preston.

Heleioporus australiacus (Shaw).

- Rana australiaca* Shaw, 1795, *Nat. Miscellany*, 6 : pl. 200 (Type locality :—New Holland) ; Andersson, 1913, *K. Svenska Vetensk.Akad. Handl.*, 52, 4 : 3.
- Philocryphus australiacus* Fry, 1915, *Proc. roy. Soc. Queensland*, 27, 4 : 70 ; Harrison, 1922, *Aust. Zool.*, 3, 1 : 32 ; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 17.
- Rana sprints* Schneider, 1799, *Hist. Amph.*, 1 : 129-130 (Type locality :—Islands of the ocean around Australia) ; Shaw, 1802, *Gen. Zoology*, 3 : 112.
- Helioporus albopunctatus* (non Gray), Fletcher, 1880, *Proc. Linn. Soc. N.S.W.*, (2), 4 : 376 ; *idem*, 1890, *op. cit.*, (2), 5 : 671 ; Werner, 1914, *Fauna S.-W. Austral.*, 4, 10, Amph. : 417 (part :—Lion Mill?).
- Philocryphus flavoguttatus* Fletcher, 1893, *Proc. Linn. Soc. N.S.W.*, (2), 8 : 233 (Type localities :—Mt. Victoria, Blue Mts. ; Thornleigh, Dural, near Paramatta ; near Manly) ; *idem*, 1894, *tom. cit.* : 530 ; Lucas & le Souef, 1909, *Ann. Austral.* : 282, fig. ; Steel, 1912, *Aust. Nat.*, 2 : 135 ; Fry, 1914, *Rec. W. Aust. Mus.*, 1 : 205, figs. 8a, 9.
- Helioporus flavoguttatus* Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22 : 670 ; Nieden, 1923, *Das Tierreich*, Anura I : 528 (part).

Vomerine teeth in two long, transverse or slightly oblique series between the choanae. Sternum in juveniles a broad cartilaginous plate, notched posteriorly, but becoming calcified, the calcified style and posterior edge becoming distinctly bifurcate with increasing age. Head broad, depressed. Snout rounded, as long as the eye, with rounded canthus rostralis and very oblique loreal region ; nostril equidistant from the end of the snout and the eye, or a little nearer the latter ; interorbital space slightly narrower than the upper eyelid ; anterior corner of the eye with a fimbriated flap of skin, well-developed in adults, less so in half-grown examples and absent in the very young. Tympanum subcircular, its horizontal diameter $\frac{2}{3}$ to $\frac{3}{4}$ the length of the eye. Fingers well developed, the first a little longer than the second, which is a little longer than the fourth ; sub-articular tubercles large ; an oval inner, and a group of 3 outer metacarpal tubercles, as well as numerous palmar tubercles, of which the most constant are one each between the first and second and second and third fingers. Toes with a distinct, though slightly variable, rudiment of rather fleshy web ; outer toe variable in length, but always shorter than the third ; a very large compressed inner metatarsal tubercle. Tarso-metatarsal articulation reaching the eye, the tip of the outer toe extending to the tip of the snout or a little beyond.

Skin regularly shagreened above, more coarsely granular on the flanks ; a large parotoid glandular complex not easily distinguished externally, and a small oval gland on the antero-ventral surface of the thigh close to the groin. Lower surfaces smooth or wrinkled ; anal region granular.

Dark grey- or purplish-brown above; frequently a vertical yellow bar on the tip of the snout; warts of the flanks and posterior half of the upper lip yellow. Lower surfaces white except the throat of the male, which has a dusky wash or reticulation.

Male at the breeding season with a series of horny, conical spines on the dorsal surfaces of the first, and sometimes also the second and third fingers. The largest is situated on the metacarpo-phalangeal knuckle of the pollex and has a bony core. Both sexes are also more or less profusely covered with small black spinules. No vocal sac.

Length from snout to vent: ♂ 80 mm.; ♀ 77 mm.

DISTRIBUTION: New South Wales (Cumberland County) and West Australia (Darling Range to Kajorup in the region of moderate rainfall).

SPECIMENS EXAMINED.

1925.8.24.1-2	♂♀	Hornsby, N.S.W.	(Rosenberg.)
1937.7.22.15-26	♂♀ and juvs.	New South Wales.	Harrison.
1937.7.22.27	♂	St. Ronan's Well, York, W.A.	Nicholls.

Heleioporus eyrei (Gray).

Perialia eyrei Gray, 1845, in Eyre, *Journ. Exped. Centr. Austral.*, **1**: 407, pl. 2, fig. 3 (Type locality:—"On the banks of the River Murray"¹).

Heleioporus albopunctatus (non Gray) Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 39 (part); Kesterstein, 1868, *Arch. Naturgesch.*, **34**: 269; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 271 (part); Werner, 1914, *Fauna S.-W. Austral.*, **4**, 10, Amph.: 417; Dakin, 1920, *Aust. Zool.*, **1**, 8: 241; Nieden, 1923, *Das Tierreich, Anura I*: 526, fig. 357; Glauert, 1929, *J. roy. Soc. W. Aust.*, **15**: 44.

Heleioporus insularis Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, **8**: 92 (Type locality:—Rottneest Island); *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 15.

Vomerine teeth in two long, transverse series between the choanae. Sternum calcified in the adult and notched posteriorly. Head broad, depressed. Snout rounded, a little longer than the eye, with rounded canthus rostralis and oblique loreal region; nostril equidistant from the eye and the end of the snout; inter-orbital space a little narrower than the upper eyelid; anterior corner of the eye with or without some small papillae. Tympanum more or less distinct, vertically oval, the annulus tympanicus with a vertical diameter $\frac{1}{2}$ to $\frac{2}{3}$ that of the eye. Fingers well developed, the first a little longer than the second, which is distinctly longer than the fourth; subarticular tubercles prominent; a prominent oval inner metacarpal tubercle (covering a bony prepollex in both sexes) and a group of smaller outer metacarpal tubercles; numerous palmar tubercles and conical ones between the first and second, and second and third fingers. Toes with a rudiment of fleshy webbing, the outer shorter than the third; a very large compressed inner metatarsal tubercle. Tarso-metatarsal articulation reaching the eye, the tip of the fifth toe extending to the tip of the snout or a little beyond.

¹ It has been suggested that this is the West Australian River Murray and not the better known river of the same name in South Australia. There is some evidence to support this view. Although the specimens are said to have been collected by Eyre, there is no proof that this is so, and Gray expressly states that "The British Museum has received from the different travellers various other species—" (*op. cit.*: 406). The types are entered in the register of 1843 as having been purchased from Turner (a dealer) and the locality is given as West Australia. Other frogs in the same collection are *Limnodynastes dorsalis dorsalis* and *Crinia signifera signifera*, of which the former does not occur in South Australia.

Skin shagreened above, more definitely tubercular on the flanks ; a parotoid complex, not discernible externally, and a small oval gland on the antero-ventral surface of the thigh, close to the groin. Lower surfaces smooth. Anal region granular. Brown above, with irregular lighter (grey or yellowish) marblings, of which the most constant are a pair of oval spots above the shoulder and a vertical light bar on the tip of the snout ; flanks and anal region sparsely dotted with yellow or white. Lower surfaces immaculate white except the throat of the male, which is slightly infuscate.

Male without or with only a single spine on the metacarpo-phalangeal knuckle of the inner finger ; no vocal sac.

Dimensions : ♂♂ 46-56 mm. (av. of 9 specs. 52 mm.) ; ♀♀ 48-59 mm. (av. of 8 specs. 53 mm.).

DISTRIBUTION : Coastal Zone of West Australia, west of the Darling Range, south to Albany county, but excluding the damp south-west corner. Rottneest Island ; ? Northern West Australia.

The species, which has usually been confused with *albopunctatus*, is closely allied to *australiacus* and may prove to be a neotenic form of that species. In West Australia the three form a complex, of which *eyrei* occupies the dry zone to the west of the Darling Range, *australiacus* the relatively damp areas on both sides of the mountains and *albopunctatus* the dry zone to the east. The two latter occur together in the neighbourhood of St. Ronan's Well, but *eyrei* and *albopunctatus* meet in the south at Toolbrunup (circa 50 miles north of Albany).

Eggs laid in a frothy mass of jelly underground in April. Development proceeds within the egg until the external gills have been lost and the operculum developed ; hatching is conditional upon the nest being flooded. A well-developed tadpole measures 58 mm., of which the head and body account for 26. Eyes and nostrils directed upwards, the latter much nearer a line connecting the anterior borders of the eyes than the end of the snout. Mouth terminal, directed downwards, lips with a single row of papillae, the upper widely interrupted in the middle ; angles of the mouth with short, transverse rows bearing three or four papillae within the lips ; mandibles powerful and finely serrated ; three or four rows of labial teeth above, the inner two or three widely interrupted mesially ; three below, the outer shortest and the innermost narrowly interrupted in the middle. Spiraculum sinistral, situated towards the ventral side. Anus dextral, slightly anterior to the base of the tail. Young at metamorphosis 23 mm. from snout to vent.

SPECIMENS EXAMINED.

B.M.	62.7.20.14	♀	(" Sydney ")	Kretz. ¹
R.K.	1930.12.3.129	♂	Port Essington, N.T. (?)	Fleming.
	69.7.27.6	♀	N.W. Australia.	(Higgins.)
	43.5.19.71-74	juvs.	Murray River (West Australia ?)	Eyre. TYPES.
	1931.7.1.10	♀	Mt. Toolbrunup, W.A.	Baldwin.
	1931.7.1.11-12	Larvae.	" " "	"
	1931.7.1.2-4	♂, ♀♀	" " "	"
	44.2.26.11	♀	Swan River, W.A.	Gilbert.
	1937.7.22.28-30	♂♂	Darling Range, W.A.	Nicholls.
	1937.7.22.31-32	♂♀	Crawley, Perth, W.A.	"
	1937.7.22.33-34	♂♀	Yallingup, W.A.	"
	1937.7.22.35	Hgr. ♀	Denmark, W.A.	Newton.

¹ Fletcher (1803 : 233) has suggested that this example was one of a series collected in 1866 by Masters in West Australia ; but it was received in London in 1862, the same year in which the Leiden Museum received the specimens labelled " King George's Sound."

1936. 10. 2. 1	juv.	Rottneft Island, W.A.	Darlington. Paratype of <i>Heleioporus insularis</i> Lov.
1937. 10. 1. 1-3	2♂♂, Hgr. ♀	Bathurst Point, Rott- neft Island.	Glauert.
Mus. Leiden 2223	3 imm.	King George's Sound, W.A.	(Sydney Mus.)
„ „ 2224	imm.	S.W. Australia.	Preiss.

Heleioporus sudelli Lamb.

Heleioporus sudelli Lamb, 1911, *Ann. Queensland Mus.*, **10** : 26 (Type locality:—Warwick, S.E. Queensland).

Vomerine teeth in two groups between the choanae. Habitus stout. Head broader than long, snout rounded, without canthus rostralis; nostril nearer the eye than the tip of the snout; interorbital space narrower than the upper eyelid; tympanum indistinct. Fingers blunt, first and second equal; toes short, blunt, half webbed; subarticular tubercles, especially those of the fingers, well developed; a small tubercle between the first and second and second and third fingers; inner metatarsal tubercle long and low; no outer metatarsal tubercle. The hind limb being carried forwards along the body, the tip of the longest toe reaches the eye or just beyond. Upper surface of body and limbs minutely tubercular; belly smooth. Brownish or olive above marbled with darker; a dark cross-band between the eyes to the outer edge of the upper eyelid; a light vertebral line and a light blotch on the upper part of the shoulders; upper edge of lower eyelid silvery white.

Length from snout to vent: 45 mm.

DISTRIBUTION: Known only from the unique type from Warwick, S.E. Queensland.

(Possibly based on a specimen of *Limnodynastes* sp.)

LIMNODYNASTES Fitzinger.

Cystignathus (part) Duméril & Bibron, 1841, *Erpét. Gén.*, **8** : 392.

Discoglossus Gray, 1842, *Zool. Miscellany* : 56.

Limnodynastes Fitzinger, 1843, *Syst. Rept.* : 31 (Type species:—*Cystignathus peronii* Dum. & Bibr.); Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 32; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 25; Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 343; *idem*, 1868, *Arch. Naturgesch.*, **34** : 256; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 258; Nieden, 1923, *Das Tierreich, Anura I* : 528; Waite, 1920, *Rep. Amph. S. Austral.* : 250; Noble, 1931, *Biol. Amph.* : 497.

Limnodynastes (emend.) Cope, 1866, *nat. Hist. Rev.* : 113; McCoy, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 182; Alexander, 1922, *J. Linn. Soc. (Zool.)*, **36** : 462.

Wagleria Girard, 1853, *Proc. Acad. nat. Sci. Philad.*, **6** : 421 (Type species by selection:—*Cystignathus peronii* Duméril & Bibron); *idem*, 1858, *U.S. Explor. Exped., Herp.* : 42.

Platyplectrum Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 27 (Type species:—*P. marmoratum*); Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 89, 94; Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 343; *idem*, 1868, *Arch. Naturgesch.*, **34** : 260.

Borborocates (part) Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 94; *idem*, 1889, *Bull. U.S. nat. Mus.*, **34** : 312.

Opisthodon Steindachner, 1867, *Reise Novara, Zool., Amph.* : 9 (Type species:—*O. frauenfeldi*), *Heliorana* *idem*, 1867, *tom. cit.* : 32 (Type species:—*H. grayi*).

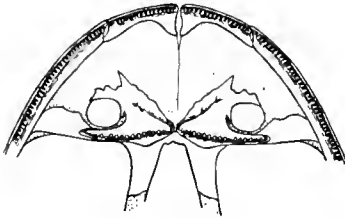
Ranaster Macleay, 1878, *Proc. Linn. Soc. N.S.W.*, **2** : 135 (Type species:—*R. convexiusculus*); Nieden, 1923, *Das Tierreich, Anura I* : 535 (part); van Kampen, 1923, *Amph. Indo-Austral. Archip.* : 19; Noble, 1931, *Biol. Amph.* : 497.

Maxillary teeth present. Prevomer present, entire, its post-choanal portion large, overlying at least the mesial half of the palatine, denticerous (text-fig. 9);

a distinct fronto-parietal foramen. Ear fully developed. Vertebrae procoelus but with the condyle incompletely ankylosed; seven presacrals; sacral diapophyses slightly dilated; coccyx articulating by two condyles. Omosternum cartilaginous; sternum undivided, cartilaginous or calcified. Terminal phalanges simple. Males with a prepollex (Pl. I).

Pupil horizontal, with a downwardly directed angle ventrally. Tongue large, oval, entire and slightly free behind. Toes usually more or less webbed, not dilated distally.

TEXT-FIG. 9.



TEXT-FIG. 10.



TEXT-FIG. 11.



TEXT-FIG. 12.



TEXT-FIG. 9.—Anterior cranial elements of *Limnodynastes dorsalis dorsalis*. $\times 3$.
(From beneath.)

TEXT-FIG. 10.—Hand of *Limnodynastes tasmaniensis* ♀. $\times 4$.

TEXT-FIG. 11.—Hand of *Limnodynastes salmini* ♀. $\times 4$.

TEXT-FIG. 12.—Hand of *Limnodynastes peronii* ♀. $\times 4$.

Distal tendon of the m. semitendinosus passing ventral to, or perforating the gracilis (*ornatus*). Alary process of the hyoid narrow proximally, expanded distally; cricoid complete; oesophageal process of the cricoid slender.

This genus shows a very peculiar trend. In two species, *fletcheri* and *peronii* (text-fig. 12), and to a less extent in a third, *salmini* (text-fig. 11), the phalanges of the inner finger are greatly reduced in size, or, in some specimens, reduced to a single one, but as a compensation, so that the inner finger is still approximately as long as the second, the inner metacarpal bone is disproportionately

long. This compensation belies the possibility of the reduction being a concomitant of loss of function unless it is assumed that there has been some secondary change necessitating a re-development of an inner digit which was originally functionless and vestigial. There is no evidence to lend support to such an assumption and it is possible that an explanation is to be found by comparison with the genus *Crinia*, in which also two species (*laevis*, text-fig. 16, and *darlingtoni*) have the phalanges of the inner finger similarly reduced, though without any compensating elongation of the metacarpal. Now it may be significant that none of the species of *Limnodynastes* in which the phalanges of the inner finger are reduced in size have nuptial pads, whereas all the remaining species of the genus have them very well developed. In *Crinia laevis*, and probably *C. darlingtoni* also, nuptial pads are likewise absent. But the former species at least, and in all probability the latter too, pairs on land, whereas all the species of *Limnodynastes*, whose breeding habits are known, including *peronii* with the reduced phalanges, pair in water. It is highly probable that nuptial excrescences are not so essential to frogs pairing on land as to those where oviposition occurs in water. Reduction of the phalanges of the inner digit appears to be accompanied by loss of nuptial pads, but in the genus *Crinia*, where pairing occurs on land, this is no handicap. In the water-breeding *Limnodynastes*, however, the loss would be gravely disadvantageous and has been overcome by the enlargement of the metacarpal which can function as a nuptial spine, as it does in the Ranid genera *Petropedetes* and *Babina*. It seems possible, therefore, that the reduction of the inner finger is an orthogenetic tendency which proceeds regardless of the requirements of the animals, and that to counteract the handicap it imposes *L. fletcheri* and *L. peronii* have secondarily hypertrophied another structure to perform the same function in a different way.

SYNOPSIS OF THE SPECIES.

- I. Inner metatarsal tubercle shovel-shaped.
 - A. A large gland on the tibia *dorsalis* subsp.
 - B. No tibial gland.
 - (1) Toes not more than $\frac{1}{4}$ webbed *ornatus*.
 - (2) Toes at least $\frac{1}{2}$ webbed *spenceri*.
- II. Inner metatarsal tubercle not shovel-shaped.
 - A. Inner metacarpal equal to, or somewhat longer or shorter than, the second; the proximal phalanx of the first finger very much longer than the distal.
 - (1) First finger shorter than the second; usually two metatarsal tubercles; vomerine teeth not extending laterally beyond the choanae *tasmaniensis*.
 - (2) First and second fingers equal; a single metatarsal tubercle; vomerine teeth extending well beyond the lateral borders of the choanae *convexiusculus*.
 - (3) First finger extending beyond the second, the proximal phalanx of the inner finger twice as long as the second; toes nearly free *salmini*.
 - B. Inner metacarpal very much longer than the second; phalanges of the first finger subequal, or (in *peronii*) sometimes reduced to one.
 - (1) Toes with a distinct basal webbing; snout not prominent . . . *fletcheri*.
 - (2) Toes long, slender, free; snout pointed and prominent . . . *peronii*.

***Limnodynastes dorsalis dorsalis* (Gray).**

- Cystignathus dorsalis* Gray, *Ann. Mag. nat. Hist.*, **7** : 61 (Type locality:—Western Australia), *idem*, 1841, in Grey, *Journ. Exped. W. Australia*, **2**, App. : 446; *idem*, 1845, in Eyre, *Journ. Exped. Central Austral.*, **1**, App. : pl. 1, fig. 2.
- W. (*aglevia*) *dorsalis* Girard, 1853, *Proc. Acad. nat. Sci. Philad.*, **6** : 421.
- Limnodynastes dorsalis* Gunther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 33; Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16 (part); *idem*, 1868, *Arch. Naturgesch.*, **34** : 260; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 261 (part); Fletcher, 1868, *Proc. Linn. Soc. N.S.W.*, **22**, 1867 : 675; Andersson, 1913, *K. Svenska Vetensk. Akad. Handl.*, **52**, 3 : 9, 10; Werner, 1914, *Fauna S.W. Austral.*, **4** : 409; Alexander, 1922, *J. Linn. Soc. (Zool.)*, **34** : 462; Nieden, 1923, *Das Tierreich, Anura I* : 532 (part); Glauert, 1929, *J. roy. Soc. W. Aust.*, **15** : 44; Noble, 1931, *Biol. Amph.* : 114.
- Limnodynastes dorsalis* var. *typica* Fry, 1913, *Rec. Aust. Mus.* **10** : 24, pl. 2, fig. 2; *idem*, 1914, *Rec. W. Aust. Mus.*, **1** : 202.
- Limnodynastes dorsalis dorsalis* (part) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 21.

Vomerine teeth in moderately long curved series separated from the maxillae by spaces equal to, or a little greater than, half the length of a single series. Snout rounded, not prominent, 1.25 to 1.5 times as long as the eye, with rounded canthus rostralis and oblique, convex, loreal region; nostril midway between the eye and the tip of the snout; interorbital space about as broad as the upper eyelid; tympanum indistinct, its horizontal diameter about half that of the eye. Fingers moderate, the first very slightly longer than the second, the first metacarpal also being slightly longer than the second; subarticular tubercles well developed; one or two small tubercles between the first and second, and second and third fingers; a prominent inner metacarpal tubercle, with a bony prepollex and a flat, longitudinally cleft outer. Toes with a rudiment of web, variable in amount, but not more than $\frac{1}{5}$; inner metacarpal tubercle large, shovel-shaped, longer than its distance from the tip of the inner toe. Tibio-tarsal articulation reaching the tympanum or the posterior corner of the eye.

Skin smooth, feebly granular or with some flat warts above; a prominent glandular ridge from beneath the eye to the forearm and a very large, conspicuous gland occupying almost the whole upper surface of the tarsus. Smooth beneath; anal region feebly granular, with two larger glandular spots one on each side of the vent.

Pale brown or greenish above with insuliform, clearly-marked dark brown, sometimes light-edged spots in regular series; a median series down the middle of the back, commencing with a triangular one connecting the upper eyelids, is bisected by a light vertebral line which is constantly present. A dorso-lateral series runs from behind the eye to the groin. Flanks spotted and splashed with darker, the inguinal region often marbled with white (? red) and brown. A curved bar from the tip of the snout through the nostril and eye to the fore-limb; sub-aural glandular fold white or yellow. Hind limbs with dark spots on a lighter ground above; hinder side of the thighs and concealed surface of the tibiae dark brown marbled with white. Lower surfaces white, sometimes faintly dusted with darker. Throat of the male infusate.

Male with a vocal sac opening by a slit on each side of the tongue and nuptial asperities on the metacarpo-phalangeal knuckles of the first and second fingers.

Length from snout to vent : ♂ 68 mm.

DISTRIBUTION : West Australia; Rottneest Island.

SPECIMENS EXAMINED.

B.M. 41. (2). 212	♂	W. Australia.	Gould.	TYPE.
41.3.6.7-8	2 ♂♂	Port Essington (?).	Fleming.	
43.5.19.27	juv.	W. Australia.	{ Turner.}	

44.7.9.34	♂	Houtman's Abrolhos.	Gould.
95.6.21.6-7	2 ♂♂	Chapman River, W.A.	Saunders.
1931.7.1.46-48	3 juvs.	Mt. Toolbrunup, W.A.	Baldwin.
96.1.30.8	skel.	Chapman River, W.A.	Saunders.

Limnodynastes dorsalis terraereginae Fry.

Limnodynastes dorsalis Günther, 1876, *J. Mus. Godeffroy*, **12** : 47; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 261 (part); Garman, 1901, *Bull. Mus. comp. Zool. Harv.*, **39** : 14; Andersson, 1916, *K. Svenska Vetensk.Akad. Handl.*, **52**, 9 : 8; Nieden, 1923, *Das Tierreich, Amura* I : 532 (part).

Limnodynastes dorsalis var. *dumerli* (non Peters) Fry, 1913, *Rec. Aust. Mus.*, **10** : 26-28, pl. 3, fig. 2.

Limnodynastes dorsalis var. *terrae-reginae* Fry, 1915, *Proc. roy. Soc. Queensland*, **27** : 67, fig. 2a (Type locality :—Somerset, Cape York).

L. dorsalis terraereginae Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 21.

This north-eastern race is similar in general morphological characters to the typical western form, except that the vomerine teeth may be slightly more extensive laterally, the first finger rather shorter (being only as long as, or but very slightly longer than, the second), shorter hind limbs, the tibio-tarsal articulation reaching the shoulder or the ear, and the sub-aural glandular fold expanded behind the angle of the mouth.

The colour is, however, very different. In juveniles there may be a pattern of spots similar to that of the typical subspecies, but the light mid-dorsal stripe is narrower and often partly or completely obliterated. With increasing size the dorsal markings break up into smaller spots and the ground-colour tends to become progressively darker, so that in adults the dorsal colour may be almost uniform dark olive, usually, however, there is some persistent trace of the spots and also there is often a light streak, with indefinite margins running forwards from the groin, obliquely upwards in the direction of the eye. Chin and throat with brown reticulations. Males with the same secondary sex-characters as in *L. dorsalis dorsalis* and females with the first and second fingers spatulate.

Length from snout to vent : ♂ 69 mm. ; ♀ 76 mm.

DISTRIBUTION : Queensland as far south as the Burnett River Valley.

SPECIMENS EXAMINED.

B.M. 70.6.26.42-44	♀, 2 Hgr., 1 juv.	Queensland.	Krefft.
49	juv.		
70.3.4.35-36	♂, ♀	Gayndah, Queensland.	Dämel.
85.9.2.30-33	4 ♂♂	Mackay, Queensland.	Ling Roth.
1903.10.19.35	♀	Near Cooktown, Queensland.	Bellenden Ker.
1924.3.3.1-2	2 juvs.	Torrens Creek, Queensland.	Wilkins.

Limnodynastes dorsalis dumerili Peters.

Limnodynastes (Platyplectron) dumerili Peters, 1863, *Mber. Akad. Berlin* : 235 (Type locality :—near Adelaide); Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 54.

Platyplectron dumerili Kieferstein, 1868, *Arch. Naturgesch.*, **34** : 262.

Limnodynastes dumerili Günther, 1868, *Zool. Rec.*, 1867, **4** : 145; *idem*, 1868, *Proc. zool. Soc. Lond.* : 478.

Limnodynastes dorsalis var. *dumerili* Fry, 1913, *Rec. Aust. Mus.*, **10**, 2 : 26 (part), pl. 2, figs. 1-1a; Waite, 1929, *Rept. Amph. S. Austral.* : 252, figs. 181-183.

Limnodynastes dorsalis dumerili Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 21 (part).

Limnodynastes bibroni (nom. nud., in err. pro *dumerili*?) Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, Add. : 107.

L. (ymnodynastes) dorsalis McCoy, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 182.

Limnodynastes dorsalis McCoy, 1880, *Prodi. Zool. Victoria*, **5** : 12, pl. 42, fig. 2. Lucas & le Souef, 1909, *Ann. Austral.* : 271, fig. ; Nieden, 1923, *Das Tierreich, Anna I* : 532 (part).

Limnodynastes dorsalis var. *interioris* Fry, 1913, *Rec. Aust. Mus.*, **10**, 2 : 33, pl. 3, figs. 1-10 (Type locality:—Merool Creek, Riverina, N.S.W.).

As understood by Fry (1913) this race ranges from Southern Queensland southwards to South Australia and Tasmania except for a small area in western New South Wales where his *interioris* was discovered. Loveridge (1935), however, includes Tasmanian specimens under the western *dorsalis dorsalis*, but it seems highly probable that there is a distinct and recognizable race in Tasmania.

The status of Fry's *interioris*, with its strongly webbed toes and heavily pigmented lower surfaces, is uncertain, but in view of the fact that this author records specimens with these two characters from the central table-land and the mountains of New South Wales it seems possible that *interioris* ought to be united with *dumerili*. The material before the author is very scanty, but, so far as it goes, the race appears to be distinguished by a somewhat shorter snout, less than 1.25 times as long as the eye; the first finger slightly but distinctly shorter than the second; toes $\frac{1}{4}$, or even slightly more, webbed; a very conspicuous wart on each side of the vent and the lower surfaces heavily marbled with brown.

DISTRIBUTION: South Australia, Victoria, southern and western New South Wales, including the mountain region.

SPECIMENS EXAMINED.

94.10.27.32-33	♂, ♀	Adelaide.	Krefft.
94.10.27.59-60	♀, Hgr.	"	"
Mus. Leiden 2033	♀	Melbourne.	van Kaathoven.

Limnodynastes dorsalis insularis subsp. n.

Limnodynastes dorsalis English, 1910, *Proc. zool. Soc. Lond.* : 629, pl. 51, fig. 3. Nieden, 1923, *Das Tierreich, Anna I* : 532 (part); Blanchard, 1929, *Aust. Zool.*, **5**, 4 : 326.

Limnodynastes dorsalis var. *dumerili* Fry, 1913, *Rec. Aust. Mus.*, **10**, 2 : 26 (part).

Limnodynastes dorsalis dorsalis (part) Loveridge, 1934, *Pap. roy. Soc. Tasmania*, **1933** : 58
idem, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 21.

As suggested above, the Tasmanian representative of *Limnodynastes dorsalis* may be recognizable as a distinct race. It resembles *L. dorsalis dumerili* in having the first finger slightly, but distinctly, shorter than the second and in the possession of a pair of large, prominent anal warts; the colour, too, is essentially similar to that of specimens from New South Wales and South Australia, though the lower surfaces are only slightly brown-mottled. There is also some resemblance to *terrae-reginae* in the degree of dilatation of the sub-aural fold posteriorly. It differs from *dumerili*, however, in having a snout 1.5 to 1.7 times as long as the eye and in the toes being almost entirely devoid of webbing.

It is essentially a burrowing frog, frequenting dry country, and hibernates from mid-April until late in August. The breeding season, according to English, is from August to October, the call of the male being a very loud booming note; Blanchard, however, found the frogs breeding in January, the eggs being laid in floating, frothy clumps, often in contact with grass or sedges.

Length from snout to vent : ♂ 58 mm. ; ♀ 57 mm.

SPECIMENS EXAMINED.

B.M. 1901.9.13.1	imm. ♂	Near Launceston.	English. (COType.)
M.C.Z. Harvard 19238	♀	Eagle Hawk Neck, Tasmania.	Blanchard ..
19339	♂	Tasmania.	English ..

Limnodynastes dorsalis grayi (Steindachner).

- Limnodynastes dorsalis* Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16 (part); *idem*, 1866, *Trans. Phil. Soc. N.S.W.*, 1862-5 : 32; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107; Fletcher, 1880, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 374; *idem*, 1890, *op. cit.*, (2), **5** : 670-675; *idem*, 1891, *op. cit.*, (2), **6** : 271-273; *idem*, 1892, *op. cit.*, (2), **7** : 7, 8, 13; *idem*, 1894, *op. cit.*, (2), **8** : 526, 528, 530; Harrison, 1922, *Aust. Zool.*, **3**, 1 : 33; Nieden, 1923, *Das Tierreich, Amura I* : 532 (part), figs. 362, 363.
- Heliorana grayi* Steindachner, 1867, *Reise Novara, Zool., Amph.* : 32, pl. 2, figs. 11-14 (Type locality :—New South Wales); Keferstein, 1868, *Arch. Naturgesch.*, **34** : 266.
- Platyplectrum superciliare* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 346 (Type locality :—Australia).
- Heliorana superciliaris* Keferstein, 1868, *Arch. Naturgesch.*, **34** : 267, pl. 5, fig. 7.
- Limnodynastes dorsalis* var. *dumerili* Fry, 1913, *Rec. Aust. Mus.*, **10**, 2 : 26 (part).
- Limnodynastes dorsalis dumerili* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 21 (part).

Fry (1913 : 29), in his consideration of the races of *Limnodynastes dorsalis*, has pointed out that *dumerili* shows a great amount of local variation. If geographical races are to be recognized at all it seems certain that *dumerili*, *sensu* Fry, must be subdivided, and one of its constituents is the small coastal form of New South Wales, for which the name *Heliorana grayi* seems to be available.

This race is generally similar to the typical form, but is distinguished by its smaller size (it rarely exceeds 55 mm. in length), subequal first and second fingers, a pair of prominent warts on either side of the vent, and the subaural glandular fold strongly dilated posteriorly.

The coloration is similar to that of the northern *terrae-reginae* except that the hinder sides of the thighs are brown, regularly dotted with white or red. Lower surfaces white or faintly brown dusted.

DISTRIBUTION : New South Wales east of the dividing range ; ? South-eastern Queensland.

Breeding period probably extensive ; spawn in a mass of frothy jelly ; tadpoles very large, 2.5-3 in. in length ; young at metamorphosis 21 mm. (Fletcher).

SPECIMENS EXAMINED.

B.M. 88.7.3.11	♂	Sydney.	Fletcher.
1925.5.25.1	♀	Nowra, N.S.W.	Rodway.
1929.7.9.1-7	7 juvs.	" "	" "

Limnodynastes ornatus (Gray).

- Discoglossus ornatus* Gray, 1842, *Zool. Miscellany* : 56 (Type locality :—Port Essington); *idem*, 1845, in Eyre, *Journ. Exped. C. Austral.* II : pl. 2, fig. 2.
- Perialia ? ornata idem*, 1845, *tom. cit.* : 407.
- Limnodynastes ornatus* Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 33; Krefft, 1865, *Pap. Proc. roy. Soc. Tasmania* : 17; Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 54; *idem*, 1868, *Zool. Rec.*, 1867, **4** : 145; *idem*, 1876, *Mus. Godeffroy*, **12** : 47; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 262; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 386; *idem*, 1890, *op. cit.*, (2), **5** : 672; *idem*, 1894, *op. cit.*, (2), **8** : 524, 529, 530; Boettger, 1894, *Denkschr. med.-naturw. Ges. Jena*, **8** : 109, 110; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22**, 1897 : 676; Lucas & le Souef, 1909, *Anim. Austral.* : 273, fig.; Andersson, 1913, *K. Svenska Vetensk.Akad. Handl.*, **52**, 4 : 9, 11; Fry, 1914, *Rec. W. Austr. Mus.*, **1** : 202; Andersson, 1916, *K. Svenska Vetensk.Akad. Handl.*, **52**, 9 : 8; Nieden, 1923, *Das Tierreich, Amura I* : 533 (part); Kinghorn, 1931, *Rec. Aust. Mus.*, **18**, 3 : 89; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 22.
- Platyplectrum ornatum* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 346; *idem*, 1868, *Arch. Naturgesch.*, **34** : 261.
- Platyplectrum marmoratum* Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 27, pl. 4, fig. A

(Type locality :—Clarence River, N.S.W.), Krefft, 1865, *Pap. Proc. roy. Soc. Tasmania* : 17. *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 197; Kesterstein, 1897, *Nachr. Ges. Wiss. Göttingen*, **18** : 315; *idem*, 1868, *Arch. Naturgesch.*, **34** : 291; Günther, 1868, *Proc. zool. Soc. Lond.* : 480.

? *Platyplectrum occidentale* Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 90 (Type locality :—West Australia).

Opisthodon frauenfeldi Steindachner, 1867, *Reise Novara, Zool., Amph.* : 6, pl. 1, figs. 1-4 (Type locality :—New South Wales).

O. frauenfeldti Cope, 1867, *J. Acad. nat. Sci. Philad.* (2), **6** : 201.

Vomerine teeth in transverse, slightly curved series behind the choanae, separated from the maxillae by a space equal to about the length of one series. Snout short, rounded, not prominent, as long as, or very slightly longer than the eye; canthus rostralis rounded, loreal region moderately oblique; nostrils directed upwards, halfway between the tip of the snout and the eyes or slightly nearer the latter; interorbital space less than the width of an upper eyelid; tympanum very indistinct, $\frac{1}{3}$ to $\frac{2}{5}$ the diameter of the eye. Fingers short, not depressed, the first being either slightly longer or shorter than the second; sub-articular tubercles well developed and prominent; a small supernumerary tubercle proximal to the basal subarticular of each finger and some fleshy web which may be tubercular between the first and second and second and third fingers; a prominent inner metacarpal tubercle, with a bony prepollex in males, and a longitudinally cleft outer, of which the outermost portion may be very indistinct or absent. Toes slender, with distinct basal webbing which frequently, in adults, extends along the toes as a distinct fringe; in juveniles and immature specimens the web midway between the third and fourth toes does not extend as far as the proximal subarticular tubercle of the fourth toe, but in adults it usually reaches to this level or very slightly beyond it; subarticular tubercles prominent; a large, shovel-shaped inner, but no outer, metatarsal tubercle. Tibio-tarsal articulation reaching the ear or the eye.

Skin usually with small, not very prominent, warts which may form longitudinal series on the back and on the upper eyelids; some tubercles at the corner of the mouth. Lower surfaces smooth; anal region granular.

Colour very variable; usually pale brown or grey above with numerous irregular darker markings, of which the most constant are :—a curved streak from the end of the snout, through the nostril, along the canthus rostralis, through the eye and expanding over the tympanic region; a vertical dark bar below the anterior half of the eye; an interorbital bar interrupted in the middle; an X- or H-shaped figure on the anterior part of the back, of which the anterior extremities arise from the posterior corners of the eyes. Frequently the area between the interorbital bar and the anterior portion of the X or H is uniformly light in colour, and one well-marked colour variant is uniformly brown or grey over the whole of the upper surface of the body, the cantho-temporal streak and labial markings alone persisting. Usually the whole of the dorsum is covered with sinuous dark markings which often have less-dark lines running close to and parallel with their outlines. Limbs with alternately broader and narrower dark cross-bars. Lower surfaces uniform white except the sides of the throat which are freckled with darker. Concealed surfaces of the hind limbs dark brown, uniform or stippled with white.

Length from snout to vent : ♂ 41 mm.; ♀ 42 mm.

Male with a vocal sac opening by a slit on each side of the tongue and with 3 patches of nuptial asperities, one on the dorso-lateral surface of the inner metacarpal tubercle, one on the dorsal and lateral surfaces of the first finger and the

other similarly disposed on the second finger. Fingers of the female not depressed or fringed.

DISTRIBUTION: West Australia, Northern Territories, Groote Eylandt, Queensland, Thursday Island and northern New South Wales.

SPECIMENS EXAMINED.

63.6.16.96	♂	Clarence River, N.S.W.	Krefft. Type of <i>Platyplectrum marmoratum</i> .
88.7.3.12	juv.	Guntawang, N.S.W.	Hamilton.
1926.2.25.7	♀	40 miles S. of Moree, N.S.W.	Wilkins.
67.5.6.89-91	♂♀	Port Denison, Queensland.	Dämel.
64.10.27.49-51	2 ♂♂, ♀	" "	Krefft.
76.3.4.38-39	2 ♀♀	Peak Downs, "	(Godeffroy Mus.)
67.5.6.87-8	2 ♀♀, juv.	Cape York, "	Dämel.
67.5.13.29			
85.9.2.26-29	♂, 3 ♀♀	Mackay, "	Ling Roth.
1924.3.3.4	♀	Torrens Creek, "	Wilkins.
1926.2.25.6	♀	" "	"
1924.10.25.3	juv.	Westwood, "	"
1930.10.11.2	♂	Stewart River, "	Thomson.
57.10.24.50	♂	" North Australia."	Elsay.
1906.3.31.20	♀	Alexandria Sta.	Stalker.
		137° E. 19° S.	
1906.11.2.7	imm. ♀	Alexandria Sta.	"
1926.2.25.5	♂	Groote Eylandt.	Wilkins.
42.2.24.17	♂	Port Essington.	Gilbert. TYPE.
85.9.2.18-19	♂♀	Albany, W. Australia.	Ling Roth.
Mus. Leiden 3930	juv.	Rockhampton, Queensland.	(Godeffroy Mus.)
" " 3820	"	" "	" "

Limnodynastes spenceri sp. n.

Limnodynastes ornatus (non Gray) Spencer, 1896, *Rep. Horn Exped. C. Austral.*, II, Zool.: 156, pl. 13, figs. 3, 4; pl. 15, figs. 18-25; Spencer & Gillen, 1912, *Across Australia*, I: 58, pl. 1, fig. b; Harrison, 1922, *Aust. Zool.*, 3, 1: 34; Nieden, 1923, *Das Tierreich*, *Auwa* I: 533 (part), figs. 364-367; Waite, 1929, *Rept. and Amph. S. Australia*: 256; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 22 (part).

Limnodynastes sp. Loveridge, 1938, *Trans. roy. Soc. S. Aust.*, 62, 2: 189.

Holotype a male, number 97.10.27.69 in the British Museum, collected at Alice Springs, C. Australia, by Professor W. B. Spencer.

Vomerine teeth in rather short curved series, widely separated from the maxillae. Snout almost vertically truncate, short, as long as the eye, with rounded canthus rostralis and slightly oblique loreal region; nostrils directed vertically upwards midway between the tip of the snout and the eye; inter-orbital space a little less than the width of the upper eyelid; tympanum hidden. Fingers short, the first and second depressed; first a little longer than the second; subarticular tubercles large and prominent; a distinct supernumerary tubercle at the base of all except the outer fingers, and traces of other tubercles along the metacarpals; one or two distinct, conical tubercles between the first and second and second and third fingers; a prominent inner metacarpal tubercle, with a bony prepollex, and a rather flat outer. Toes pointed and webbed to the tips, the lowest point of the web between the third and fourth toes reaching well

beyond the level of the distal subarticular tubercle of the third toe ; subarticular tubercles small but distinct, the basal one (metatarso-phalangeal articulation) of the fourth toe wanting ; a very large, shovel-shaped inner metatarsal tubercle. Tibio-tarsal articulation reaching the tympanic region.

Skin smooth above and below ; anal region granular ; a few indistinct warts on the upper eyelid.

Pale brownish grey above with irregular dark markings ; a chevron-shaped cross-bar connecting the upper eyelids and a dark stripe from the posterior corner of each eyelid, curving towards, but not meeting its fellow on the scapular region ; remainder of the dorsum with irregularly-shaped dark blotches and spots ; a dark streak from the labial margin through the nostril and along the canthus rostralis and a vertical bar running somewhat obliquely forwards from beneath the eye. Lower surfaces uniform white. Limbs with dark cross-bars.

A vocal sac opening by a slit on each side of the tongue. Four distinct dark brown patches of nuptial asperities on each hand, one on the lateral aspect of the inner metacarpal tubercle, another covering the dorsal surface of the inner finger (except for the terminal joint) a third on the dorso-lateral aspect of the second finger and the fourth along the inner edge of the third finger. The whole of the dorsum is more or less beset with minute dark, horny spinules.

Length from snout to vent : 39 mm.

The paratypes agree closely with the type in almost all morphological characters. The principal variation is to be found in the degree of webbing of the toes. Spencer has stated that the amount of webbing is independent of sex and age and that it overlaps that described for *ornatus*. But in this he seems to be wrong, for no specimen from Central Australia has as little web as *ornatus*, in which this character shows very little variation over a wide area (p. 40). In these Central Australian frogs (which differ also from *ornatus* in their somewhat shorter truncate snouts, shorter hind limbs, absence of the proximal tubercle of the fourth toe, and the presence of a nuptial pad on the third finger) the minimum amount of webbing is in females and immature examples ; but even here the lowest point of the web between the third and fourth toes reaches almost or quite to the distal subarticular tubercle of the third toe, whereas in *ornatus* it never extends beyond half way between the proximal and distal tubercles. In adult males the lowest point is always beyond the distal tubercle of the third toe.

Length from snout to vent : ♂ 44 mm. ; ♀ 49 mm.

DISTRIBUTION : Apparently confined to the central, desert regions of the Northern Territories and South Australia from Oodnadatta to the Macdonnell Range west to Hermannsburg and Officer Creek.

The species frequents soft, sandy ground, generally in the beds of creeks ; it burrows by day to a depth of about a foot and becomes active by night. Spawning takes place in the early part of the year (January or February) in waterholes. The tadpole reaches a length of 56 mm., the body 25 mm. and the tail 31, the latter being 11 mm. deep and rounded terminally with subequal ventral and dorsal crests. Body once and a half to nearly twice as long as broad ; nostrils directed upwards, nearer a line connecting the anterior borders of the eyes than the end of the snout ; spiraculum sinistral ; anus dextral. Mouth surrounded by a fringe of papillae except its median half anteriorly ; the papillae forming a single row except at the corners of the mouth where they invade the oral cavity. Mandibles very finely denticulate ; two long rows of labial teeth anteriorly, the inner divided mesially ; three long rows posteriorly, the innermost divided, the outermost shortest. Toes webbed as in adult females.

SPECIMENS EXAMINED.

B.M.	97.10.27.68	♂	Alice Springs, N.T. Australia.	Spencer.	} Paratypes.
	97.10.27.60-67	8 ♂♂, 2 ♀♀	" " "	Hillier.	
	1910.5.28.32-35	3 ♂♂, ♀	Hermannsburg, "	Hillier.	
	1932.3.7.1-2	2 juvs.	Central Australia.	Basedow.	
M.C.Z.	18530-18546	9 ♂♂, 11 ♀♀	Hermannsburg, N.T.	Schevill.	}
		5 juvs.			
B.M.	97.10.27.69	skel.	Alice Springs, N.T.	Spencer.	
	1907.10.3.2	Larva.	Hermannsburg.	Hillier.	

***Limnodynastes tasmaniensis* Günther.**

Limnodynastes tasmaniensis Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 33, 134, pl. 2, fig. B (Type localities:—Tasmania and New Holland); Peters, 1863, *Mber. Akad. Berlin* : 235; Krefft, 1865, *Pap. Proc. R. Soc. Tasmania* : 19; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 26; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 258; McCoy, 1880, *Prodrom. Zool. Victoria*, **5** : 11, pl. 42, fig. 1; Parker, 1881, *Phil. Trans. roy. Soc. Lond.*, **3** : 90, pl. 18, figs. 5-8; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 260; Fletcher, 1880, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 374; *idem*, 1890, *op. cit.*, (2), **5** : 669-675; *idem*, 1891, *op. cit.*, (2), **6** : 271, 272, 274; *idem*, 1892, *op. cit.*, (2), **7** : 7; *idem*, 1894, *op. cit.*, (2), **8** : 527, 528, 530; Lucas & le Souef, 1909, *Anim. Austral.* : 260, figs. ; English, 1910, *Proc. zool. Soc. Lond.* : 628, pl. 51, figs. 1, 2; Fry, 1915, *Proc. R. Soc. Queensland*, **27**, 4 : 62; Harrison, 1922, *Aust. Zool.*, **3**, 1 : 33; Nieden, 1923, *Das Tierreich, Anura I* : 531; Waite, 1929, *Rept. Amph. S. Austral.* : 251, figs. 179, 180; Kinghorn, 1932, *Rec. Aust. Mus.*, **18** : 361; Loveridge, 1934, *Pap. roy. Soc. Tasmania*, 1933 : 59; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 19 (part).

Limnodynastes tasmanicus McCoy, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 182.

Limnodynastes peronii var. *tasmaniensis* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 344.

Limnodynastes peronii (part) Fitzinger, 1861, *S.B. Akad. weiss. Wien*, **42** : 414.

Limnodynastes affinis Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 27 (Type locality:—Clarence River, N.S.W.); Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107; McCoy, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 182; Günther, 1868, *Proc. zool. Soc. Lond.* : 480.

Limnodynastes peronii var. *rugulosus* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 344 (Type locality:—Sydney).

Limnodynastes platycephalus Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 54 (Type locality:—Adelaide); *idem*, 1868, *Proc. zool. Soc. Lond.* : 480; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 200, pl. 17, fig. 3; Fry, 1915, *Proc. roy. Soc. Queensland*, **27**, 4 : 63; Nieden, 1923, *Das Tierreich, Anura I* : 532; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 19.

Limnodynastes tasmanensis var. *platycephalus* Waite, 1929, *Amph. S. Australia* : 250.

Vomerine teeth in nearly straight transverse series, almost in contact mesially but separated from the maxillae laterally by a space nearly equal to the length of one series. Snout rounded, slightly prominent, 1.3 to 1.5 times as long as the eye, with rounded canthus rostralis and oblique loreal region; nostril midway between the tip of the snout and the eye or very slightly nearer the latter; interorbital space equal to, or slightly wider than, the width of the upper eyelid; tympanum indistinct, about half the length of the eye. Fingers moderate, the first distinctly shorter than the second, and with a shorter metacarpal than the second; subarticular tubercles moderate; a prominent, inner, metacarpal tubercle, with a bony prepollex in males, and a flat, longitudinally cleft, outer; fingers all with lateral "seams." Toes with a slight indication of web at the base and with lateral "seams" which rarely are developed to form well-developed dermal fringes; subarticular tubercles moderate; a prominent oval inner, and usually a very small outer, metatarsal tubercle. Tibio-tarsal articulation reaching the posterior corner of the eye in juveniles and males, the tympanic region in females.

Skin smooth or very slightly warty above; smooth beneath; a narrow, pronounced glandular fold from beneath the eye, beneath the tympanum to the insertion of the fore limb. Hinder side of the thighs below the vent slightly granular.

Light brown, yellowish or infused with pink above, usually with regular, large, dark brown or green spots, of which the most constant is a triangular, interorbital marking. The number, disposition and size of the spots is variable and they may be very indistinct. There is constantly a curved, dark brown stripe from the tip of the snout along the canthus rostralis, through the eye and tympanum to the fore-limb, above the sub-aural glandular fold, which is yellow, and frequently a yellow, orange or reddish vertebral stripe from the tip of the snout to the vent. Limbs with dark cross-bars. Lower surfaces uniform white except the gular region of the male, which is uniformly dusky.

Male with a vocal sac opening by a slit on each side of the tongue and brown nuptial asperities at the breeding season on the inner metacarpal tubercle, adjacent parts of the inner digit and metacarpo-phalangeal knuckle of the second finger. Breeding females with the first and second fingers strongly depressed and spatulate, with thick fleshy fringes more strongly developed on their pre-axial margins.

Length from snout to vent: ♂ 39 mm.; ♀ 42 mm.

DISTRIBUTION: Tasmania, Victoria, S. Australia, New South Wales and southern Queensland.

The species frequents relatively dry areas and breeds throughout the year, usually after rain. The call of the species is given in two keys, a lower "cook-kuk-kuk-cook" and a higher (? female) "Kuk-ku-kuk." Amplexus is axillary and spawning takes place in any available water-supply, though in captivity the presence of plants in the water appears to have a stimulating effect. The eggs are small, about 1.3 mm. in diameter, and are enclosed in a floating gelatinous mass which contains many air-bubbles. This foam "nest" is produced by the female paddling with her fore-limbs at the surface of the water before and during the act of oviposition. This action, rendered more efficient by the dilated fingers of this sex, causes a stream of bubbles to pass backwards under the bodies of the frogs; these accumulate in the cloacal region, where they become entangled in the mucus which precedes and accompanies the extrusion of the eggs. The egg mass, measuring *circa* 60 × 35 mm., contains about 200 to 300 eggs which, at a temperature of 22° C., hatch in 48 hours; the newly emerged larvae measure from 2.5 to 5 mm. and immediately attach themselves to water plants, debris, etc. Growth under favourable conditions is rapid; the larval stage may be prolonged to 4 or 5 months and the mature tadpole measures about 60 mm., though lungs are developed and functional 5 days after hatching; the juvenile frog at metamorphosis measures 15 mm. Sexual maturity is reached (in captivity) in the following year, 7 months after metamorphosis.

Numerous observations, often contradictory, on the behaviour and breeding habits of the species have been published, notably in the *Blätter für Aquarien- und Terrarienkunde*. The following references may be cited: Zernecke, 1926, 37: 465; Rehacek, *tom. cit.*: 120; Wolterstorff, *tom. cit.*: 463; Schreitmüller, 1927, 38: 104; Weingand, 1928, 39: 30; Geyer, *tom. cit.*: 195, 224; Hesse, 1932, 43: 315; Luther, 1933, 44: 302.

I have been unable to find any characters whereby *platycephalus* may be distinguished from *tasmaniensis*, and in view of this and the fact that Loveridge (1935: 20) refers two frogs from Kangaroo Island, S. Australia, one to *tasmaniensis* and one to *platycephalus*, it seems probable that they cannot be retained

as distinct species. *Limnodynastes olivaceus* de Vis, on the other hand, appears to represent a distinct northern species and is not, as Loveridge (*op. cit.*) believes, a synonym of *tasmaniensis*. A few specimens of *tasmaniensis* in which the outer metatarsal tubercle is wanting approach the condition of *olivaceus* (*q.v.*), but the two may be distinguished by their inner fingers, vomerine teeth, subarticular tubercles and gular coloration.

SPECIMENS EXAMINED.

B.M.	45.5.2.34-36	3 ♀♀	Tasmania.	Gunn. COTYPES.
	58.11.25.75-78	2 ♂♂, Hgr. and juv.	" Van Diemen's Land."	Smith.
	1901.9.13.2-7	♂, 4 ♀♀, juv.	Near Launceston.	English.
	1936.9.7.1-3	2 ♂♂, ♀	" "	"
	74.4.29.1243- 1249	2 ♂♂, 7 ♀♀	Sandhurst, Victoria.	Beddome.
	74.4.29.1284-5			
	64.10.27.54-55	2 ♂♂	Adelaide.	Krefft. (Cotypes of <i>Limnodynastes platy- cephalus</i> Günther.)
	46.7.11.67-68	2 ♂♂	" New Holland."	Jukes. COTYPES.
	44.10.17.20	♀, juv.	" "	(Lord Derby.) COTYPES.
	63.6.16.86	♀	Clarence River, N.S.W.	Krefft. (Type of <i>L. affinis</i> Günther.)
	88.7.3.9-10	♂, 2 ♀♀, Hgr., juv.	Capetree, N.S.W.	Fletcher.
	92.9.16.2	♀	Sydney.	"
	96.7.1.31	♀	Tamworth, N.S.W.	Porter.
	1926.2.25.8-11	♂, 2 ♀♀, juv.	40 miles S. of Moree, N.S.W.	Wilkins
	70.6.26.45, 53, 54	2 ♀♀, juv.	Queensland.	Krefft.
	67.5.6.82	♂	Rockhampton, Q.	Dämel.
	98.10.19.18-19	♂♀	Cooktown, Q.	Le Souef.
	1901.9.13.9	Skel. ♀	Near Launceston, Tasmania.	English.
Mus. Leiden	6786	♀	Port Mackay, Q.	(Godeffroy Mus.)
" "	4252	♂	Queensland.	(" ")
" "	4258	♂	" "	(" ")

***Limnodynastes convexiusculus* (Macleay).**

Ranaster convexiusculus Macleay, 1828, *Proc. Linn. Soc. N.S.W.*, 2 : 135 (Type locality :—Katow, Brit. N. Guinea); Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 444; Barbour, 1912, *Mem. Mus. Comp. Zool. Harvard*, 44, 1 : 177; Fry, 1913, *Mem. Queensland Mus.*, 2 : 47; Nieden, 1923, *Das Tierreich, Anura I* : 537, figs. 369, 370; van Kampen, 1923, *Amph. Indo-Austr. Archip.* : 19, fig. 3.

Limnodynastes olivaceus de Vis, 1884, *Proc. Linn. Soc. N.S.W.*, 9 : 66 (Type locality :—Mackay, Queensland); Boulenger, 1885, *Ann. Mag. nat. Hist.*, (5), 16 : 387; Fry, 1915, *Proc. roy. Soc. Queensland*, 27 : 65; Nieden, 1923, *tom. cit.* : 530.

Phanerotis novae-guineae van Kampen, 1909, *Nova Guinea*, 9, 1 : 36, pl. ii, fig. 4 (Type locality :—Merauke, Dutch N. Guinea).

Limnodynastes salmini (part) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 19.

Vomerine teeth in very long, slightly curved series, almost in contact mesially, and separated from the maxillae by a space much less than half the length of one series. Snout pointed, scarcely prominent, 1.5 to 1.8 times as long as the eye, with rounded canthus rostralis and very oblique loreal region; nostril midway between the tip of the snout and the eye or a little nearer the latter; interorbital space equal to, or a little broader than the upper eyelid; tympanum indistinct, about half the diameter of the eye. Fingers moderate, rounded, without lateral seams; first finger equal to the second; first metacarpal as long as the second; a very prominent inner metacarpal tubercle, with a bony prepollex

in males, and a flat outer, fissured longitudinally; subarticular tubercles very large and prominent; sometimes a supernumerary tubercle on the base of each finger proximal to the basal tubercle and indications of a tubercle between the first and second fingers. Toes cylindrical, without fringes or lateral seams, with the merest indication of web at the base; subarticular tubercles large and prominent; a prominent, oval, inner, but no outer, metatarsal tubercle. Tibio-tarsal articulation reaching the posterior corner of the eye.

Skin with numerous glandular areas above, which may be raised to form distinct plicae (often as a post-mortem condition when immersed in too concentrated a preservative); a glandular fold from beneath the eye to the fore-limb; lower surfaces smooth; anal region granular.

Grey or brown above, with numerous insuliform spots irregularly arranged in linear series; the most constant are a quadrangular pair closely apposed commencing one on each upper eyelid and running backwards on to the scapular region; a dark blotch commencing on the tip of the snout, running through the eye and covering the tympanic region; a dark labial spot below the eye; subaural glandular fold white. Limbs with irregular dark cross-bars; hinder side of the thighs brown, mottled and spotted with white. Lower surfaces white, the gular region with brown or grey reticulations.

Male with a vocal sac opening by a slit on each side of the tongue and a nuptial rugosity on the metacarpo-phalangeal knuckle of the first finger. Female without or with only slightly spatulate fingers.

Length from snout to vent: ♂ 44 mm.; ♀ 51 mm.

DISTRIBUTION: New Guinea, Queensland and Northern Territories.

This species is very closely allied to *tasmaniensis* and to *salmini*, but may be distinguished from either by the characters given in the synopsis. Loveridge, misled by de Vis' original statement that there are two metatarsal tubercles, concluded that Fry's redescription (1915: 65) was based on a different frog and placed *olivaceus* as a synonym of *tasmaniensis*. But the type and other material examined reveals constancy in the presence of only a single metatarsal tubercle and the presumption is that Fry was correct.

SPECIMENS EXAMINED.			
B.M. 85.9.2.25	♀	Mackay, Queensland.	Ling Roth. Type of <i>Limnodynastes olivaceus</i> de Vis.
92.1.14.17	♀	Port Darwin, N.T.	Walker.
95.11.14.23	♀	Daly River, N.T.	Dahl.
1926.2.25.3-4	♂♀	Groote Eylandt.	Wilkins.
Mus. Amsterdam	♂	Fred Hendrik Island, New Guinea.	Maart.
" "	♂	Merauke, New Guinea.	Koch. (Cotype of <i>Phanerotis novae guineae</i> van Kampen.)
" "	♀	" "	v. Weel.

Limnodynastes salmini Steindachner.

Limnodynastes salmini Steindachner, 1867, *Reise Novara, Zool., Amph.*: 27, pl. 4, figs. 12-15 (Type locality:—Australia); Keferstein, 1868, *Arch. Naturgesch.*, **34**: 259; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 259; Fletcher, 1880, *Proc. Linn. Soc. N.S.W.*, (2), **4**: 374; *idem*, 1880, *op. cit.*, (2), **5**: 669-675; *idem*, 1801, *op. cit.*, (2), **6**: 265, 272; *idem*, 1894, *op. cit.*, (2), **8**: 530; Boettger, 1894, *Denkschr. med.-naturw. Ges. Jena*, **8**: 109; Nieden, 1923, *Das Tierreich, Austra I*: 530; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 10.

Limnodynastes kreffti (non Günther, 1863) Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20**: 54.

Vomerine teeth in long, slightly curved series, almost in contact mesially and separated from the maxillae laterally by a space much less than half the length of one series. Snout bluntly rounded, not prominent, about once and a half as long as the eye, with rounded canthus rostralis and very oblique loreal region; nostril midway between the tip of the snout and the eye or a little nearer the latter; interorbital space subequal to the width of the upper eyelid; tympanum more or less distinct, $\frac{1}{2}$ to $\frac{3}{5}$ the diameter of the eye. Fingers moderate, rounded, without lateral "seams"; first metacarpal distinctly longer than the second; first finger extending beyond the second, the proximal phalanx very much longer than the distal; a prominent inner metacarpal tubercle, with a bony prepollex in males, and a flat outer, fissured longitudinally; subarticular tubercles very large and prominent; a supernumerary tubercle at the base of each finger and a distinct tubercle between the first and second fingers.

Toes cylindrical, without seams or fringes, with the merest trace of web at the base; subarticular tubercles large and prominent; a prominent, elongate inner, but no outer, metatarsal tubercle. Tibio-tarsal articulation reaching the tympanum in adults, the posterior corner of the eye in juveniles.

Skin smooth or with some scattered flat warts above; smooth beneath; a strong glandular ridge from beneath the eye to the insertion of the fore-limb; sometimes a strong pectoral fold; anal region feebly granular.

Brown or pinkish above with small, scattered, subcircular dark spots; an irregular dark blotch from the nostril, along the canthus rostralis, through the eye and covering the tympanic region above the subaural glandular fold, which is yellow or red; a dark labial spot below the anterior half of the eye; a red or pink line runs from above the shoulder obliquely to the groin and there may be traces of a similarly coloured vertebral stripe, especially in the coccygeal region. Groins and concealed surfaces of the hind limbs dark brown with small yellow or white spots. Lower surfaces dirty white; gular region more or less heavily dusted with brown.

Male with a vocal sac opening by a slit on each side of the tongue. First and second fingers of the female with a fleshy fringe on their preaxial sides.

Length from snout to vent: ♂ 63 mm.; ♀ 70 mm.

DISTRIBUTION: New South Wales both east and west of the dividing range as far south as Sydney (Castlereagh); E. Queensland.

This species, which is so closely allied to *olivaceus* that the two have probably been confused, is recognizable by its larger size, longer first finger and metacarpal, somewhat shorter legs and colour.

SPECIMENS EXAMINED.

B.M. 62.8.1.28	imm. ♀	Sydney.	(Stevens.)
64.10.9.7	♀	Clarence River, N.S.W.	Krefft.
64.10.27.45	juv.	" "	" "
67.5.6.83	juv.	Port Denison, Q.	Dämel.
67.5.13.26-27	♂, ♀	Rockhampton, Q.	" "
Mus. Leiden 1733	♀, juv.	Port Mackay, Q.	(Godeffroy Mus.)

***Limnodynastes fletcheri* Boulenger.**

Limnodynastes fletcheri Boulenger, 1888, *Ann. Mag. nat. Hist.*, (6), **2**: 142 (Type locality:—Guntawang, near Mudgee, N.S.W.); Fletcher, 1800, *Proc. Linn. Soc. N.S.W.*, (2), **5**: 672, 675; *idem*, 1894, *op. cit.*, (2), **8**: 529; Fry, 1915, *Proc. R. Soc. Queensland*, **27**, **4**: 65; Nieden, 1923, *Das Tierreich, Anura* 1: 531.

Limnodynastes tasmaniensis (part) Fletcher, 1892, *Proc. Linn. Soc. N.S.W.*, (2), **7**: 8, 9, 16; *idem*, 1894, *op. cit.*, (2), **8**: 529.

Limnodynastes marmoratus Lamb, 1911, *Ann. Queensland Mus.*, **10**: 28 (Type locality:—Goondiwindi); Fry, 1912, *Rec. Aust. Mus.*, **9**: 98, 106.

Vomerine teeth in relatively short transverse series, separated from the maxillae by spaces about equal to the length of one series of teeth. Snout depressed, rounded, 1.3 to 1.5 times as long as the eye, with very obtuse canthus rostralis and oblique loreal region; nostril midway between the tip of the snout and the eye; interorbital space a little less, or a little greater, than the width of the upper eyelid; tympanum indistinct, about half the diameter of the eye. Fingers depressed, with lateral "seams"; first not extending quite as far as the second, the proximal and distal phalanges small, subequal, but the first metacarpal greatly elongate, much longer than the second; subarticular tubercles distinct but not prominent; no supernumerary tubercles and no tubercles between the fingers. A prominent inner metacarpal tubercle, with bony prepollex in males, and a small longitudinally cleft outer. Toes pointed, with lateral seams and some webbing; in males the web midway between the third and fourth toes extends distally beyond the proximal tubercle of the fourth toe; in females to about the centre of this tubercle; an oval inner, but no outer, metatarsal tubercle.¹ Tibio-tarsal articulation reaching the tympanum or the posterior corner of the eye.

Skin smooth or somewhat warty and glandular above; smooth beneath; anal region feebly granular; a glandular ridge from beneath the eye to the insertion of the fore-limb.

Pale brown or grey above, with darker brown or grey spots and suffused with carmine or pink, especially on the upper eyelids. The most constant markings are a labial spot beneath the eye, a curved band along the canthus rostralis and from the eye to the fore-limb, an interorbital blotch and a subquadrangular mark (very irregular) from the scapular region almost to the sacrum. Sub-aural fold lighter; limbs with dark spots and cross-bars above, the concealed surfaces pale, mottled and stippled with darker. Lower surfaces uniformly white, except that the edge of the lower jaw and the gular region may be very feebly stippled with darker.

Male with a vocal sac opening by a slit on each side of the tongue; first finger swollen but apparently without a spinose nuptial pad. Second finger of the female somewhat spatulate.

Length from snout to vent: ♂ 47 mm.; ♀ 41 mm.

DISTRIBUTION: New South Wales west of the dividing range, and southern Queensland; probably extending into northern Victoria and South Australia.

SPECIMENS EXAMINED.

B.M.	88.7.3.7-8	2 ♂♂ ²	Guntawang, N.S.W.	Hamilton. TYPES.
	92.9.16.3	♂	Wentworth, N.S.W.	Oliff.
	1929.2.25.12	♂	40 miles S. of Moree, N.S.W.	Wilkins.
	92.9.16.4	♀	Waroo, S. Queensland.	Ewen.
	1923.11.12.2	Hgt.	St. George Distr., S. Queensland.	Wilkins.

***Limnodynastes peronii* (Dum. & Bibr.).**

Cystignathus peroni Duméril & Bibron, 1841, *Expét. Gén.*, 8: 400 (Type locality:—New Holland). *Limnodynastes peroni* Fitzinger, 1843, *Syst. Rept.*: 31; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 134; Fitzinger, 1861, *S.B. Akad. weiss. Wien*, 42: 414 (part); Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, 18: 313; *idem*, 1868, *Arch. Natugesch.*, 34: 257, pl. 5, fig. 1; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 258; *idem*, 1885,

¹ The original description of an outer tubercle as present appears to be erroneous.

² Originally, but erroneously, described as ♂ and ♀.

- Ann. Mag. nat. Hist.*, (5), **16** : 386; Fletcher, 1880, *Proc. Linn. Soc. N.S.W.*, (2) **4** : 373; *idem*, 1890, *op. cit.*, (2), **5** : 669-673; *idem*, 1891, *op. cit.*, (2), **6** : 272; *idem*, 1892, *op. cit.*, (2), **7** : 8-13; *idem*, 1894, *op. cit.*, (2), **8** : 524, 526, 527, 529; Lucas & le Souef, 1900, *Anim. Austral.* : 269, figs. ; Andersson, 1913, *Svenska Vetensk.Akad. Handl.*, **52**, 4 : 9; Harrison, 1922, *Aust. Zool.*, **3**, 1 : 33; Nieden, 1923, *Das Tierreich, Anura I* : 529; Trewavas, 1933, *Phil. Trans. roy. Soc. Lond.*, **222**, B : 435, fig. 25.
- Wagleria peronii* Girard, 1853, *Proc. Acad. nat. Sci. Philad.*, **6** : 421; *idem*, 1858, *U.S. Explor. Exped., Herpet.* : 42, pl. 3, figs. 29-33.
- Limnodynastes peronii peronii* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 17.
- Limnodynastes krefftii* Günther, 1863, *Ann. Mag. nat. Hist.*, (3), **11** : 26 (Type locality :— near Sydney); Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 26; Günther, 1868, *Proc. zool. Soc. Lond.* : 480.
- Limnodynastes peronii* var. *krefftii* Kesterstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 345; *idem*, 1868, *Arch. Naturgesch.*, **34** : 258.
- Limnodynastes lineatus* de Vis, 1884, *Proc. Linn. Soc. N.S.W.*, **9** : 65 (Type locality :— Mackay).
- Limnodynastes peronii lineatus* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 18.
- Limnodynastes dorsalis dorsalis* (part : spec. 19371) Loveridge, 1934, *Pap. roy. Soc. Tasmania* : 58; *idem*, 1935, *Bull. Mus. Comp. Zool. Harv.*, **78** : 21.

Vomerine teeth in long curved series separated from the maxillae by a space not greater than half the length of one series. Snout rounded, distinctly prominent, 1.6 to 1.8 times as long as the eye, with rounded canthus rostralis and moderately oblique loreal region; nostril midway between the tip of the snout and the eye or a little nearer the latter; interorbital space subequal to the width of the upper eyelid; tympanum indistinct or hidden, $\frac{2}{3}$ to $\frac{3}{4}$ the diameter of the eye (exposed by dissection). Fingers depressed, the two inner with more or less distinct marginal seams; first not extending quite as far as the second, with two very small, subequal phalanges, or with but a single one (Pl. I, figs. E, F); the first metacarpal greatly elongate and much longer than the second; subarticular tubercles distinct, except on the first finger; no supernumerary tubercles or papillae between the fingers; a prominent inner metacarpal tubercle, with a bony prepollex in males, and a longitudinally cleft outer. Toes long, slender, rounded, without marginal seams and almost completely free from web; an oval inner, but no outer metatarsal tubercle. Tibio-tarsal articulation reaching the eye.

Skin smooth with some flat glands which may form longitudinal series; a pronounced glandular ridge from beneath the eye to the fore-limb; smooth beneath; anal region feebly granular.

Pale brown or grey above, with dark brown markings in the form of rows of spots or longitudinal stripes arranged thus. A median dorsal stripe commencing on the synciput, broadening between the eyes, narrowing and running almost to the vent; this marking is often bisected lengthwise by a white or yellow vertebral line. A dorso-lateral stripe or series of spots commences behind the upper eyelid and runs parallel with the dorsal stripe to the groin. Flanks with some scattered spots; a curved band from the tip of the snout, along the canthus rostralis, through the eye to the fore-limb; sub-aural fold white or yellow. Limbs with insuliform spots. Lower surfaces white, stippled with pale brown.

In some northern specimens, described as *lineatus* by de Vis, the longitudinal stripes are very regular and clearly marked, but the available material is insufficient to decide whether or not this is a general characteristic of all northern frogs. Loveridge (1935 : 18) regards *lineatus* as a distinct race, with a rather shorter leg than the southern typical form, but in the two cotypes of *lineatus* examined by the present author the hind-limbs are quite as long as in any specimens from the south.

Males have a vocal sac opening by a slit on each side of the tongue and in the breeding season the first finger is much swollen, though apparently without any spinose nuptial pad; instead, the metacarpal appears to furnish the means of gripping the female, for the phalanges are dislocated from its tip and lie at right angles to the axis of the digit, very much as in the African *Petropedetes johnstoni*. Some specimens seem to have indications that the bone may at times perforate the skin, as in some Ranids, to form a nuptial spine. In breeding females the first and second fingers are depressed and spatulate, with fleshy lateral fringes, more developed on the pre- than post-axial edges.

Length from snout to vent : ♂ 61 mm. : ♀ 58 mm.

DISTRIBUTION : Queensland, New South Wales, Victoria, Tasmania.

The species breeds at any time of the year, following rain, and shallow, grassy pools are preferred as the spawning site. The call is an explosive "toc." The egg-mass is similar to that of *L. tasmaniensis* (q.v.) but larger, 4-6 in. in diameter and is usually found entangled in the sedges at the margins of the pool.

SPECIMENS EXAMINED.

B.M.	70.6.26.46-47	♂♀	Australia (?Queensland).	Krefft.
	70.6.26.55	♂	Queensland.	"
	84.7.4.1-2	♂, ♀	Mackay, Queensland.	Ling Roth. (Cotypes of <i>L. lineatus</i> de Vis.)
	63.6.16.89-91	3 juvs.	Sydney.	Krefft. Cotypes of <i>L. krefftii</i> Günther.
	63.6.16.85	♂	"	"
	63.6.16.?	♀	"	"
	62.8.1.29	♀	Sydney.	(Stevens.)
	87.7.16.7	juv.	"	Fletcher.
	88.7.3.5-6	2 ♀♀	Burrawang, N.S.W.	"
	1925.9.19.1	Hgr.	Nowra, N.S.W.	Rodway.
	88.7.3.4	♂	Warragul, Gippsland, Victoria.	Baker.
	45.5.25.7	♂	?	C. Darwin.
	60.6.19.34-35	♂♀	[Erromango.]	(Cuming.)
Mus, Leiden	4251	♂	Queensland.	(Godtroy Mus.)
"	" 1729	♂♀	Sydney.	(Sydney Mus.)
"	" 1864	♂, 3 Hgr.	?	(" ")
B.M.	58.11.25.57	♀	" Van Diemen's Land "	Sir A. Smith.
M.C.Z.	Harvard 19371	♀	Stanley, Tasmania.	Scott.
Austr. Mus	R.8490 (part)	juv.	Tweed River, N.S.W.	

PHILORIA Spencer.

Philoria Spencer, 1901, *Proc. roy. Soc. Victoria*, (2), 13 : 176 (Type species :—*Philoria frosti*) ; Nieden, 1923, *Das Tierreich, Anura* I : 537 ; Noble, 1931, *Biol. Amph.* : 498.

Maxillary teeth present. Prevomer present, entire, its post-choanal portion overlying the mesial half of the palatine and dentigerous, the teeth forming oblique series nearly in contact mesially, but not extending laterally beyond the inner borders of the choanae; a distinct fronto-parietal foramen. Ear fully developed. Vertebrae procoelous, but with the condyle incompletely ankylosed and the notochord persistent; seven presacral(?)¹; sacral diapophyses moderately

¹ In the single specimen examined there are only 5 free pre-sacral vertebrae of which the foremost represents 1 + 2 fused. But fused with the sacrum anteriorly are two other centra, the transverse processes of which are small but free from the sacral diapophyses. It seems probable that this shortening of the vertebral column may be an individual anomaly, but should it prove to be normal it provides a very sharp distinction from all other members of the subfamily.

strongly dilated; coccyx articulating by two condyles. Omosternum cartilaginous. Terminal phalanges simple. Distal tendon of the m. semitendinosus passing ventral to the head of the gracilis. Alary processes of the hyoid small and antero-lateral, as in *Limnodynastes*.

Pupil horizontal with a ventral angle. Tongue heart-shaped, slightly free behind. Toes quite free, not or but slightly dilated distally.

These characters are taken from a single specimen of what appears to be a northern species of *Philoria* and not from the genotype, which is not available to the author for examination. There is thus room for doubt as to whether the two really are congeneric and whether the foregoing diagnosis is really applicable to *Philoria*. If it is, however, the genus is very closely allied to *Limnodynastes* and differs only in the absence of digital webbing and the reduction of the digits, a character in which it resembles *Crinia*.

***Philoria frosti* Spencer.**

Philoria frosti Spencer, 1901, *Proc. roy. Soc. Victoria*, (2), 13 : 176 (Type locality :—Mt. Baw Baw, Victoria); Lucas & le Souef, 1909, *Anim. Austral.* : 283; Nieden, 1923, *Das Tierreich*, Anura I : 537.

Habitus stout. Head broader than long; snout rounded, slightly longer than the orbital diameter; nostril nearer to the eye than the tip of the snout; canthus rostralis not strongly marked. Interorbital space as broad as the length of the orbit. Tympanum not visible. Fingers blunt and free; first finger not extending so far as the second. Toes short and blunt, no trace of webbing; subarticular tubercles present; three metacarpal tubercles, the inner one strongly, the outer feebly developed. The inner metatarsal tubercles small and blunt. Hind limbs short, stout and strongly built; carried forwards the tibio-tarsal articulation barely reaches as far forwards as the shoulder. Upper eyelids, tympanic region, the top of the head and dorsal surface of the body, the upper surface of the arm and fore arm and the upper surface of the leg covered with small warts arranged in roughly longitudinal rows along the back. A very large and prominent triangular shaped parotoid gland is present on either side extending backwards over the shoulder region; the longest side of the triangle runs parallel to the mid-dorsal line, and these two sides are separated from one another by a space which is narrower than that between the orbits. From the posterior angle a special row of warts somewhat larger than the rest runs backwards to the groin and is continued forwards over the surface of the gland, which is otherwise comparatively smooth. Upper surface of body and limbs a general dark brown colour with here and there small irregular light patches; groins and under surface of body and limbs yellowish, mottled with brown.

Length from snout to vent : 44 mm.

Habitat : Mount Baw Baw, Victoria (Spencer).

***Philoria loveridgei* sp.n.**

Philoria frosti Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 16.

Habitus moderately stout. Head as long as, or longer than, broad; snout subacuminate, 1.4 times as long as the eye; nostril much nearer the eye than the tip of the snout; canthus rostralis sub-angular; loreal region slightly oblique and distinctly concave; interorbital space 1.2 to 1.5 times as broad as the upper

eyelid; tympanum just discernible, or hidden, its horizontal diameter half that of the eye. Fingers very short, the first much shorter than the second; small subarticular tubercles beneath the proximal joints; two metacarpal tubercles, the outer largest and notched distally. Toes rather short, quite free, their tips slightly spatulate; subarticular tubercles feebly developed; a small inner, and no outer, metatarsal tubercle. Tibio-tarsal articulation reaching the tympanic region in males, or not quite so far in females.

Skin slightly warty or quite smooth above; a supratympanic fold but no distinct parotoid gland. Smooth beneath.

Brown above, almost uniform, but the edge of the upper lip spotted with lighter. Lorcal and tympanic regions darker, the edge of the supratympanic fold lighter; flanks with some large dark spots; groins and axillae white (? red in life). Lower surfaces white, the chin and throat profusely and the belly sparsely dotted with dark brown.

Length from snout to vent: ♂ 25.5 mm.; ♀ 33 mm.

DISTRIBUTION: Macpherson Range, 3-4000 ft., S. Queensland.

MATERIAL EXAMINED.

B.M. 1933.4.8.6 ♀ Macpherson Range, 3-4000 ft. Darlington. TYPE.

This specimen is one of the series recorded as *P. frosti* by Loveridge. No material of Spencer's species is available for comparison, but there are a number of differences between the description of *frosti* and these northern frogs, which suggest that the two are not conspecific. Both species appear to be montane forms.

NOTADEN Günther.

Notaden Günther, 1873, *Ann. Mag. nat. Hist.*, (4), **11**: 349 (Type species:—*Notaden bennettii*); Boulenger, 1882, *Cat. Fish. Sal. Brit. Mus.*, ed. 2: 328; Cope, 1886, *Bull. U.S. nat. Mus.*, **34**: 200; Nielsen, 1923, *Das Tierreich, Anura I*: 192; Noble, 1931, *Biol. Amph.*: 498.

Maxillary teeth absent. Prevomer bordering the choana anteriorly and sending a branch diagonally backwards towards its fellow; this branch is raised into a knob-like prominence at its extremity on a level with the mesial ends of the palatines and bears a few teeth or tooth-like structures; a large fronto-parietal foramen; ear fully developed, the extra-plectal cartilage large, but not as large as the tympanum. Vertebrae procodous with the condyle incompletely ankylosed and the notochord persistent; 7 presacra; sacral diapophyses moderately strongly dilated; coccyx articulating by two condyles. Omosternum small, cartilaginous; sternum cartilaginous or calcified, undivided. Terminal phalanges simple.

Distal tendon of the m. semitendinosus passing ventral to the mm. graciles. Alary processes of the hyoid narrow proximally, expanded distally.

Pupil horizontal. Tongue subcircular, adherent. Palate with a series of two or three smooth transverse folds in front of the pharynx. Digits not dilated.

SYNOPSIS OF THE SPECIES.

1. First finger shorter than the second; inner metatarsal tubercle 1.2 to 2.0 times as long as its distance from the tip of the inner toe. Dorsal markings forming a cruciform or Ξ -shaped pattern . *N. bennettii*.

- II. First finger as long as, or longer than, the second; inner metatarsal tubercle as long as its distance from the tip of the inner toe. Dorsal markings not forming a definite pattern *N. nichollsi*.

Notaden bennetti Günther.

Notaden bennetti Günther, 1873, *Ann. Mag. nat. Hist.*, (4), **11** : 350 (Type locality :—Castle-reagh River); Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 328, pl. 27, fig. 3; Fletcher, 1880, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 360; *idem*, 1890, *op. cit.*, (2), **5** : 672-675; *idem*, 1891, *op. cit.*, (2), **6** : 265, 271, 272; *idem*, 1892, *op. cit.*, (2), **7** : 12; *idem*, 1894, *op. cit.*, (2), **8** : 530, 531; Lucas & le Souef, 1909, *Anim. Austral.* : 286, fig.; Nieden, 1923, *Das Tierreich, Anura I* : 162, fig. 212; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 37.

Habitus globose. Head broader than long, its width contained about 3.75 times in the length from snout to vent. Snout short and deep, about as long as the eye, vertically truncate and not prominent; canthus rostralis rounded; loreal region vertical; nostrils subterminal; interorbital space as broad as, or broader than, the upper eyelid; tympanum hidden. Fingers rather short, depressed, the first shorter than the second, which is longer than the fourth; small subarticular tubercles beneath the metacarpo-phalangeal joints and indications of tubercles between the first and second and second and third fingers; two rather indistinct metacarpal tubercles. Toes short, depressed, with fleshy lateral fringes and basal webbing which midway between the third and fourth toes reaches the middle of the proximal phalanx of the third toe; no subarticular tubercles; a large shovel-shaped inner metatarsal tubercle which is 1.5 to 2.0 times as long as its distance from the tip of the inner toe. Hind limb, measured from the vent to the tip of the fourth toe with the leg extended at right angles to the body, as long as the distance between the vent and the anterior corner of the eye or the nostril.

Skin very thick and glandular with closely set, raised warts except for 5 patches which are almost smooth and disposed as follows: a cruciform patch on the head, the transverse bar connecting the upper eyelids anteriorly and the longitudinal member running backwards to the nape; a latero-dorsal sub-circular patch above each arm, and a similar, but larger pair above the middle of each flank; a linear zone, less defined than the remainder, along the coccyx. Gular region and chest smooth; belly feebly granular and wrinkled; circum-anal region with scattered small pimples.

Colour pattern following the arrangement of the warts, which are dark brown or black often stippled with white, on a greenish background with isolated patches of rusty- or orange red; the smooth areas are lighter, bright or greenish-yellow. Lower surfaces yellowish white, the throat and chest spotted with brown.

Length from snout to vent; ♀ 45 mm.

The species is cryptozoic, frequenting the dry areas of inland New South Wales and southern Queensland; it is myrmecophagous and seldom seen above ground except after rain. The skin exudes a milky venom when the frog is handled.

DISTRIBUTION: Plains of New South Wales and southern Queensland west of the dividing range.

SPECIMENS EXAMINED.			
B.M.	73.4.30.17	HO	Castlereagh River. (Sydney Mus.)
	73.4.30.0	HO	" " Bennett. } COTYPES.
	90.12.18.1	HO	Dandaloo, N.S.W. Fletcher.
	81.12.6.1	juv.	Wilson's River, Queens- (Gerrard.) land.

Notaden nichollsi sp. n.

Notaden bennetti (non Günther) Andersson, 1913, *K. Svenska Vetensk.Akad. Handl.*, 52, 4 : 20, pl. 1, figs. 7, 8.

Habitus globose. Head broader than long, its width contained 3.4 to 3.6 times in the length from snout to vent. Snout short and deep, not prominent, obtusely rounded and truncate; canthus rostralis rounded; loreal region oblique; nostril midway between the eye and the end of the snout; interorbital space as broad as or a little broader than the upper eyelid; tympanum hidden. Fingers rather short; in adults the first as long as or slightly longer than the second which is longer than the fourth; in juveniles the first is shorter than the second; small subarticular tubercles beneath the proximal joints of the fingers; two rather indistinct metacarpal tubercles. Toes short, depressed, with thick, fleshy fringes and webbing which between the third and fourth reaches nearly or quite to the level of the distal end of the proximal phalanx of the third; no subarticular tubercles; a compressed inner metatarsal tubercle as long as or very slightly longer than its distance from the tip of the inner toe in adults; distinctly shorter in the very young. Length of the hind-limb, measured from the tip of the fourth toe to the vent with the leg extended at right angles to the body, as long as the distance from vent to eye.

Skin very thick and glandular with larger and smaller warts uniformly distributed; sometimes there may be some larger warts forming a very indefinite linear series dorso-laterally from the posterior corner of the eye. Lower surfaces smooth or wrinkled; anal region with scattered pimples.

Adults olive-grey or brown above, the larger warts brown or blackish; there is often no defined colour pattern but sometimes traces of a faint, interorbital triangle, its apex directed backwards, may be discerned, and where the warts have a linear arrangement interrupted irregular dark lines may be apparent or groups of dark warts with a faintly cruciform arrangement. Warts on the flanks tipped with yellow. Lower surfaces uniform yellowish white. Throat of the male infuscate.

Juveniles at metamorphosis with a well-defined pattern. Ground-colour silvery grey; a curved dark-brown streak along the canthus rostralis and a large triangular interorbital marking, the apex directed posteriorly; a series of three dark triangles on each side, apices directed ventrally and their bases sub-continuous to form a dorso-lateral stripe; the light median zone thus cut off with two dark spots one about the middle of the back and one in front of the sacrum. Scattered warts on the back and sides white-tipped. Limbs silver-grey with dark cross bars.

Male with a vocal sac; diffuse nuptial pads on the inner surfaces of the first and second fingers and a series of pustules capped with horny spinules beneath the lower jaw.

Length from snout to vent : ♂ 63 mm. ; ♀ 64 mm.

Juveniles at metamorphosis (tail incompletely resorbed) : 12 mm.

DISTRIBUTION : Northern West Australia.

SPECIMENS EXAMINED.					
B.M.	96.7.2.19	♂	Roebuck Bay, W.A.	Dahl.	HOLOTYPE.
	1937.7.22.36-40	3 ♂♂, 2 ♀♀	Rabbit-Proof Fence No. 1, Far North, W.A.	Nicholls.	PARATYPES.
Swedish Mus.	1569	♀	Noonkambah, Kimberley Divn., W.A.	Mjöberg.	PARATYPES.
"	"	1570	♀	St. George Range, Kimberley Divn., W.A.	" "
"	"	1568 (part)	♂, 4 juvs.	Mowla Down, Mt. Alexander, 70 miles south of Fitz Roy River, Kimberley Divn., W.A.	" "

Subfamily MYOBATRACHINAE.

CYSTIGNATHI (part) Tschudi, 1838, *Mém. Soc. neuchâtel. Sci. nat.*, **2** : 37, 78.

RANIFORMES (part) Duméril & Bibron, 1841, *Épét. Gén.*, **8** : 317.

ALYTAE (part) + BOMBITATORES (part) Fitzinger, 1843, *Syst. Rept.* : 32.

MYOBATRACHIDAE, MYOBATRACHINA Bonaparte, 1850, *Consps. Syst. Herp., Amph.*

MYOBATRACHIDAE Schlegel, 1850, *Proc. zool. Soc. Lond.* : 10.

MYOBATRACHIDAE + CYSTIGNATHIDAE (part) + UPEROLEIIDAE + BRACHYCEPHALIDAE (part) + ENGYSTOMATIDAE (part) Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 3, 26, 30, 45, 51.

BRACHYMERIDAE (part) + BUFONIDAE (part) + SCAPHIOPODIDAE (part) + CYSTIGNATHIDAE (part) Cope, 1865, *Nat. Hist. Rev.*, n.s., **5** : 97-120.

CYSTIGNATHIDAE, CRINIÆ (part) Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 67-97.

BUFONIDAE (part) Cope, 1866, *tom. cit.* : 180.

ALYTIDAE (part) + PHRYNSCIDAE (part) Steindachner, 1867, *Reise Novara, Zool., Amph.* : 7-34.

CYSTIGNATHIDAE (part) + UPEROLEIIDAE Kefenstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 343-349.

CYSTIGNATHIDAE (part) + ALYTIDAE (part) + PHRYNSCIDAE + ENGYSTOMIDAE (part) Kefenstein, 1868, *Arch. Naturgesch.*, **34** : 251-273.

PHRYNSCIDAE, PHRYNSCINA (part) + ENGYSTOMIDAE, BREVICIPITINA (part) + ALYTIDAE, UPEROLINA (part) + RANIDAE, CYSTIGNATHINA Mivart, 1869, *Proc. zool. Soc. Lond.* : 288-294.

CYSTIGNATHIDAE (part) + BUFONIDAE (part) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 183-432.

BUFONIDAE (part) Noble, 1922, *Bull. Amer. Mus. nat. Hist.*, **46** : 1-87.

CERATOPHRIDAE (part) + BUFONIDAE (part) Waite, 1929, *Rept. Amph. S. Australia* : 244-266.

BUFONIDAE, CRINIÆ (part) Noble, 1931, *Biol. Amph.* : 496.

LEPTODACTYLIDAE (part) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 8.

Tongue narrowly oval or small; intermaxillary glands opening by not more than two ducts close to the mid-line of the palate. Prevomer much reduced or absent; vomerine teeth vestigial or absent (text-figs. 13-15). Alary processes of the hyoid wing-like expansions of the lateral border of the hyoid plate (text-fig. 3, p. 5); sternohyoid and petrohyoid muscles attached to the ventral surface of the hyoid, approaching the mid-line posteriorly. Distal tendon of the m. semitendinosus perforating the mm. graciles or their distal tendon, or passing dorsal to them. Sterno-epicoracoideus absent (*Uperoleia*). Presacral vertebrae 8, and the notochord always more or less persistent.

KEY TO THE GENERA.

I. Ear fully developed.

A. Maxillary teeth present.

(1) Toes webbed; a large fronto-parietal foramen . . . *Glauertia*.

(2) Toes free.

(a) Fronto-parietal foramen closed in the adult . . . *Uperoleia*.

(b) Fronto-parietal foramen persistent, large . . . *Crinia*.

B. Maxillary teeth absent.

- (1) Toes webbed ; a large fronto-parietal foramen *Glauertia*.
- (2) Toes free.
 - (a) Fronto-parietal foramen closed in adults *Uperoleia*.
 - (b) Fronto-parietal foramen large, persistent.
 - (i) Clavicles broad mesially ; epicoracoids meeting edge to edge anteriorly (text-fig. 20) *Myobatrachus*.
 - (ii) Clavicles not dilated ; epicoracoids overlapping *Metacrinia*.

II. No tympanum, cavum tympani, annulus tympanicus, columella (plectrum) or Eustachian tubes ; maxillary teeth absent *Pseudophryne*.

GLAUERTIA Loveridge.

Pseudophryne (part) Andersson, 1913, *K. Svenska Vetensk.Akad. Handl.*, **52**, 4 : 19 ; Nieden, 1923, *Das Tierreich, Anura I* : 150.
Glauertia Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, **8** : 89 (Type species :—*Glauertia russelli*).

Maxillary teeth present or absent. Prevomere absent ; fronto-parietal foramen very large and persistent, the fronto-parietal bones being confined to the lateral regions of the cranium. Ear fully developed. Vertebrae prococleous,¹ but the condyle incompletely ankylosed ; sacral diapophyses moderately dilated ; 8 presacral vertebrae ; coccyx articulating by two condyles. Omosternum rudimentary ; sternum large, cartilaginous. Terminal phalanges simple.

Distal tendon of the m. semitendinosus passing through the tendon of the gracilis complex (*G. orientalis*) or passing dorsal to it (*G. russelli*). Alary process of the hyoid a wing-like expansion of almost the whole lateral margin of the hyoid plate.

Pupil horizontal with a ventral angle. Tongue small, oval, $\frac{1}{3}$ free behind. Tympanum hidden. Digits not dilated ; toes webbed.

The species of this genus appear to be closely allied and to be descended from some Criniine stock. They may be distinguished from the true *Crinia*s by their webbed toes. This difference, in itself, seems trivial enough, but the fact remains that these web-footed species represent one line of descent whereas the unwebbed species, whether with or without teeth, are a separate evolutionary branch. To include all of them in the same genus would mask their phylogeny and this seems adequate justification for the retention of *Glauertia* as a distinct, if not very easily diagnosable, genus.

SYNOPSIS OF THE SPECIES.

- I. Maxillary teeth present ; a tarsal tubercle ; toes webbed at the base *G. mjöbergi* (Andersson).
- II. Maxillary teeth absent ; no tarsal tubercle.
 - A. Toes half webbed *G. russelli* Loveridge.
 - B. Toes $\frac{1}{4}$ to $\frac{1}{3}$ webbed *G. orientalis* sp. nov.

¹ One specimen examined appears diplasiocoelous, but owing to the incomplete fusion of the condyle this might be an artefact.

Glauertia mjobergi (Andersson).

Pseudophryne mjobergi Andersson, 1913, *K. Svenska Vetensk. Akad. Handl.*, **52**, 4 : 19, pl. 1, figs. 5, 6 (Type locality :—Noonkambah, Kimberley Divn., W. Australia); Nieden, 1923, *Das Tierreich, Anura I* : 150, fig. 197; Harrison, 1927, *Rec. Aust. Mus.*, **15** : 284; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 9.

Head as long as broad; snout truncate, very slightly longer than the eye; nostrils directed upwards, nearer the tip of the snout than the eye; canthus rostralis rounded; loreal region slightly oblique; interorbital space convex, once and a third as wide as the upper eyelid; tympanum hidden; occiput swollen. Fingers free, not dilated, the first much shorter than the second, which is a little shorter than the fourth; subarticular tubercles well developed; palm with rows of small tubercles; two large metacarpal tubercles. Toes with a distinct rudiment of web and fleshy lateral fringes; fifth much shorter than the third; subarticular tubercles conical; two large, shovel-shaped metatarsal tubercles, the outer obliquely transverse; a conical papilla on the lower surface of the tarsus, close to the tibio-tarsal articulation. Tarso-metatarsal articulation reaching the posterior corner of the eye.

Skin with scattered small warts above; a large parotoid gland; a similar gland along the flanks to the groin and a smaller gland on each side of the coccyx. Smooth beneath, except the hinder sides of the thighs which are granular.

Pale grey above with a few large insuliform spots of which the most prominent are a kidney-shaped pair bordering the parotoid glands above; the small warts light-tipped. Lower surfaces white.

Length from snout to vent : 20 mm.

DISTRIBUTION : Known only from the type locality, Noonkambah, Kimberley Divn., W. Australia.

SPECIMEN EXAMINED.

Swedish Mus. 1567

♀

Noonkambah

Mjöberg. COTYPE.

Glauertia russelli Loveridge.

Glauertia russelli Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, **8** : 89 (Type locality :—Gascoyne River, near Landor Station, W. Australia); *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 37, pl. 1, figs. 1-3.

Head broader than long; snout triangular, truncate distally, a little longer than the diameter of the eye; nostrils directed upwards, nearer the tip of the snout than the eye; canthus rostralis rounded; loreal region nearly vertical, slightly concave; interorbital space flat, once and a half to twice as broad as the upper eyelid; tympanum hidden. Fingers free, not dilated; first much shorter than the second which does not extend as far as the fourth; subarticular tubercles well developed; palm with rows of small tubercles; two metacarpal tubercles. Toes half webbed, the membrane midway between the third and fourth reaching the level of the distal subarticular tubercle of the third; fifth much shorter than the third; subarticular tubercles well developed; two large shovel-shaped metatarsal tubercles, the outer transversely disposed. Tarso-metatarsal articulation reaching the anterior corner of the eye in juveniles or the axilla in adults.

Skin warty above; more or less granular on the abdomen and beneath the thighs.

Brown above with indistinct darker spots and with or without a light (pink in life) vertebral stripe; a light blotch on each scapular region (reddish

orange in life) and a similar but smaller spot may be present on each side of the coccyx; the two may be more or less connected by an indefinite zone of the same colour. Dirty yellow beneath, the throat sometimes freckled with brown.

Length: ♂ 23.5 mm.; ♀ 30 mm.

DISTRIBUTION: Known only from the type locality.

SPECIMENS EXAMINED.

Stellenbosch Univ. Colln.	2 juvs.	Landor Sta., W. Austr.	Glauert.	PARATYPES.
B.M. 1937.7.23.3-5	♀♀, Hgr.	"	"	"

Glauertia orientalis sp. nov.

Pseudophryne fimbriatus? Parker, 1926, *Ann. Mag. nat. Hist.*, (9), **17**: 670 (Groote Eylandt).

Holotype a male, number 1908.2.25.34 in the British Museum from Alexandria Station (19° 08' S., 136° 43' E.), Northern Territories, Australia, collected by W. Stalker.

Head a little broader than long; snout short, vertically truncate, shorter than the eye; nostrils directed vertically upwards, close to the tip of the snout; canthus rostralis rounded; loreal region slightly oblique; interorbital space once and a third the width of the upper eyelid; tympanum hidden. Fingers free, the first shorter than the second, which does not extend quite as far as the fourth; subarticular tubercles well developed; palm with rows of small, round tubercles; two metacarpal tubercles. Toes a quarter webbed, the edge of the membrane midway between the third and fourth not extending beyond the proximal tubercle of the fourth toe; edge of the membrane raised into a tubercle; fifth toe much shorter than the third. Two large, compressed metatarsal tubercles, the outer disposed transversely. Tarso-metatarsal articulation reaching the tympanic region.

Skin slightly warty above; a moderately distinct parotoid gland and a smaller, circular inguinal gland. Lower surfaces feebly granular except beneath the thighs where the granulations are more pronounced.

Brown above, each wart lighter and ringed with darker; faint indications of a light, mid-dorsal line; parotoid and inguinal glands rufous. Lower surfaces dirty white, the gular region infuscate. Hinder side of thighs brown with a light (non-glandular) spot behind the knee.

A vocal sac opening internally by a slit on each side close to the lower jaw; base of the first finger on its inner side thickened and glandular.

Length from snout to vent: 26 mm.

Hind limb: 29 mm.

PARATYPES: Two males from the type locality, and a female from Groote Eylandt.

These examples show little variation. The parotoid and inguinal glands are not always clearly defined and the digital webbing of the toes is not absolutely constant, varying from $\frac{1}{4}$ to $\frac{1}{3}$; in none of them is it as extensive as in *G. russelli*. The female has a deeply fimbriated cloacal flap, as in the genus *Uperoleia*.

These eastern specimens appear to differ constantly from the western *G. russelli* in their shorter digital webbing and slightly shorter more acuminate snouts; but it must be admitted that with reasonably long series, these differences may not be found to hold good and that the two forms may not be tenable.

SPECIMENS EXAMINED.

B.M. 1908. 2. 25. 34	♂	Alexandria Sta., N. Territory.	Stalker. HOLOTYPE.
1908. 2. 25. 35-36	♂♂	Alexandria Sta., N. Territory.	„ PARATYPES.
1926. 2. 25. 2	♀	Groote Eylandt.	Wilkins. PARATYPE.

UPEROLEIA Gray.

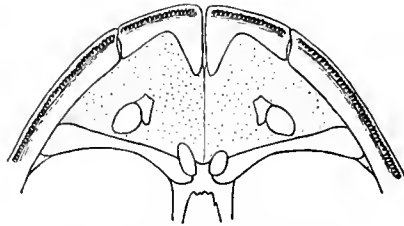
*Uperoleia*¹ Gray, 1841 (April), *Ann. Mag. nat. Hist.*, **7** : 90 (Type species:—*Uperoleia marmorata*); Gray, 1841, in Grey, *Journ. Exped. Austral.*, **2** : 448; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 39; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 33; Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 349; Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 55; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 270.

Uperoleja Gray, 1841, *loc. cit.* : 43^o.

*Hyperolia*¹ (emend.) Cope, 1865, *Nat. Hist. Rev.*, n.s., **5** : 108; *idem*, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 94; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 267; Cope, 1889, *Bull. U.S. nat. Mus.*, **34** : 312; Nieden, 1923, *Das Tierreich, Anura I* : 535; Noble, 1931, *Biol. Amph.* : 498.

Pseudophryne (part) Andersson, 1916, *K. Svenska Vetensk. Akad. Handl.*, **52**, 9 : 13; Parker, 1926, *Ann. Mag. nat. Hist.*, (9), **17** : 660.

Maxillary teeth present or absent. Prevoemer reduced to two fragments, one bounding the choana and the other overlying the mesial end of the palatine (*U. rugosa*, text-fig. 13) or completely absent (*U. marmorata*); fronto-parietal



TEXT-FIG. 13.— Anterior cranial elements of *Uperoleia rugosa*. $\times 6.5$. (From beneath.)

foramen present in juveniles, but completely roofed over in the adult. Ear fully developed. Vertebrae procoelous, but the condyle incompletely ankylosed; eight pre-sacrales; sacral diapophyses moderately dilated; coccyx articulating by two condyles. Omosternum rudimentary; sternum small, cartilaginous. Terminal phalanges simple. Distal tendon of the m. semitendinosus perforating the gracilis complex.

Alary process of the hyoid a wing-like lateral expansion of the whole of the border of the hyoid plate.

Pupil rhomboidal, often somewhat vertically compressed. Tongue oval, entire and free behind. Tympanum hidden. Parotoid glands large and prominent. Digits free, not dilated.

The relationships of this genus are discussed below, under *Pseudophryne*.

¹ Under Art. 19 of the Rules of Nomenclature the original orthography of a name may be emended when, *inter alia*, an error of transliteration "is evident." What is "evident" is not capable of rigid definition, so that it seems advisable to consider names as arbitrary combinations of letters except when their derivation is expressly stated in the original publication of the name. Gray does not state the etymological derivation of *Uperoleia* and so, although Cope's emendation to *Hyperolia* is probably based on a perfectly correct assumption, there is no sure proof. Consequently it seems preferable to continue the use of the name as it was originally proposed, the more so since this course will not involve any change of the name *Hyperolius* Rapp, 1842.

Despite Loveridge's (1935 : 31) contention that *rugosa* Anderson is at most racially distinct from *marmorata*, there appear to be sufficient well-marked differences to indicate that they are truly specifically distinct. Harrison (1927 : 284) suggested "with some diffidence" that *Pseudophryne mjobergi* Andersson might be a synonym of *U. marmorata*, but the species appears to be referable to the genus *Glauertia*.

SYNOPSIS OF THE SPECIES.

- I. Maxillary teeth present ; metatarsal tubercles not compressed ; snout rounded *U. marmorata*.
 II. Maxillary teeth absent ; metatarsal tubercles distinctly shovel-like, the outer disposed transversely ; snout truncate *U. rugosa*.

***Uperoleia marmorata* Gray.**

- Uperoleia marmorata* Gray, 1841 (April), *Ann. Mag. nat. Hist.*, **7** : 60 (Type locality : — Western Australia) ; Gray, 1841, in Grey, *Journ. Exp. Austral.*, **2** : 448 ; Gunther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 39 ; Kretz, 1865, *Pap. roy. Soc. Tasmania* : 17 ; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107 ; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 33 ; Gunther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 55 ; Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 349 ; *idem*, 1868, *Arch. Naturgesch.*, **34** : 270, pl. 6, fig. 14 ; Harrison, 1922, *Austr. Zool.*, **3**, 1 : 31.
Hyperoleius (Uperoleia) marmoratus Parker, 1881, *Phil. Trans. roy. Soc. Lond.*, **3** : 134, pl. 24, figs. 6, 7.
Hyperolia marmorata Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 267 ; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 379 ; *idem*, 1890, *op. cit.*, (2), **5** : 672-675 ; *idem*, 1891, *op. cit.*, (2), **6** : 272 ; *idem*, 1892, *op. cit.*, (2), **7** : 7-9, *idem*, 1894, *op. cit.*, (2), **8** : 526, 528, 530 ; Boettger, 1894, *Denkschr. med.-naturw. Ges. Jena*, **8** : 109 ; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22** : 678 ; Lucas & le Souef, 1909, *Ann. Austral.* : 277 ; Nieden, 1923, *Das Tierreich, Anura I* : 535, fig. 368.
Uperoleia marmorata var. *laevigata* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 349 (Type locality : — Raudewick, N.S.W.).

Snout rounded, a little longer than the eye ; canthus rostralis quite indistinct ; loreal region oblique, not concave ; nostril a little nearer the tip of the snout than the eye ; the distance from nostril to tip of snout contained 1.3 to 1.5 times in distance from nostril to eye ; interorbital space once and a quarter to once and a half as broad as the upper eyelid. Fingers moderate, with prominent subarticular tubercles ; the first much shorter than the second, which is a little shorter than the fourth ; carpus with rows of small tubercles ; two well-developed metacarpal tubercles. Toes with indications of fleshy, lateral fringes and prominent subarticular tubercles ; third much longer than the fifth ; two large, but not compressed, metatarsal tubercles. Tarso-metatarsal articulation reaching the eye.

Upper surfaces smooth or minutely tubercular ; a large parotoid gland ; lower surfaces smooth or feebly granular ; hinder side of thighs granular ; anal flap undivided in males, fimbriated in females.

Pale brown to dark olive above, with or without darker spots and marblings, of which the most constant are an interorbital blotch and a curved stripe on the upper borders of the parotoids. A large yellow spot in the groin and another behind the thigh close to the knee ; these areas do not appear to be glandular. Lower surfaces pale brown to dark olive, minutely stippled with lighter or pale brown mottled with darker ; chin of the male infuscate.

Male with a vocal sac opening by a slit on each side of the tongue and a glandular thickening of the base and inner side of the first finger.

Length from snout to vent: ♂ 28 mm.: ♀ 31 mm.

As in *Pseudophryne bibroni*, examples from the coastal region of New South Wales are very dark in colour and may be recognizable as a distinct race.

Habits cryptozoic. Breeding in early spring (N.S.W.); eggs laid singly, over 200 in a clutch. Call note an explosive "akh" (Fletcher, 1889 : 376, and Harrison, 1922 : 31).

DISTRIBUTION : Australia.

SPECIMENS EXAMINED.

B.M. 41 (2) 215	♂	W. Australia.	TYPE.
64.7.9.14	♀	Sydney.	Günther.
87.7.16.1	♂	"	Fletcher.
87.7.16.2	♂ (cleared)	"	"
87.7.16.3	♂	Burrawang, N.S.W.	"
88.7.3.14	♀	"	"
1915.3.9.23	♀	Parramatta.	Schrader.
1926.2.16.1	♀	Huskisson, Jervis Bay, N.S.W.	Rodway.
1932.10.2.147- 148	♀♀	W. Australia.	Reischek.
Mus. Leiden 4259	♀	Queensland.	(Mus. Godeffroy.)
Austr. Mus. R. 7981	♀	Upper Colo, via Rich- mond, N.S.W.	
R. 7379 (part)	♂	Burrawang, N.S.W.	

Uperoleia rugosa (Andersson).

Hyperolia marmorata (part) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 267 (Cape York); Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2), 5 : 673 (Dandaloo).

Pseudophryne rugosa Andersson, 1916, *K. Svenska Vetensk.Akad. Handl.*, 52, 9 : 13, pl. 1, fig. 4 (Type locality :—Colosseum, Queensland).

Uperoleia marmorata rugosa Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 31.

Pseudophryne fimbrianus Parker, 1926, *Ann. Mag. nat. Hist.*, (9), 17 : 669, fig. 3 (Type locality :—St. George District, Queensland).

Snout vertically truncate, a little longer than the diameter of the eye; canthus rostralis rounded; loreal region nearly vertical, not concave; distance from the nostril to the tip of the snout contained nearly twice in the distance from nostril to eye; interorbital space once and a third as broad as the upper eyelid. Fingers depressed, the first much shorter than the second, which is a little shorter than the fourth; subarticular and metacarpal tubercles well developed; carpus with rows of smaller tubercles. Toes with feeble indications of fleshy lateral fringes, especially proximally, and prominent subarticular tubercles; third much longer than the fifth; two large, metatarsal tubercles, the outer the larger, usually distinctly transverse and shovel-like. Tarso-metatarsal articulation reaching the tympanic region.

Upper surfaces regularly warty. A distinct parotoid gland and a more or less distinct lateral gland extending from the posterior corner of the latter towards the groin and a circular gland on each side of the coccyx posteriorly. Lower surfaces feebly granular; hinder side of thighs distinctly granular. Anal flap fimbriated in females.

Brown above with more or less profuse darker spots of which the most constant is a V-shaped interorbital bar. Posterior half of the parotoids often with a light spot. A distinct white patch in the groin and another on the thigh behind the knee; these areas are not glandular. Lower surfaces white, dusted or spotted with brown; chin of male infusate.

Male with a vocal sac opening by a slit on each side of the tongue, and with a thickened glandular pad on the inner side of the first finger.

Length from snout to vent : ♂ 26 mm. : ♀ 28 mm.

DISTRIBUTION : Queensland and New South Wales west of the dividing range.

SPECIMENS EXAMINED.			
B.M. 67.5.6.84	♂	Cape York.	Dâmel.
90.7.28.3-4	♀♀	Bogan River, Danda- loo, N.S.W.	Fletcher.
1923.11.12.3	♀	St. George Distr., Queensland.	Wilkins. (Type of <i>Pseudophryne tm- brannus</i> .)
Swedish Mus. 1630	♀	Colosseum, S. Queens- land.	Mjoberg. TYPE.
Mus. Leiden 6785	♀	Queensland.	(Godeffroy Mus.)
Austr. Mus. R.7347	2 ♀♀	Emu Plains, Urana,	
" " R.7348	♂♀	N.S.W.	

CRINIA Tschudi.

Crinia Tschudi, 1883, *Mém. Soc. neuchâtel. Sci. nat.* : 38, 78 (Type species :—*Crinia georgiana*) ; Fitzinger, 1843, *Syst. Rept.* : 32 ; Girard, 1853, *Proc. Acad. nat. Sci. Philad.*, **6** : 420 ; Cope, 1865, *Nat. Hist. Rev.*, n.s., **5** : 107 ; *idem*, 1866, *J. Acad. nat. Sci. Philad.*, (2), **6** : 95 ; Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 347 ; *idem*, 1868, *Arch. Naturgesch.*, **34** : 262 ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 293 ; Cope, 1880, *Bull. U.S. nat. Mus.*, **34** : 312 ; Werner, 1914, *Fauna S.W. Austral.*, **4** : 407 ; Nieden, 1923, *Das Tierreich, Anwa 1* : 539 ; Waite, 1929, *Rept. Amph. S. Austral.* : 257 ; Noble, 1931, *Biol. Amph.* : 498.

Cystignathus (part) Duméril & Bibron, 1841, *Expét. Gén.*, **8**, 302 ; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 26.

Ranidella Girard, 1853, *Proc. Acad. nat. Sci. Philad.*, **6** : 421 (Type species :—*Ranidella signifera*) ; *idem*, 1858, *U.S. Explor. Exped., Herp.* : 44.

Pterophrynus Lütken, 1862, *Vidensk. Medd. Naturh. Foren. Kbh.* : 302 (Type species :—*Pterophrynus verrucosus*) ; Steindachner, 1867, *Reise Novara, Zool., Amph.* : 30.

Pterophryne Günther, 1867, *Ann. Mag. nat. Hist.*, (3), **20** : 53.

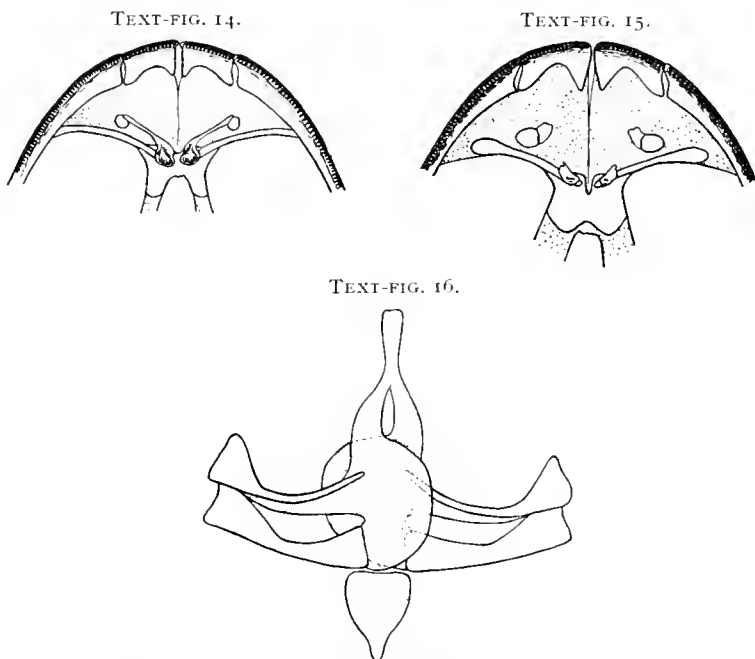
Camariolius Peters, 1863, *Mber. Akad. Berlin* : 236 (Type species :—*Camariolius varius*).

Maxillary teeth present. Prevomer variable. In its most primitive condition (*leai*, *rosea*, *laevis* and *darlingtoni*) a small anterior portion, bounding the choana antero-mesially, is connected by a narrow strip with a small posterior portion overlying the mesial end of the palatine which often bears vomerine teeth. In *acutirostris* only the anterior portion bounding the choana persists, but in *georgiana*, *signifera*, *tasmaniensis* and *glauerti* both the anterior portion and a small fragment overlying the palatine mesially are present, but unconnected ; the posterior portion may, or may not bear teeth. A very large fronto-parietal foramen. Ear fully developed. Vertebrae procoelous, the condyle incompletely ankylosed ; notochord persistent ; sacral diapophyses slightly dilated ; urostyle articulating by two condyles ; eight presacral vertebrae. Omosternum small, cartilaginous, not fully differentiated from the procoracoids (text-figs. 16 and 18) ; sternum undivided, cartilaginous ; procoracoids broad. Terminal phalanges simple.

Distal tendon of the m. semitendinosus passing between the m. gracilis major and minor.

Alary process of the hyoid a wing-like expansion of almost the whole lateral margin of the hyoid plate ; cricoid cartilage incomplete ; oesophageal process of the cricoid broad or almost absent ; m. omohyoideus absent ; mm. sternohyoideus and petrohyoideus anterior inserted on the ventral surface of the hyoid, reaching the middle line in the posterior part of this insertion.

Pupil horizontal but with a downwardly directed angle ventrally. Tongue narrowly oval, partly free behind. Toes free, not or but feebly dilated distally.



TEXT-FIG. 14.—Anterior cranial elements of *Crinia laevis laevis*. $\times 6.5$. (From beneath.)
 TEXT-FIG. 15.—Anterior cranial elements of *Crinia tasmaniensis*. $\times 6.5$. (From beneath.)
 TEXT-FIG. 16.—Ventral elements of the shoulder girdle of *Crinia haswelli*. (Cotype ♀.)

SYNOPSIS OF THE SPECIES.

- I. Prevomer undivided or with its anterior and posterior portions in contact. Vomerine teeth usually present.
- A. Belly, and usually the upper surfaces also, quite smooth. Toes not fringed.
- (1) Inner finger and toe not reduced, the latter $\frac{2}{3}$ the length of the second.
- (a) Toes with distinct subarticular tubercles and slight terminal dilatations *C. laei*.
- (b) Toes without or with very indistinct subarticular tubercles and not dilated terminally *C. rosea*.
- (2) Inner finger and toe much reduced, the latter not more than half the length of the second and the inner finger with, at most, a single very short phalanx.
- (a) Toes pointed; groins and hinder side of the legs marked with red and brown.
- (i) Belly with a few large blotches *C. laevis laevis*.
- (ii) Belly regularly dusted with brown *C. laevis victoriana*.
- (b) Toes slightly dilated terminally; no red on the groins or limbs
C. darlingtoni.
- B. Belly more or less granular. Toes fringed *C. haswelli*.

- II. Prevomer divided and the two halves widely separated or the posterior absent. Vomerine teeth reduced or absent.
- A. Vomerine teeth usually present; toes not fringed; belly granular. Hinder side of thighs red in alcohol.
- (1) Snout short, rounded, 1.14 to 1.3 times the length of the eye.
Average size of adults, ♂♂ 26, ♀♀ 27.3 mm. *C. georgiana*.
- (2) Snout longer, pointed, prominent, 1.35 times the length of the eye. Average size of adults 16.8 mm. *C. glauerti*.
- B. Adults with more or less distinct dermal fringes on the toes. Vomerine teeth vestigial or absent.
- (1) Belly smooth or only slightly granular.
- (a) Two metatarsal tubercles; loreal region very oblique; belly blotched with pink *C. tasmaniensis*.
- (b) A single, inner, metatarsal tubercle; loreal region nearly vertical *C. acutirostris*.
- (2) Belly granular, a tarsal fold, belly not pink.
- (a) Inner metatarsal tubercle $\frac{1}{3}$ its distance from the tip of the inner toe. Nostril equidistant from the eye and the end of the snout *C. signifera signifera*.
- (b) Inner metatarsal tubercle about half its distance from the tip of the inner toe. Nostril usually a little nearer the eye than the end of the snout.
- (i) Digital fringes well-developed, thin. Tibio-tarsal articulation reaching the tympanic region. Snout somewhat pointed and slightly prominent *C. signifera englishi*.
- (ii) Digital fringes short and fleshy. Tibio-tarsal articulation scarcely reaching beyond the shoulder. Snout bluntly rounded, not prominent *C. signifera montana*.

Crinia leai Fletcher.

Crinia leai Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22**, 1897: 677 (Type localities:—Bridgetown and Pipe Clay Creek, near Jarrabdale); Fry, 1914, *Rec. W. Aust. Mus.*, **1**: 203, pl. 28, figs. 2, 2a; Nieden, 1923, *Das Tierreich, Anura 1*: 543; Harrison, 1927, *Rec. Aust. Mus.*, **15**, 4: 277; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 30.

Crinia michaelsoni Werner, 1914, in Michaelson & Hartmeyer, *Fauna S.W. Australiens*, **4**: 416 (Type locality:—Donnybrook, W.A.). Nieden, 1923, *loc. cit.*

Vomerine teeth usually present in transverse series behind the level of the choanae. Snout depressed, rounded, not prominent, 1.3 times as long as the eye; canthus rostralis rounded; loreal region very oblique; nostril midway between the eye and the tip of the snout; interorbital space once and a quarter to once and a half as wide as the upper eyelid; tympanum hidden. Fingers moderately long with subarticular tubercles; palm with a few indistinct granules; two metacarpal tubercles. Toes long, distinctly spatulate distally, without dermal fringes¹; subarticular tubercles distinct but not prominent; a single, inner metatarsal tubercle; no tarsal fold. Tibio-tarsal articulation reaching the eye.

Skin smooth above and below; a distinct parotoid glandular thickening; hinder side of the thighs, beneath the vent, granular.

¹ Fletcher speaks of a "tendency to fringed toes"; Fry of a "distinct fringe or devoid of a fringe," and Werner says "Zehen gesaumt." The specimens examined have no trace of fringes, but in some of the cotyphes which are somewhat shrivelled there are lateral seams on the toes.

Pinkish grey or brown above, with, in young specimens, a large rectangular, dark spot commencing between the eyes and extending backwards almost to the hind limbs. This marking may have obscure mottlings within it and is not generally completely persistent in adults. Usually with increasing age a process of emargination commences posteriorly and spreads forwards; the lateral borders are often more or less persistent, sometimes as lines, sometimes as rows of spots, and in extreme cases only a triangular dark interorbital spot persists; synciput grey; upper lip with one or two dark bars radiating from the eye; a dark stripe from the nostril through the eye, interrupted on the parotoid region and sometimes continued on the anterior part of the flanks. Limbs cross-barred; a triangular dark spot enclosing the vent, not clearly outlined below; tarsus and metatarsus blackish towards their outer edges beneath. Lower surfaces white, more or less brown freckled.

Male with a vocal sac opening by a slit on each side of the tongue and a glandular, non-rugose nuptial pad.

Length from snout to vent: ♂ 19 mm.; ♀ 25 mm.

DISTRIBUTION: Coastal belt of S.W. Australia from Albany northwards almost to Perth.

Cryptozoic in habits and frequenting damp areas.

SPECIMENS EXAMINED.

M.C.Z. 18465-75	♀	Augusta, W. Australia.	Brooks.
(part)			
Austr. Mus. R.8337	2 ♂♂, 2 juvs.	Bridgetown, W. Australia.	COTYPES.
" " R.10324	♂, 2 ♀♀, 2 juvs.	Pipe Clay Creek, "	"
" " R.10978	♀, juv.	Augusta, "	Brooks.
" " R.10959	♀, juv.	Near the mouth of the Denmark River, W.A.	

Crinia rosea Harrison.

Crinia rosea Harrison, 1927, *Rec. Aust. Mus.*, 15: 279 (Type locality:—Pemberton, in the Karri Country, 218 miles south of Perth); Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 30.

Vomerine teeth strongly developed. Snout slightly acuminate, not prominent, depressed, once and a quarter as long as the eye; canthus rostralis rounded; loreal region very oblique; nostril equidistant from the tip of the snout and the eye, or a little nearer the latter; interorbital space once and a half the width of the upper eyelid; tympanum hidden. Fingers short, pointed, with scarcely perceptible subarticular tubercles; palm smooth; metacarpal tubercles faintly indicated only. Toes moderate, pointed, not fringed, with scarcely a trace of subarticular tubercles; a very indistinct inner metatarsal tubercle; no tarsal fold; tibio-tarsal articulation reaching the shoulder.

Skin smooth above and below; no sub-anal granular patch; glandular areas behind the angle of the mouth, in the parotoid region and behind the thighs; a slight fold across the chest.

Dark purplish grey above, uniform or obscurely mottled with darker, or with a median dark zone commencing between the eyes, with parallel sides running backwards to the pelvic region, more or less deeply emarginate behind. Limbs cross-barred. Lower surfaces whitish (red in life) with some brown freckling. Gular region of male blackish.

Length from snout to vent: ♂ 22 mm.; ♀ 25 mm.

DISTRIBUTION: Pemberton, W.A.

A cryptozoic frog found under logs in wet forest country; possibly distributed throughout the hard-wood forests of S.W. Australia.

SPECIMEN EXAMINED.

M.C.Z. 18419

♀

Pemberton, W.A.

Darlington.

Crinia laevis laevis (Günther).

Pterophrynus laevis Günther, 1864, *Proc. zool. Soc. Lond.*: 48, pl. 7, fig. 4 (Type locality:—Tasmania); *idem*, 1864, *Ann. Mag. nat. Hist.*, (3), **14**: 314; Krefft, 1865, *Pap. roy. Soc. Tasmania*: 10.

Crinia laevis Günther, 1868, *Proc. zool. Soc. Lond.*: 480; Keferstein, 1868, *Arch. Naturgesch.*, **34**: 265; Boulenger, 1882, *Cat. Batv. Sal. Brit. Mus.*, ed. 2: 206; Lucas & le Souef, 1900, *Anim. Austral.*: 276; English, 1910, *Proc. zool. Soc. Lond.*: 930, pl. 51, fig. 6; Harrison, 1922, *Aust. Zool.*, **3**, 1: 31; Nieden, 1923, *Das Tierreich, Anura I*: 542 (part); Blanchard, 1929, *Aust. Zool.*, **5**, 4: 327, pl. 35; Loveridge, 1934, *Pap. roy. Soc. Tasmania*, **1933**: 60; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 29.

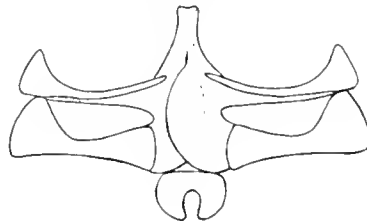
Vomerine teeth present or vestigial. Snout rounded, depressed, not prominent, 1.4 times as long as the eye; canthus rostralis rounded; loreal region very oblique; nostril a little nearer the eye than the tip of the snout; interorbital space once and three quarters as broad as the upper eyelid; tympanum hidden. Fingers short, with scarcely perceptible subarticular tubercles; first finger very short, with the phalanges reduced to a single, small, cartilaginous or bony nodule

TEXT-FIG. 17.



TEXT-FIG. 17.—Hand of *Crinia laevis laevis*. $\times 9$.

TEXT-FIG. 18.



TEXT-FIG. 18.—Ventral elements of the shoulder girdle of *Crinia laevis victorianus*.

at the extremity of the metacarpal; two flat, indistinct metacarpal tubercles; palm smooth. Toes short, not fringed, the inner short, but variable in length, with one or two (type) phalanges; subarticular tubercles scarcely indicated; a very indistinct inner metatarsal tubercle, but no outer, and no tarsal fold. Tibio-tarsal articulation reaching the vicinity of the shoulder.

Skin smooth above or with a few scattered tubercles; smooth below; a parotoid glandular thickening.

Brown or slate-grey above with small, irregular, scattered, red spots more or

less bordered by black. Belly and throat with moderately large dark brown spots, the ground-colour white, suffused with bluish anteriorly and pink posteriorly. Hind limbs marbled with black or brown and pink; a deep pink spot in the axilla and groin, outlined or marbled with black. Throat of the male less spotted than that of the female and coloured bright yellow.

Male with a vocal sac opening by a slit on each side of the tongue.

Length from snout to vent : ♂ 31 mm. ; ♀ 33 mm.

The species is nocturnal and cryptozoic, frequenting damp localities. Breeding in late summer (March). The song is a short, rasping note repeated several times in a few seconds. Eggs to the number of about 120 in a clutch are laid in cavities underground in low-lying places, or attached to the stems of grasses and rushes a little above ground level, but always in spots liable to be flooded during rain. The developmental period within the egg is probably long (at least five weeks), and the tadpole is hatched in an advanced stage of development, without any trace of external gills (English and Blanchard).

DISTRIBUTION : Tasmania up to 3000 ft.

SPECIMENS EXAMINED.

Collection	Sex	Locality	Collector	Type
B.M. 60.11.29.25	♀	Tasmania.	Milligan.	TYPE.
70.6.26.23	♀	?	Kreft.	
1928.4.25.2	♂	National Park, Tasmania.	Blanchard.	
Austr. Mus. R.7597-7600	8 ♀♀	Ulverstone, "		
R.10328	2 ♂♂, juv.	" "		
R.9832	♂	National Park, "		
R.10322	2 ♀♀	Port Arthur, "		
R.10325	♂	Tasmania.		
—	3 ♂♂, ♀	Wilmot, Tasmania.		
R.10352 (part)	♀	Between Port Arthur and Roger River, Tasmania.		

Crinia laevis victoriana Boulenger.

- Crinia victoriana* Boulenger, 1888, *Ann. Mag. nat. Hist.*, (6), 2 : 142 (Type locality :—Warra-gul, Gippsland, Victoria) ; Lucas & le Souef, 1909, *Anim. Austral.* : 276 ; Nieden, 1923, *Das Tierreich, Anura I* : 543.
- Crinia froggatti* Fletcher, 1891, *Proc. Linn. Soc. N.S.W.*, (2), 6 : 274, 275 (Type localities :—Buninyong and Gong Gong, near Ballarat) ; *idem*, 1894, *op. cit.*, (2), 8 : 523 ; Lucas & le Souef, 1909, *Anim. Austral.* : 276 ; Blanchard, 1929, *Aust. Zool.*, 5, 4 : 328.
- Crinia laevis froggatti* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 29.
- ? *Crinia* sp. Lucas, 1892, *Proc. roy. Soc. Victoria*, 4 : 61.
- Crinia laevis* (part) Nieden, 1923, *Das Tierreich, Anura I* : 542.

This race is very similar to the typical form in morphological characters and colour, but has a slightly longer hind limb, the tibio-tarsal articulation reaching nearly to the angle of the mouth, and the ventral surfaces are beset with smaller spots and some degree of dark stippling, giving a generally more dusky appearance. Frequently there is a dark triangular, interorbital spot, apex directed posteriorly, which may, or may not, be continuous with two dark, sinuous streaks which run backwards on each side of the middle line towards the groins. The voice of the male is also different, consisting of a series of low rasping notes followed by a series of high-pitched "pips", thus—crrack, crrack, crrack, pip, pip, pip, pip-pip-pip-pip-pip-pip-pip. (Blanchard.)

DISTRIBUTION : Victoria, south of the Dividing Range.

SPECIMENS EXAMINED.

B.M. 88.7.3.13	♀	Warragul, Gippsland, Victoria.	R. T. Baker. TYPE.
92.9.16.6	♀	Ballarat, Victoria.	Froggatt. Cotype of <i>C. froggatti</i> Fletcher.
Austr. Mus. R.9498	♀	Healesville, Victoria.	
R.8338, 19326	5 ♂♂, 4 ♀♀, juv.	Ballarat, Victoria.	COTYPES of <i>C. froggatti</i> Fletcher.
R.10350	♂	Panton Hill, Victoria.	
R.8331-6 R.10332-4 ¹	5 ♂♂, 18 ♀♀, ¹ 11 juvs. ¹	Warragul, Victoria.	

***Crinia darlingtoni* Loveridge.**

Crinia darlingtoni Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, 8 : 57 (Type locality : 3000-4000 ft., Queensland National Park, MacPherson Range, Queensland); *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 29.

Vomerine teeth absent.¹ Snout obtusely rounded, not prominent, 1.3 times as long as the eye; canthus rostralis rounded; loreal region moderately oblique; nostril equidistant from the eye and the tip of the snout; interorbital space 1.5 times as broad as the upper eyelid; tympanum hidden. Fingers very short, the first reduced to a mere stump (without phalanges); the remainder with distinct subarticular tubercles; palm smooth; two large metacarpal tubercles. Toes short, not fringed, the first rudimentary; remainder slightly dilated terminally, with indistinct subarticular tubercles; a small inner, and sometimes traces of an outer, metatarsal tubercle. Tibio-tarsal articulation reaching the shoulder in adults, the eye in juveniles.

Skin perfectly smooth above and below.

Brown or pinkish brown above with traces of a Microhylid type of colour pattern consisting of a dark median band commencing between the upper eyelids and connecting them, narrowing in the scapular region, broadening in the sacral region, narrowing and then finally bifurcating, the two branches running towards the groins where they terminate in darker spots. A vertical dark bar beneath the eye. A lateral dark band from the nostril, through the eye, above the arm and along the flanks. Hind limbs with a single diagonal cross-bar each on the femur, tibia, and tarsus; a dark spot on the knee and a triangular black spot enclosing the vent. Some or all of these markings may become obscure and the dorsal and lateral bands are frequently broken up, the posterior portions being lost before the anterior. Lower surfaces heavily mottled and stippled with brown, except on the belly and thighs.

Length from snout to vent : ♀ 19 mm.

DISTRIBUTION : 3000-4000 ft., Queensland National Park, MacPherson Range.

SPECIMEN EXAMINED.

M.C.Z. 18302 juv. Type locality. Darlington. Paratype.

***Crinia haswelli* Fletcher.**

Crinia haswelli Fletcher, 1894, *Proc. Linn. Soc. N.S.W.*, 1893, (2), 8 : 522, 526, 530 (Type locality :—near head of Jervis Bay); Noden, 1923, *Das Tierreich, Anna I* : 549.

Epicoracoids very strongly overlapping and extending forwards beyond the

¹ The original description states "mandible toothed," but this is presumed to be a slip, "maxilla" being intended.

clavicles (text-fig. 16). Vomer entire; vomerine teeth present, in short transverse series well behind the level of the internal nares. Snout rounded, 1.2 to 1.5 times as long as the eye, shorter in juveniles than adults, with rounded canthus rostralis and very oblique, convex, loreal region; nostril equidistant from the eye and the end of the snout; tympanum hidden or just perceptible; inter-orbital space 1.1 to 1.2 times as broad as the upper eyelid in females, 1.2 to 1.4 times in males. Fingers slender, free, with well-developed subarticular tubercles; palm smooth; two metacarpal tubercles. Toes slender, fringed; subarticular tubercles well developed; a small inner metatarsal tubercle, but the outer minute or absent; no tarsal fold. Tibio-tarsal articulation reaching the tympanic region.

Skin smooth or with scattered tubercles above; a fold from the posterior corner of the eye above the arm to the middle of the flanks, with a well-marked parotoid gland below it; a circular glandular spot on the flank just in front of the groin. Belly slightly granular, hinder side of the thighs more strongly so; a small pectoral spot close to the insertion of the fore-limb, and a minute papilla on the heel.

Colour in spirit, pale brown, with scattered small darker spots. A dark brown band from the nostril through the eye and below the supra-tympanic fold to the middle of the flanks. Lower surfaces uniform dirty white in juveniles, pale brown in adults with the abdomen covered with large, circular white spots. Groins and concealed surfaces of the limbs dark brown with large white spots. A fine, light, mid-dorsal line may be present. In life, the ground-colour dorsally is chestnut brown, drab, or silver-grey, with an incomplete darker band down the middle, commencing between the eyes; the light spots of the groin and concealed surfaces of the limbs carmine or orange red.

Male with a vocal sac opening by a slit on each side of the tongue and glandular, non-spinous nuptial pads at the base of the two inner fingers and on the inner surface of the forearm.

Length from snout to vent: ♂ 26 mm.; ♀ 32 mm.

DISTRIBUTION: Coastal districts of New South Wales.

SPECIMENS EXAMINED.

Austr. Mus. R.10335	2 ♂♂, ♀, Hgr.	Jervis Bay.	COTYPES.
R.4210,	♂, ♀, 8 juvs.	Maroubra, near Sydney.	
5288, 6132-5			

This species is in many respects intermediate between the smooth-skinned species of the *laevis* group and the granular bellied *signifera-georgiana* group. The peculiar shoulder-girdle, in which the omosternum shows its double origin from the epicoracoids, may be considered primitive, and it is possible that *haswelli* is the most primitive member of the genus.

Crinia georgiana Tschudi.

Crinia georgiana Tschudi, 1838, *Mém. Soc. neuchâtel. Sci. nat.*, 2: 38, 78 (Type locality:—King George's Sound); Kesterstein, 1867, *Nachr. Ges. Wiss. Göttingen*, 18: 347 (part); *idem*, 1868, *Arch. Naturgesch.*, 34: 263; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 264; Fletcher, 1886, *Proc. Linn. Soc. N.S.W.*, (2), 4: 375, 387; *idem*, 1898, *op. cit.*, 22, 1897: 676; Lucas & le Souef, 1909, *Anim. Austral.*: 276; Werner, 1914, *Fauna S.W. Austral.*, 4: 408; Nieden, 1923, *Das Tierreich, Anura I*: 540; Hoffman, 1931, *S. Afr. J. Sci.*, 28: 405 (? possibly *C. signifera*); Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 23.

- Cystignathus georgianus* Duméril & Bibron, 1841, *Expét. Gén.*, 8: 416; Bell, 1843, *Zool. Beagle, Rept.*: 33, pl. 16, fig. 4; Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 30; Krefft, 1865, *Pap. roy. Soc. Tasmania*: 16; Krefft, 1867, *Cal. Industr. Prod. N.S.W., Add.*: 107.
- Pterophryne georgiana* Günther, 1867, *Ann. Mag. nat. Hist.*, (3), 20: 53.
- Crima ignita* Cope, 1866, *J. Acad. nat. Sci. Philad.*, (2), 6: 95 (Type locality:—West Australia).
- Crima signifera ignita* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 25.
- Pterophryne affinis* Günther, 1864, *Proc. zool. Soc. Lond.*: 47, pl. 7, fig. 2 (Type locality:—Western Australia); *idem*, 1864, *Ann. Mag. nat. Hist.*, (3), 14: 312; Krefft, 1865, *Pap. roy. Soc. Tasmania*: 16.
- Crima affinis* Günther, 1868, *Proc. zool. Soc. Lond.*: 480.
- Crima georgiana* var. *affinis*, Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 265.
- Crima affinis affinis* Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 26.
- Crima stolata* Cope, 1867, *J. Acad. nat. Sci. Philad.*, (2), 6: 201 (Type locality:—West Australia).
- Crima georgiana* var. *stolata* Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 264; Fry, 1914, *Rec. W. Aust. Mus.*, 1: 203, pl. 28, fig. 1.

Vomerine teeth usually present in adults. Snout moderate, rounded, not prominent, 1.14 to 1.35 times as long as the eye (mean of 29 specs. 1.25); canthus rostralis rounded; loreal region oblique; nostril equidistant from the eye and the end of the snout; tympanum usually slightly distinct $\frac{1}{2}$ to $\frac{2}{3}$ the diameter of the eye; interorbital space about once and a quarter as broad as the upper eyelid. Fingers moderately long, free, with well-developed subarticular tubercles; palm tubercular; two metacarpal tubercles. Toes long, without dermal fringes; subarticular tubercles well developed; two metatarsal tubercles and an oblique tarsal fold from the inner. Tibio-tarsal articulation reaching the tympanic region or the posterior corner of the eye.

Skin above from quite smooth to distinctly and irregularly rugose, specimens from the same area showing all intermediate conditions. From a perfectly smooth frog (*affinis*) the next stage is the progressive development of a dorso-lateral fold from behind the upper eyelid (*ignita* or *stolata*); smaller secondary folds may be associated with these and, with the development of ridges and warts elsewhere, the dorso-laterals tend to be broken up. There is always a parotoid-like glandular swelling above and slightly in advance of the arm and a small dermal papilla on the heel. Cloacal flap fimbriated. Lower surfaces coarsely granular; a triangular, finely granular patch on the hinder side of the thighs behind the vent.

As in *C. signifera*, the dorsal colour pattern is associated with the rugosity of the skin. Smooth specimens have the *affinis* colour, uniform, or nearly uniform pale brown above, with a dark brown lateral stripe from the nostril through the eye to the groin, partially interrupted in the parotoid region. Where the skin is warty the warts are each picked out in dark brown, so that in the *ignita* or *stolata* varieties there are two dark longitudinal dorsal stripes separated from each other by a lighter area and from the lateral stripe by an area of grey; a triangular or V-shaped interorbital blotch is also developed and dark markings radiating from the eye on the upper lip. With the breaking up of the dorso-lateral folds and the increased development of warts and folds elsewhere the whole dorsum has a complex, irregular pattern of dark marblings separated by lighter brown or silvery grey. Limbs cross-banded. Armpits, groins and hinder aspect of the knees brilliant carmine, this colour being "fast" in alcohol (traces still present after nearly a century) but fugitive in formalin (destroyed in six months). Lower surfaces of juveniles and half-grown specimens washed with pale brown except for a white median line; the tips of some of the warts and especially a larger, pectoral spot on each side white or rose-tipped. With increasing age the brown

wash tends to become less and less distinct, but the pectoral glandular spots remain a clearer white than the rest of the lower surfaces. Throat of the breeding male infuscate.

Male with a vocal sac opening by a slit on each side of the tongue, but without any definite nuptial pad.

Length from snout to vent: ♂♂ 18.5-33.5 (mean of 14 exs. 26.0); ♀♀ 22.6-35.0 (mean of 12 exs. 27.3).

DISTRIBUTION: West Australia.

The localities "Port Essington" and "Sydney" recorded by Boulenger for this species, based on specimens in the British Museum, are very doubtful indeed, and can be neglected unless confirmation is forthcoming—an unlikely event after the lapse of more than half a century.

		SPECIMENS EXAMINED.		
B.M.	R.R.1936.12.3.86	♀	W. Australia.	Dämel. Type of <i>Pterophrynus affinis</i> .
	64.10.27.56-57	2 ♀♀	King George's Sound, W.A.	Krefft.
	85.0.2.20-22	♂, 2 ♀♀	Albany, W.A.	Ling Roth.
	1929.12.11.3	♀	Lefroy River, near Pemberton, W.A.	Nicholls.
	1933.1.1.1-2	Hgr. and juv.	Angusta, W.A.	Brooks.
M.C.Z.	13011-5 (part)	♂	Manjimup, W.A.	"
	18395	♂	Lesmurdie, W.A.	Nicholls.
B.M.	R.R.1936.12.3.85	♂	"Port Essington" (?).	Fleming.
	R.R.1936.12.3.83-84	♂, 2 ♀♀	" " (?).	"
	70.6.26.49-51, 24	♀, 5 Hgr.	?	Krefft.
	45.5.25.26	♀	King George's Sound.	C. Darwin.
	58.8.21.1	♀	?	(Günther.)
	62.8.1.1-8	3 ♂♂, 3 ♀♀, 2 juvs.	"Sydney" (?).	(Stevens.)
Austr. Mus.	R.6758	♂	Cape Leeuwin, W.A.	
	R.6761	♀	" "	
	R.7710	juv.	Tudor, W.A.	" "
	R.7740	♂	Lucky Bay, 26 miles E. of Esperance, W.A.	
	R.7741	♂	Mississippi Bay, E. of Esperance, W.A.	
	R.7742	imm. ♀	Ditto.	
	R.7746	♂, 2 Hgr., 1 juv.	Below Forts, Albany, W.A.	
	R.9979	♀	Between Carnarvon and N.W. Cape.	
	R.10329	♂	Mt. Barker, W.A.	
	R.10330	2 ♂♂	Como Swamp, Perth, W.A.	
	R.10331	2 ♂♂, ♀	Ditto.	
	R.10462	2 ♂♂	South-west Australia.	
	R.10952	♂	Pemberton, W.A.	
	R.10958	2 juvs.	Manjimup, W.A.	
	R.10968	juv.	Rottnest Island, W.A.	

Like *Crinia signifera* this species exhibits a good deal of variation in colour pattern in correlation with variations in the degree of development of the dorsal warts and folds. The two species parallel one another very closely in these characters, and the variants of each, though forming a continuous series, can be roughly subdivided into three main groups, the smooth, uniform, *affinis* type of pattern, the striped *stolata* or *ignita* pattern with its concomitant longitudinal folds and the irregularly marbled and warty typical form. It seems probable that Loveridge in his recent (1935) consideration of the genus has assigned too

much importance to these characters, and rather neglected the other morphological characters such as vomerine teeth, digital fringes and degree of development of the tympanum which the present author believes to provide a surer index of relationship. As a result Loveridge recognizes no less than five separate forms (out of a potential six), but applies specific and subspecific names to them on the basis of colour and geography. The result is as follows :

Species.	Colour var.	Locality.	Loveridge's name.
<i>C. signifera</i>	Typical	S.E. Australia.	<i>C. signifera signifera</i> .
	" <i>ignita</i> ."	S.E. Australia.	" " "
	" <i>affinis</i> ."	S.E. Australia.	<i>C. affinis haswelli</i> .
<i>C. georgiana</i>	Typical.	W. Australia.	<i>C. georgiana</i> .
	" <i>ignita</i> ."	W. Australia.	<i>C. signifera ignita</i> .
	" <i>affinis</i> ."	W. Australia.	<i>C. affinis affinis</i> .

This also leads to some entirely fictitious conclusions (p. 28) as to the development of vomerine teeth in frogs from the south-west of Australia and their absence in eastern " forms " of the same " species." Actually the presence or absence of vomerine teeth appears to be a good specific character and the two species may be distinguished thus :

<i>C. georgiana.</i>	<i>C. signifera.</i>
Vomerine teeth usually present.	Vomerine teeth always absent.
Digital fringes absent.	Digital fringes present in adults.
Tympanum larger and slightly distinct.	Tympanum smaller, not distinct.
Flash colours of carmine strongly developed and fast.	Flash colours of orange or carmine absent or, if present, fugitive.

***Crinia glauerti* Loveridge.**

Crinia glauerti Loveridge, 1933, *Occ. Papers Boston Soc. nat. Hist.*, 8 : 57 (Type locality :—Mundaring Weir, 30 miles N.E. of Perth, West Australia) ; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, 78 : 24.

The status of this species is doubtful. In the first place, although it is described as a " miniature replica " of *C. georgiana*, digital fringes are said to be present and vomerine teeth absent—both characters of *signifera* rather than *georgiana*. However, in the two paratypes examined vomerine teeth are present, though few in number, and there are no true digital fringes, but only the lateral seams found in most frogs ; they have the appearance of small examples of *georgiana*, though having been fixed in formalin, it is not possible to say whether the characteristic red on the legs of that species was also present. If the name is applicable to these small, but sexually mature, examples which are so closely allied to *georgiana*, the only differences to be found distinguishing the two are size and the length of the snout. In *signifera* it is found that there is a great range of variation in the size at which sexual maturity is reached, and that this is not wholly connected with locality ; it may conceivably be dependent on the climatic and food conditions prevailing during the larval and post-larval period ; the same state of affairs might well be expected to occur in *georgiana* and, in that event, *glauerti* would fall within the range of size of *georgiana*. There remains

only the length of the snout. In the examples of *glauerti* examined it is 1.35 times as long as the eye; this is equal to the maximum length found (twice) in a series of 29 examples of *georgiana*. Obviously it is necessary to know much more concerning the range of variation of this character in *glauerti* before it can be used with confidence diagnostically.

Vomerine teeth present. Snout pointed, slightly prominent, 1.35 times as long as the eye, with somewhat marked canthus rostralis; nostril equidistant from the eye and the end of the snout; tympanum slightly indicated; interorbital space 1.4 times the width of the upper eyelid. Fingers slender, free, with well-developed subarticular tubercles; palm tubercular; two metacarpal tubercles. Toes long, free, without fringes, but with well-developed subarticular tubercles; two metatarsal tubercles, the inner about $\frac{1}{3}$ its distance from the tip of the inner toe, an oblique tarsal fold from the inner metatarsal tubercle. Tibio-tarsal articulation reaching the tympanic region or the posterior corner of the eye.

Skin somewhat warty with a pair of curved folds, convex towards the mid-line, on the scapular region. Granular beneath and on the hinder side of the thighs; a pectoral glandular spot close to the insertion of the arms; a small papilla on the heel.

Blackish above (formalin preservation) with traces of a darker pattern, especially an interorbital mark; popliteal region white (? red in life). Lower surfaces dirty white, marbled with black in females; throat of breeding male infuscate.

Male with a vocal sac opening by a slit on each side of the tongue; no nuptial pad.

Length from snout to vent: ♂♂ 14.5–15.5 mm.; ♀♀ 20.5 mm.

DISTRIBUTION: Known only from the type locality, near Perth, West Australia.

SPECIMENS EXAMINED.

M.C.Z. 18422	♀	Mundaring Weir, near Perth.	Darlington. (PARATYPE.)
Austr. Mus. 10910	♂	" " " "	Darlington. (PARATYPE.)
Swedish Mus. 1557	♂♀	" " " "	Mjöberg.

***Crinia tasmaniensis* (Günther).**

¹ *Camariolius varius* (part) Peters, 1863, *Mber. Akad. Berlin*: 236.

Pterophrynus tasmaniensis Günther, 1864, *Proc. zool. Soc. Lond.*: 48, pl. 7, fig. 3 (Type locality:—van Diemen's Land); *idem*, 1864, *Ann. Mag. nat. Hist.*, (3), **14**: 313; Krefft, 1865, *Pap. roy. Soc. Tasmania*: 16.

Crinia tasmaniensis Keferstein, 1868, *Arch. Naturgesch.*: 265; Günther, 1868, *Proc. zool. Soc. Lond.*: 480; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 266; Lucas & le Souef, 1909, *Anim. Austral.*: 276; Nieden, 1923, *Das Tierreich, Anura* I: 541, fig. 373; Blanchard, 1929, *Aust. Zool.*, **5**, 4: 324; Loveridge, 1934, *Pap. Proc. roy. Soc. Tasmania*, 1933: 60; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 28.

Camariolius (Pterophrynus) tasmaniensis (?) Parker, 1881, *Phil. Trans. roy Soc. Lond.*, **3**: 102, pl. 19, figs. 1–5.

Vomerine teeth vestigial or, usually, absent. Snout depressed, not prominent, 1.3 to 1.5 times as long as the eye; canthus rostralis rounded; loreal region very oblique; nostril a little nearer the eye than the end of the snout; tympanum indistinct; interorbital space 1.2 to 1.4 times as broad as the upper eyelid. Fingers moderate, free, with well-developed subarticular tubercles; palm tubercular; two metacarpal tubercles. Toes long, with well-marked dermal fringes;

¹ See p. 89 below.

subarticular tubercles well developed; two metatarsal tubercles; no tarsal fold. Tibio-tarsal articulation reaching the shoulder or tympanum in adult females and from the latter point to the eye in males and juveniles.

Skin smooth or with more or less distinct plicae and small warts dorsally; glandular but smooth or feebly granular ventrally except behind the thighs, which are strongly granular. Indications of a minute papilla on the heel; a parotoid glandular thickening.

Dark brown, grey or olive above, with darker longitudinal stripes or spots. Usually a lateral stripe from the nostril through the eye, interrupted above the arm, and a pair of dorso-lateral stripes separated from the laterals by a light brown, orange or even reddish stripe; a dark, triangular or V-shaped inter-orbital spot and a vertical dark bar beneath the eye. Lower surfaces brown or blackish, marbled with white anteriorly and with white or bright red spots and blotches posteriorly and on the limbs; the extent of each colour is variable, so that the belly may appear light with dark vermiculations; a pair of pectoral glandular spots also red. This red pigment is fast in alcohol (persistent after 80 years) but destroyed by formalin. Gular region of the male almost completely black.

Male with a vocal sac opening by a slit on each side of the tongue and a glandular, not rugose, nuptial pad at the base of the inner digit, not extending appreciably on to the forearm.

Length from snout to vent: ♂ 24 mm.; ♀ 30 mm. Juveniles at metamorphosis: 9-10 mm.

The species is apparently strictly aquatic. Breeding season extended in the summer months; sexual maturity reached at the end of the second season after metamorphosis. Eggs 46 to 69 in a clutch (Blanchard, 1929).

DISTRIBUTION: Tasmania at relatively high altitudes (2500-4000 ft.).

SPECIMENS EXAMINED.

			COTYPES.
B.M. 58.11.25.63	3 ♂♂, 2 ♀♀, 2 juvs.	Tasmania.	
1928.4.25.1	♀	National Park, Tasmania.	Blanchard.
1936.12.2.3-7	1 ♂, 4 ♀♀	Cradle Valley, Tasmania.	"
1936.12.2.8	♀ skel.	" "	"
Austr. Mus. R.4400-4401, 5087	2 ♂♂, juv.	Summit of Mt. Wellington, Tas- mania.	
R.10337, 10349	3 ♂♂, ♀	The Spring, Mt. Wellington, Tasmania.	
R.10336	♀	Tasmania.	
R.10339-10349	♂, 3 ♀♀	Cradle Valley, Tasmania.	"
R.10338	♂	Ulverstone, Tasmania.	"
R.10341, 10342, 10345, 10347)	4 ♂♂, ♀	National Park, c. 4000 ft., Tas- mania.	"
R.10343, 10344, 10346, 10348)	5 ♂♂, 2 ♀♀, juv.	Lake Fenton, National Park, Tasmania.	"
R.10074	♂	Mt. Wellington, Tasmania.	
R.10352	♂	Between Port Arthur and Roger's River, Tasmania.	

Crinia acutirostris Andersson.

Crinia acutirostris Andersson, 1919, *Svenska Vetensk. Akad. Handl.*, 52, 9: 8, pl. 1, fig. 2 (Type locality: -Malanda, Queensland); Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 30.

Vomerine teeth absent. Snout truncate, not projecting beyond the labial margin, once and a quarter as long as the eye; canthus rostralis angular; loreal

region nearly vertical; nostril equidistant from the eye and the end of the snout, interorbital space a little broader than the upper eyelid; tympanum slightly distinct, a little less than half the diameter of the eye. Fingers free, with well-developed subarticular tubercles; palm smooth; two metacarpal tubercles. Toes long, slightly dilated terminally, with well-marked dermal fringes; subarticular tubercles moderate; a single, inner metatarsal tubercle; a tarsal fold present or absent. Tibio-tarsal articulation reaching the eye.

Skin quite smooth or granular and tuberculate with spinose warts in breeding males, these spines forming series on each side of the vent and on the hind limbs, with a pair on the back behind the eyes and others forming a triangle on the posterior part of the back; sometimes a narrow glandular fold from the eye to the groin. Smooth beneath. Sometimes a papilla on the heel.

Grey-brown above, uniform or with a darker, triangular, interorbital marking and some smaller dark spots on the posterior part of the back; a dark lateral band from the nostril to the groin, sometimes narrowly light-edged above; two light bars on the lip beneath the eye; groins yellow or red; limbs cross-barred; lower surfaces white (reddish-yellow in life), with a reticulate brown stippling; throat of the male infuscate.

Male with a vocal sac opening by a slit on each side of the tongue.

Length from snout to vent: ♂ 23 mm.; ♀ 30 mm.

DISTRIBUTION: Queensland.

SPECIMENS EXAMINED.

M.C.Z. 18416	♀	Mt. Spurgeon, Q.	Darlington.
B.M. 1938.7.2.1	♂	Mundubbera, Q.	Sherrin.

Crinia signifera Girard.

- Crinia (Ranidella) signifera* Girard, 1853, *Proc. Acad. nat. Sci. Philad.*: 422 (Type locality:—New Holland); Cope, 1867, *J. Acad. nat. Sci. Philad.*, (2), 6: 203.
- Ranidella signifera* Girard, 1858, *U.S. Explor. Exped., Herp.*: 44, pl. 3, figs. 39–43.
- Crinia signifera* Boulenger, 1882, *Cat. Batr. Brit. Mus.*, ed. 2: 265; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), 4: 375; *idem*, 1891, *op. cit.*, (2), 6: 272–274; *idem*, 1892, *op. cit.*, (2) 7: 8, 9; Lucas, 1892, *Proc. roy. Soc. Victoria*, 4: 61; Fletcher, 1894, *Proc. Linn. Soc. N.S.W.*, (2), 8: 526, 527, 528, 530; *idem*, 1898, *op. cit.*, 22, 1897: 676; Lucas & le Souef, 1909, *Anim. Austral.*: 275, fig.; English, 1910, *Proc. zool. Soc. Lond.*: 629, pl. 51, figs. 4, 5; Werner, 1914, *Fauna S.W. Austral.*: 411; Andersson, 1913, *K. Svenska Vetensk.Akad. Handl.*, 52, 4: 12, pl. 1, fig. 1; Roux, 1920, *Rev. suisse Zool.*, 28: 115; Nieden, 1923, *Das Tierreich, Anura* 1: 541; van Kampen, 1923, *Amph. Indo-Austral. Archip.*: 21; Blanchard, 1929, *Aust. Zool.*, 5, 4: 326; Waite, 1929, *Rept. Amph. S. Austral.*: 257; Glauert, 1929, *J. roy. Soc. W. Austral.*, 15: 45; Trewavas, 1933, *Phil. Trans. roy. Soc. Lond.*, 222, B: 436, figs. 26, 27.
- Crinia signifera signifera* Loveridge, 1934, *Pap. roy Soc. Tasmania*, 1933: 59; Oeser, 1934, *Bl. Aquar. -u. Terrarienk.*, 45: 355; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 24.
- Pseudophryne australis* (part) Fitzinger, 1861, *S.B. Akad. wiss. Wien*, 42: 415.
- Pterophryne verrucosus* Lutken, 1862, *Vidensk. Medd. naturh. Foren. Kbh.*: 302, pl. 1, fig. 4 (Type locality:—Australia).
- Crinia verrucosa*, Günther, 1868, *Proc. zool. Soc. Lond.*: 478.
- ? *Camariolius varius* Peters, 1863, *Mber. Akad. Beylin*: 236 (Type locality:—near Adelaide).
- Pterophryne varius* Steindachner, 1867, *Reise Novara, Zool., Amph.*: 31, pl. 2, figs. 1–6; Krefft, 1867, *Cat. Industr. Prod. N.S.W.*, Add.: 107.
- Crinia georgiana* var. *varia* Kieferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, 18: 349.
- Crinia varia* Kieferstein, 1868, *Arch. Naturgesch.*, 34: 264, pl. 6, figs. 11–13.
- Crinia stictiventris* Cope, 1867, *J. Acad. nat. Sci. Philad.*, (2), 6: 203 (Type locality:—Australia).
- Pterophryne fasciatus* Steindachner, 1867, *Reise Novara, Zool., Amph.*: 31, pl. 5, figs. 3, 4 (Type locality:—New South Wales).
- Pterophryne fasciata* Günther, 1867, *Ann. Mag. nat. Hist.*, (3), 20: 53.
- Crinia fasciata* Günther, 1868, *Proc. zool. Soc. Lond.*: 478.

Crinia georgiana var. *laevipes* Keferstein, 1867, *Nachr. Ges. Wiss. Göttingen*, **18** : 348 (Type locality:—Sydney).

Cystignathus sydneyensis Krefft (*nom. nud.*), Keferstein, 1867, *loc. cit.*

Crinia affinis haswelli (non Fletcher) Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 27.

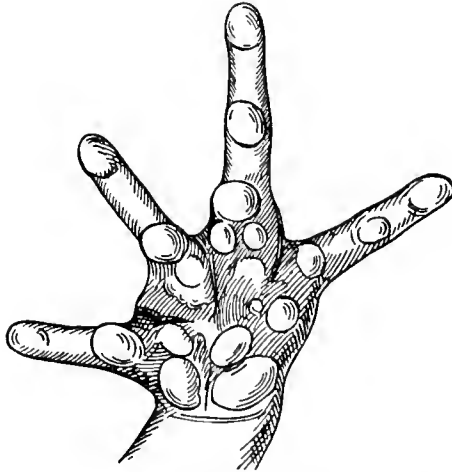
Crinia georgiana (part) Loveridge, 1935, *tom. cit.* : 23.

Pseudophryne semimarmorata (non Lucas) Loveridge, 1935, *tom. cit.* : 34.

This species exhibits a great deal of variation both in morphological characters and colour-pattern. The latter is believed to have little taxonomic significance, but at least two apparently distinct geographical races appear to be recognizable, in addition to the typical form, as indicated in the key. None of the existing names are obviously applicable to either of these forms, and it will lead to less confusion to give them new names, which may subsequently have to be placed in synonymy, rather than to use, incorrectly, ones which already exist.

Crinia signifera signifera (Girard).

Vomerine teeth absent. Snout short, rounded, not prominent, 1.1 to 1.4 times as long as the eye; canthus rostralis rounded; loreal region oblique; nostril equidistant from the eye and the end of the snout, the internarial space less than, or equal to the distance from eye to nostril; tympanum hidden; inter-orbital space about 1.3 times the width of the upper eyelid. Fingers moderately long, free, with well-developed subarticular tubercles; palm tubercular; two



TEXT-FIG. 19.—Hand of *Crinia signifera*. $\times 6$.

metacarpal tubercles. Toes long, almost always with well-developed dermal fringes in adults, though these may be only feebly developed or absent in juveniles (see table of dimensions below); subarticular tubercles well developed; two metatarsal tubercles, the outer not, or scarcely, more than $\frac{1}{3}$ its distance from the tip of the inner toe and an oblique tarsal fold from the inner. Tibio-tarsal articulation reaching the tympanic region or the eye in males and the shoulder or tympanum in females.

Skin above quite smooth to distinctly and irregularly warty; a complete transition can be traced in specimens from the same region between these extremes,

with an intermediate stage with two strong folds down the back commencing behind the upper eyelids and slightly convergent on the scapular region ; with the development of additional warts elsewhere these folds may be broken up, though usually traces of them persist ; a more or less distinct glandular aggregation above the insertion of the fore-limb. Belly and gular region coarsely granular ; a definite area finely granular below the vent on the hinder side of the thighs. A small papilla on the heel. Cloacal flap fimbriated.

The colour pattern is intimately connected with the degree of wartiness of the skin. Smooth specimens are almost uniform brown above, with a dark lateral stripe from the nostril through the eye, interrupted behind the tympanic region and continued along the flanks to the groin ; lips with dark bars irregularly radiating from the eye ; usually there is an indistinct triangular marking between the eyes, and a fine white line from snout to vent. With the development of warts, each tends to be light in the centre, edged with darker ; in consequence, where there are two well-developed dorsal folds a striped pattern is developed, the centre of each fold forming a narrow light line bordered on each side by darker, these darker areas being in turn separated from each other in the middle and from the lateral stripe by broader light zones, which may be marked with very narrow dark streaks. Where the dorsum is irregularly warty all over, a pattern of obscure irregular darker marblings ensues. Limbs with diagonal cross-bars. Anal flap invariably with a light dot. Lower surfaces more or less profusely brown spotted, these markings attaining their maximum development in specimens from New South Wales which have the colours almost reversed, i.e. are brown with large white spots. There is constantly a pair of small white, glandular pectoral spots, one close to the insertion of each fore-limb. Gular region of male plicate and infusate, but the edge of the jaw lighter. In life the colours are browns and greys above, but there may be suffusions of yellow, orange or carmine on the concealed surfaces of the limbs and flanks, these colours being fugitive in alcohol.

Male with a vocal sac opening by a slit on each side of the tongue, and in the breeding season, a non-spinous glandular area on the base of the inner finger and distal half of the inner surface of the forearm.

Length from snout to vent, maxima : ♂ 25 mm. ; ♀ 30 mm. Juveniles at metamorphosis : 6·7–10 mm.

There is some geographical variation in size with latitude, and in the size at which maturity is attained, and digital fringes developed. This may be summarized as follows :

Locality.	No.	Length ♂♂.	Mean.	Length ♀♀.	Mean.	Minimum with fringes.	Maximum without fringes.
Queensland and North. Terr.	14	15·5–18·5	16·9	17–19	18·3	15·5	17
West. Austr.	57	11·5–24	18·4	17–26	21·1	11·5	20
N.S.W.	38	17·2–20	18·7	17·3–20·5	21·5	17·2	18·5
S. Austr.	32	18·5–25	21·2	19–30	26·0	18·3	19·3

On Kangaroo Island there may be a distinct race, recognizable by even larger size and suppression of the digital fringes ; unfortunately the series examined is somewhat shrivelled, so that the latter character cannot be satisfactorily determined. Females of 23 mm. do not appear to be fully mature and have only rudimentary digital fringes.

The species is largely aquatic, with a considerable tolerance of differing conditions from mountain streams to shallow, muddy pools. Breeding occurs throughout the year after rain in New South Wales and South Australia. The note of the males is an insect-like chirrup, embrace lumbar; eggs to the number of about 150 are laid in masses attached to objects at the bottom of the water; individual eggs are about 1.3 mm. in diameter, with a jelly-capsule of 4 mm. in diameter. Hatching takes place in about ten days after oviposition, and the tadpole stage is prolonged (estimated as three months by Harrison, 1922 : 31).

DISTRIBUTION: New South Wales, Victoria (?), South Australia, West Australia, Queensland and Northern Territories; New Guinea (Merauke).

SPECIMENS EXAMINED.

B.M.	43.5.19.75	♀	W. Australia.	(Turner.)
	45.5.25.25	♂, 2 ♀♀	" Australia."	Charles Darwin.
	44.10.17.20	♂	" "	Earl of Derby.
	04.10.27.42-44	3 ♀♀	Sydney.	Kreffit.
	04.7.8.5-7	4 ♀♀	" "	" "
	62.8.1.1-8 (part)	♀	" "	Stevens.
	60.6.16.39	♀	" "	(Cumung.)
	70.6.26.22 (part)	♀	Port Macquarie, N.S.W.	Kreffit.
	1936.7.15.4	juv.	Dorrigo, N.S.W.	Heron.
	1937.7.22.41	♂	Como, near Perth.	Nicholls.
	1937.10.2.1-4	2 ♂♂, 2 ♀♀	Near Perth.	Mjoberg.
	1923.11.11.4-5	2 ♀♀	Bukalowie Cave, near Carrieton, S.A.	Wood Jones.
	1923.11.11.3	Hgr.	W. Kangaroo Island, S.A.	" "
M.C.Z.	19586	♀	Third Creek, Magill, S.A.	Tepper.
B.M.	1931.7.1.61-71	5 ♂♂, 6 ♀♀	Baldwin's Lake, north of Mt. Toolbrunup, Albany, W.A.	Baldwin.
	1931.7.1.49-60	12 juvs.	Ditto.	" "
	—	♀, Hgr.	Abrolhos.	(Günther.)
Mus.	Basel 3180	♀	Merauke, N. Guinea.	Wirz.
Mus.	Leiden 2253	♀	New Holland.	Perron & Lesueur.
" "	4238	♂	Sydney.	(Godeffroy Mus.)
Swedish Mus.	1552 (part)	13 ♂♂, 9 ♀♀,	Near Perth.	Mjoberg.
	1559	5 juvs.	" "	" "
	1559	2 ♂♂, 2 juvs.	Yandina, S.E. Queensland.	" "
	1553	2 ♂♂, ♀	Adelaide, S.A.	" "
			FitzRoy River, Kimberley Divn., W.A.	" "
	1554-1559	9 ♂♂, 4 juvs., larvae	St. George's Range, Kimberley Divn., W.A.	" "
Austr. Mus.	R.6757	♀	Pallngup River, N. of Cape Riche, W.A.	" "
	R.7539	2 ♂♂, ♀	Newcastle, W.A.	" "
	R.7694	2 juvs.	Albany, W.A.	" "
	R.7701	♀	" "	" "
	R.7704	11 juvs.	Bornham, W.A.	" "
	R.7708-7709, 7711	♀, 2 juvs.	Tudor, W.A.	" "
	R.7746 (part)	♀	Below Forts, Albany, W.A.	" "
	R.8415	2 ♂♂, 4 ♀♀, 4 juvs.	Donnybrook, Mt. Barker, W.A.	" "
	R.9080	♀	Between Carnarvon and N.W. Cape, W.A.	" "
	R.10323	♂, 4 ♀♀	Perth, W.A.	" "
	R.10331 (part)	♀	Como Swamp, Perth, W.A.	" "
	R.10069	♀, juv.	Manjup, W.A.	" "
	R.10084	♂	Night Cliff, Port Darwin, N. Terr.	" "

Austr. Mus. R.7413	7 ♂♂, 3 ♀♀	Waroo, Inglewood, 60 miles W. of Stanthorpe, Q.
R.8636	♂, 2 ♀♀	Isis Scrub.
— 6953	♀	New South Wales.
— 6965	♀	Sydney, N.S.W.
A.2879	imm. ♂	Smithfield, near Sydney, N.S.W.
R.204	2 ♂♂, ♀	Kangaroo Valley, N.S.W.
R.4109	♂	Lindfield, near Sydney, N.S.W.
R.4209	5 ♀♀	Maroubra, near Sydney, N.S.W.
R.4250	4 ♀♀	Warrell Creek, Nambucca River, N.S.W.
R.4327-9	10 ♂♂	Lindfield, near Sydney, N.S.W.
R.4352	♂	Woodford, Blue Mts., N.S.W.
R.4364	♂	Lindfield, N.S.W.
R.4370	♂, 2 ♀♀	Bundanoon, N.S.W.
R.4397-9	6 ♂♂, 2 ♀♀	Lindfield, N.S.W.
R.4628-9	♂, ♀, 8 Hgr.	Warrell Creek, Nambucca River, N.S.W.
R.4764	2 ♀♀	Tamworth, N.S.W.
R.5210	2 ♂♂, 2 ♀♀	Megalong Valley, Blue Mts., N.S.W.
R.5888-5892	4 ♂♂, 9 ♀♀, 3 juvs.	Gurravembi, near Macksville, Nambucca River, N.S.W.
R.6304-6	4 ♂♂, 5 ♀♀, 5 juvs.	Ditto.
R.6490	2 ♂♂, ♀	Tweed River, N.S.W.
R.6496-8	4 ♀♀	Wilde's Meadow, Moss Vale, N.S.W.
R.6500	♂♀	Avoca, near Gosford, N.S.W.
R.7328	3 ♂♂, ♀	Bungendore, 2290 ft., N.S.W.
R.7378-7380	10 ♀♀	Burrawang, 2000 ft., N.S.W.
R.7397 (part)	2 ♂♂, ♀	Yass, N.S.W.
R.7977	♂	Upper Colo, via Richmond, N.S.W.
R.8085	♀, juv.	Maroubra, Sydney, N.S.W.
R.8242	4 ♂♂, 4 ♀♀	Longueville, near Sydney, N.S.W.
R.8303, 8321	8 ♂♂, 4 ♀♀, 2 juvs.	Maroubra, near Sydney, N.S.W.
R.8487	4 Hgr.	Wilde's Meadow, Moss Vale, N.S.W.
R.8490	11 ♂♂, ♀♀ and juvs.	Tweed River, N.S.W.
R.8497	3 ♀♀	Wilde's Meadow, Moss Vale, N.S.W.
R.8502	♂	Avoca, N.S.W.
R.8638 (part)	♀	Bundanoon, N.S.W.
R.8725	♀	Northwood, near Sydney, N.S.W.
R.8765	2 ♂♂, 3 juvs.	Long Bay Rifle Range, Sydney, N.S.W.
R.9835	juv.	Rose Bay, Sydney, N.S.W.
R.10352	♂, 2 ♀♀	Mosman, Sydney, N.S.W.

Austr. Mus.	R.10530	♀	Mt. Keira, 1100 ft., N.S.W.
	R.10562	7♂♂, juv.	Maroubra, Sydney, N.S.W.
	R.11383	2♀♀	Comboyne, N.S.W.
	R.11868	♀	Cooper's Creek, Huon- brook, N.S.W.
	—	46♂♂, ♀♀ juvs.	Adelaide, S.A.
	R.7168	2♂♂, 5♀♀	Port Lincoln, Eyre's Penin- sula, S.A.
	R.7127	♂, 4♀♀, juv.	Birchmore Lagoon, Kan- garoo Island, S.A.
	R.7132-3	♂, 3♀♀, 3 juvs.	Ditto.
	R.7151	2♂♂, 4♀♀	Timber Creek, Kangaroo Island, S.A.
	R.7161	♀, 5 juvs.	Deep Creek, Kangaroo Island, S.A.

The specimens referred to *haswelli* by Loveridge (1935: 27) have no vomerine teeth, and, to judge from the specimen examined (19586), no red on the limbs; they appear to be normal smooth-skinned *signifera* with which several of them had previously been associated in the collections of the M.C.Z.

The colour pattern of *signifera* is extremely variable, and is paralleled by that of its congener *C. georgiana*; an almost exactly similar series of colour variations in a single species is exhibited by the S. American *Physalaemus cuvieri* Fitzinger. *Camariolius varius* Peters 1863 is included in the synonymy of this species, although, as Cope (1867: 203) and Boulenger (1882: 266) pointed out, Peters may have had two species confounded; in the description of *varius* based on six specimens, five from Adelaide and one from an unknown source, the belly is said to be granular or smooth. The specimens from Adelaide are almost certain to be *signifera*, but the other, if it had a smooth venter, may be *tasmaniensis*. Should this prove to be so, Cope's restriction of the name *varius* for the smooth-bellied form must stand and the name would have priority over *tasmaniensis* (1864).

Crinia signifera englishi subsp. n.

Vomerine teeth absent. Snout short, somewhat pointed to slightly prominent, with obtuse canthus rostralis and very oblique lores, 1.2 to 1.5 times as long as the eye; nostril equidistant from the tip of the snout and the eye, or a little nearer the latter; internarial space as long as, or slightly longer than, the distance from eye to nostril; interorbital space 1.25 to 1.5 times as wide as the upper eyelid. Fingers moderate, free, with well-developed subarticular tubercles; palm tubercular; two metacarpal tubercles. Toes moderate, with well-developed dermal fringes in adults; subarticular tubercles well developed; two metatarsal tubercles, the outer approximately half as long as its distance from the tip of the inner toe, and an oblique tarsal fold from the inner. Length of the foot contained 1.84 to 2.23 times in the length from snout to vent (mean of 32 specimens 2.01). Tibio-tarsal articulation reaching the tympanic region.

Skin with small scattered warts above and usually with a more or less continuous, dorso-lateral, linear row on each side of the back; a glandular aggregation in the parotoid region. Lower surfaces and hinder side of the thighs granular. A small papilla on the heel. Cloacal flap fimbriated.

Brown or greyish above, almost uniform sometimes, but usually with more or less distinct traces of some or all of the following darker brown markings.

A triangular interorbital spot, the apex directed posteriorly; a dark dorso-lateral stripe on the dorsolateral line of warts; a canthal stripe continued behind the eye as a temporal spot and a lateral stripe from above the fore-limb to the groin. Lower surfaces yellowish white, mottled with brown; a white, glandular pectoral spot close to the insertion of the fore-limb. Anal flap lighter. Throat of the male infuscate. In life the ground-colour dorsally is dark brown or grey as a rule, males tending to be darker than females, and sometimes almost black. There may be markings of bright orange and the hinder side of the thighs may be washed with blood-red, though this colour is fugitive; tadpoles and juveniles black.

Male with a vocal sac opening by a slit on each side of the tongue and a glandular, non-spinous nuptial pad on the inner finger and distal half of the forearm.

Length: ♂♂ 18.8–24.5 mm. (mean of 18, 22.2 mm.); ♀♀ 21.5–30.0 mm. (mean of 13, 24.9 mm.).

Largely aquatic with a wide tolerance, but very active on land. Call of the male a cricket-like chirp; breeding season chiefly from May to August; eggs laid in masses spread over stones and weeds at the bottom of shallow water. Apparently does not hibernate (English).

DISTRIBUTION: Tasmania.

COTYPES EXAMINED.

B.M. 1901.9.13.10-19	9 ♂♂, 10 ♀♀	Near Launceston.	English.
1936.9.7.4-7	4 ♂♂	Near Devonport.	"
Austr. Mus. 6041-5	5 ♂♂, 2 ♀♀	Launceston.	
10353	♀	Eagle Hawk Neck.	Blanchard.
10356-7	2 ♂♂, 4 ♀♀	National Park.	"
7601	♂♀	Ulverstone.	
Macleay Mus. —	3 ♂♂, 4 ♀♀	George's Bay.	

Crinia signifera montana subsp. n.

Vomerine teeth absent. Snout short, bluntly rounded, not prominent, with obtuse canthus rostralis and very oblique lores, 1.2 to 1.5 times (mean of 31, 1.34) times the length of the eye; nostril a little nearer the eye than the end of the snout; internarial space longer than the distance from eye to nostril; interorbital space 1.2 to 1.5 times the width of the upper eyelid. Fingers moderate, free, with well-developed subarticular tubercles; palm tubercular; two metacarpal tubercles. Toes with short, fleshy fringes in adults; subarticular tubercles well developed; two metatarsal tubercles, the inner about half as long as its distance from the tip of the inner toe; an oblique tarsal fold from the inner. Length of foot contained 1.9–2.35 (mean of 32, 2.12) times in the length from snout to vent. Tibio-tarsal articulation reaching the shoulder.

Skin very warty above, the warts tending to form longitudinal ridges, of which the most constant are an irregular dorso-lateral pair; a glandular parotoid aggregation behind the tympanic region. Lower surfaces and hinder side of thighs granular. A small papilla on the heel. Cloacal flap fimbriated.

Colour pattern and secondary sex characters essentially similar to those of *englishi*.

Length: ♂♂ 19.5–23.7 mm. (mean of 15, 21.8 mm.); ♀♀ 20.5–28.5 mm. (mean of 16, 24.5 mm.).

DISTRIBUTION: Mt. Kosciusko.

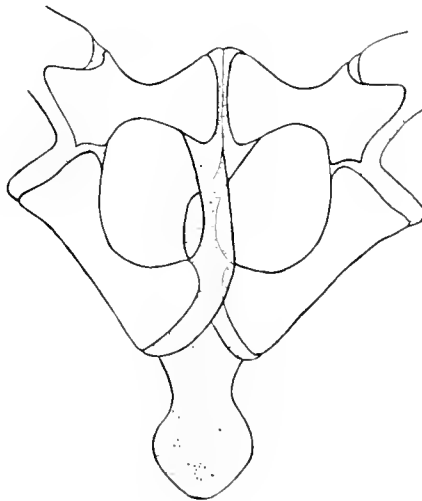
COTYPES EXAMINED.

Austr. Mus. 4647	♀, juv.	Mt. Kosciusko, 5000 ft.
579	♀	" " 5500 ft.
5043-4	♂, 3 ♀♀	" " 7000 ft.
5040-8	♂, 2 ♀♀	
5050-3	4 ♂♂, ♀	
7439	6 ♂♂, 4 ♀♀, 2 juvs.	Pretty Point, Mt. Kosciusko.
9741, 9743	♂, 3 ♀♀	Lake Cootapatamba, Mt. Kosciusko, 6500 ft.
9742	♂♀	Rawson Pass, Mt. Kosciusko, 8800 ft.

MYOBATRACHUS.

Breviceps (non Merrem) Gray, 1841, in Grey, *Journ. Exped. W. Austral.*, 11 : 448.
Myobatrachus Schlegel, 1850, *Proc. zool. Soc. Lond.* : 9 (Type species:—*M. paradoxus*);
idem, 1851, *Ann. Mag. nat. Hist.*, (2), 7 : 70, Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 3;
 Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 328; Cope, 1880, *Bull. U.S. nat. Mus.*, 34 : 259; Nieden, 1923, *Das Tierreich, Anura* I : 167; Noble, 1931, *Biol. Amph.* : 498.
Myobatrachus Schlegel, 1858, *Handleid. Dierk.*, 2 : 59, 545.
Chelydobatrachus Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 53 (Type species:—*Breviceps gouldii* Gray); Cope, 1895, *Nat. Hist. Rev.*, n.s., 5 : 102.

Maxillary teeth absent. No prevomer; a large fronto-parietal foramen; quadrato-jugal short, not reaching the maxilla; ear fully developed, with a very large, thick, extraplectal cartilage, covering the whole of the tympanum. Vertebrae procoelous, with the condyle incompletely ankylosed and notochord



TEXT-FIG. 20.—Ventral elements of the shoulder girdle of *Myobatrachus gouldii*.

persistent; eight presacrals; sacral diapophyses broadly dilated; coccyx articulating by two condyles. No omosternum; clavicles short and stout, widely dilated mesially; epicoracoids meeting edge to edge for a third of their length anteriorly and so approaching an arcifero-firmisternal condition; coracoids directed obliquely backwards; sternum small, cartilaginous or calcified (text-fig. 20).

Terminal phalanges simple. Distal tendon of the m. semitendinosus passing deep (dorsal) to the m. gracilis. Alary processes of the hyoid, broad wing-like expansions of almost the whole lateral margins of the hyoid plate.

Pupil horizontal with a ventral angle. Tongue small, oval, partly free behind. Digits not dilated distally.

Myobatrachus gouldii (Gray).

- Breviceps gouldi* Gray, 1841 (April), *Ann. Mag. nat. Hist.*, **7** : 89 (Type locality :—Western Australia); Gray, 1841, in Grey, *Journ. Exped. W. Austral.* **11** : 436, 448, pl. 1, fig. 1.
- Myobatrachus gouldii* Gray, 1850, *Proc. zool. Soc. Lond.* : 10; *idem*, 1851, *Ann. Mag. nat. Hist.*, (2), **7** : 70; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 329; Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, **22**, 1897 : 680, 682; Lucas & le Souef, 1909, *Anim. Austral.* : 288; Werner, 1914, *Fauna S.W. Austral.*, **4** : 421; Fry, 1914, *Rec. W. Aust. Mus.*, **1** : 208; Alexander, 1922, *J. Linn. Soc. Lond. (Zool.)*, **34** : 462; Nieden, 1923, *Das Tierreich, Anura I* : 167, fig. 216; Harrison, 1927, *Rec. Aust. Mus.*, **15** : 287; Kinghorn, 1932, *Rec. Aust. Mus.*, **18** : 361; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 37.
- Chelydobatrachus gouldii* Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 53, 138; Krefft, 1865, *Pap. roy. Soc. Tasmania* : 17.
- Breviceps Heliogabali* Gray, 1841, in Grey, *Journ. Exped. W. Austral.*, **11** : pl. 1, fig. 1, caption.
- Myobatrachus paradoxus* Schlegel, 1850, *Proc. zool. Soc. Lond.* : 9 (Type locality :—Swan River, W.A.); Günther, 1858, *Cat. Batr. Sal. Brit. Mus.* : 3, 128; Krefft, 1865, *Pap. roy. Soc. Tasmania* : 16; Peters, 1867, *Mber. Akad. Berlin* : 37.
- Myobatrachus paradoxus* Schlegel, 1858, *Handleid. Dierk.*, **2** : 59, 545, pl. 4, fig. 76.

Habitus globose. Head small, as long as broad, its length contained 4.6 times in the length from snout to vent. Snout bluntly rounded, 1.7 times as long as the eye; nostrils terminal, directed forwards; canthus rostralis rounded; loreal region oblique; interorbital space twice as broad as an upper eyelid; crown of the head dome-shaped owing to the presence of a pad of fibro-glandular thickened skin; tympanum hidden. Limbs very short and stout. Fingers short, stout, depressed, the first shorter than the second; fourth very short (the phalanges reduced to small nodules) but very stout, due to the skin being thickened and somewhat cornified; a tract of similarly thickened skin extends along the outer side of the forearm for a short distance; subarticular tubercles indicated on the proximal joints of the first three fingers; an indefinite outer, but no inner, metacarpal tubercle. Toes very short, free, depressed, the outermost stoutest; traces of subarticular tubercles on the proximal joints only; an extensive, but indistinct, outer metatarsal tubercle, the inner small and only faintly indicated. The total length of the hind limb (vent to tip of fourth toe) about $\frac{2}{3}$ the length from snout to vent.

Skin shagreened and porous above, but not glandular; similar beneath or slightly warty on the abdomen.

Dull brown above, sometimes with faint, ill-defined darker and lighter areas and small pink dots; the cornified skin of the crown of the head and on the outer fingers and forearm yellow or rusty brown; a fine light vertebral line may be present. Dirty white beneath, uniform or dotted with dark brown.

Length from snout to vent : ♂ 44 mm. ; ♀ 57 mm.

A cryptozoic species frequenting termites' nests. Male with a vocal sac and, at the breeding season (?), with numerous small, horny spinules very numerous on the dorsal surfaces, larger and more scattered beneath. Eggs very large, ovarian follicles 4 to 4.5 mm. in diameter.

DISTRIBUTION : West Australia.

SPECIMENS EXAMINED.

B.M. 41 (2) 216	♀	W. Australia.	Gould. TYPE.
05.5.4.134-5	♂♀	Swan River.	(Sir A. Smith.)
58.11.25.2	♂	" "	" "
44.7.9.33	♂	Houtman's Abrolhos.	Gould."
1920.12.11.4-5	♂♀	Crawley, near Perth.	Nicholls.
1931.7.1.1	imm.	Mt. Toolbrunup.	Baldwin.
Mus. Leiden 2068	imm. (bad state)	S.W. Australia.	Preiss. (Type of <i>Myobatrachus paradoxus</i> .)

METRACRINIA gen. nov.

Type species: *Pseudophryne nichollsi* Harrison.

Pseudophryne (part) Harrison, 1927, *Rec. Aust. Mus.*, **15**: 285; Barbour & Loveridge, 1929, *Copeia*, **170**: 12; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 35.

Maxillary teeth absent. Preomer represented by a minute narrow, non-dentigerous bone bordering the antero-mesial edge of each choana; a very large fronto-parietal foramen. Ear fully developed. Vertebrae procoelous, the condyle incompletely ankylosed; notochord persistent; sacral diapophyses broadly dilated; urostyle articulating by two condyles¹; eight presacral vertebrae. Omosternum rudimentary; sternum undivided, cartilaginous; procoracoids very broad. Terminal phalanges simple.

Distal tendon of the m. semitendinosus passing dorsal to the m. gracilis. Alary process of the hyoid a wing-like expansion of almost the whole lateral border of the hyoid plate.

Pupil horizontal with a ventral angle. Tongue narrow, oval, half free behind. Toes free and not dilated distally.

Metacrinia nichollsi (Harrison).

Pseudophryne nichollsi Harrison, 1927, *Rec. Aust. Mus.*, **15**: 284 (Type locality:—Pemberton, W.A.); Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 35.
Pseudophryne bibronii (non Steindachner) Barbour & Loveridge, 1929, *Copeia*, **170**: 12.

Snout very short, bluntly rounded, not prominent, a little longer or a little shorter than the diameter of the eye; canthus rostralis rounded; loreal region slightly oblique; nostrils much nearer the tip of the snout than the eye; tympanum hidden; interorbital space once and a quarter as wide as the upper eyelid. Fingers short, with flat subarticular tubercles; palm slightly tubercular; two metacarpal tubercles. Toes short, free, without dermal fringes, not dilated terminally, with feebly-developed subarticular tubercles; two rather indistinct metatarsal tubercles; no tarsal fold. Tibio-tarsal articulation not quite reaching the shoulder.

Skin uniformly and regularly warty above, with a pair of curved folds from behind the upper eyelids, convergent towards the middle line. Ventral surfaces regularly and coarsely granular.

Uniform dark brown or blackish above, sometimes with obscure darker markings or with a silvery-grey wash and minute pink dots. Lower surfaces dark grey, blue or black, marbled and spotted with white; a pair of bright yellow pectoral glandular spots and similarly coloured spots on the posterior part of the belly in front of the thighs (sometimes confluent), in the popliteal region, on

¹ In the single specimen examined an additional vertebra appears to be intercalated between the urostyle and the sacrum, fused with the former but articulating with the latter by a single condyle and by zygapophyses; probably this is an anomalous condition.

thighs and tibiae, and on the upper, inner side of the metatarsus. Sometimes a narrow white vertebral line is present in juveniles and may persist as a coccygeal stripe in the adult; a similar line may traverse the hinder side of the thighs above the vent. Throat of the male darker.

Length from snout to vent: ♂ 23 mm.; ♀ 25 mm.

The species is sluggish in disposition, crawling rather than hopping, and is often found in association with the ant *Myrmecia regularis* Crawley, but not with any other species; the frogs are often to be found using the galleries constructed by the ants under logs and stones in damp places. When disturbed the frog habitually turns over on its back to exhibit the brilliantly coloured lower surfaces. The eggs are large, about 5 mm. in diameter, and are laid under cover of some kind, such as a log, on land close to water; 25 to 30 eggs appear to constitute a clutch, and development reaches an advanced stage within the egg. Breeding period apparently during late summer.

DISTRIBUTION: West Australia, west of the Darling Range and south of Geopraphe Bay.

SPECIMENS EXAMINED.

B.M. 70.6.26.56	♀	?	Kreffit.
1936.10.2.2	♀	Pemberton, W. Australia.	Schevill.
1937.7.23.1-2	2 ♀♀	Yanmah, near Manjimup, W.A.	Glauert.
1927.8.30.1-2	♂♀	Augusta, W.A.	Brooks.

PSEUDOPHRYNE Fitzinger.

Bombinator Gray, 1835, *Proc. zool. Soc. Lond.*: 57.

Phryniscus (part) Duméril & Bibron, 1841, *Erpét. Gén.*, 8: 722.

Pseudophryne Fitzinger, 1843, *Syst. Rept.*: 32 (Type species:—*Phryniscus australis* Dum. & Bibr. = *P. semimarmorata* Lucas¹); Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 45; Cope, 1865, *Nat. Hist. Rev.*, n.s., 5: 103; Steindachner, 1867, *Reise Novara, Zool., Amph.*: 34; Keferstein, 1868, *Arch. Naturgesch.*, 34: 271; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 277; Cope, 1889, *Bull. U.S. nat. Mus.*, 34: 259; Nieden, 1923, *Das Tierreich, Anura I*: 147 (part); Harrison, 1927, *Rec. Aust. Mus.*, 15: 286; Waite, 1929, *Rept. Amph. S. Austral.*: 264; Noble, 1931, *Biol. Amph.*: 498.

? *Bufo*nella Girard, 1853, *Proc. Acad. nat. Sci. Philad.*: 424 (Type species:—*Bufo*nella *crucigera*).

Maxillary teeth absent. Prevomer reduced to a fragment bordering the choana mesially, or entirely absent, never dentigerous. Fronto-parietals widely separated.² Ear reduced, without tympanum, annulus tympanicus, cavum tympani, columella auris or Eustachian tubes. Vertebrae procoelous, but with the condyle incompletely ankylosed; notochord persistent; sacral diapophyses moderately dilated; urostyle articulating by two condyles; 8 presacral

¹ *Phryniscus australis* Duméril & Bibron, 1841, *Erpét. Gén.*, 8: 725, does not appear to have been conspecific with *Bombinator australis* Gray, 1835, but to have been a composite of two other species. One of these, that figured on plate 100, fig. 2, was considered typical, the other (pl. 100, fig. 4) being a "variety"; the typical form is the species subsequently named *semimarmorata* by Lucas, which consequently becomes genotype of *Pseudophryne* Fitzinger.

² W. K. Parker, 1881, *Phil. Trans. roy. Soc. Lond.*, 172: 230, pl. 42, figs. 1-7, describes and figures a skull ascribed to *Pseudophryne bibroni*. It differs from any member of the genus examined by the present author in having the fronto-parietals in contact mesially, a larger, bifid prevomer, an annulus tympanicus, the shape of the basi-sphenoid and the length of the post-orbital part of the skull. It seems certain that there must have been a misidentification, and, since Parker is so insistent on a number of characters which are "quasi-juvenile" or show "arrested metamorphosis" or "relapse," the probability is that the specimens were really juveniles of something very different.

vertebrae. Omosternum vestigial; sternum undivided; cartilaginous. Terminal phalanges simple.

Distal tendon of the m. semitendinosus perforating the distal tendon of the mm. graciles. Alary process of the hyoid a broad, wing-like expansion of the lateral border of the hyoid plate.

Pupil horizontal. Tongue small, narrow and oval, half free behind. Toes free.

In recent years it has been believed that *Pseudophryne* and *Crinia*, though at one time referred to two different families, were very closely allied, and the former has even been described as a *Crinia* without teeth. But there are some other differences distinguishing the two, amongst which the most important appears to be the condition of the ear. In *Crinia* this organ is fully developed, with Eustachian tubes, a columella auris, cavum tympani, annulus tympanicus and tympanum, but in the great majority of the species of *Pseudophryne*, including the genotype, all these structures¹ appear to be completely absent. It is scarcely conceivable that, amongst a group of closely allied species, such a profound modification should appear haphazard, and the presence or absence of the middle ear must be regarded as a good index of affinity. The only species of "*Pseudophryne*" in which the ear is known to be fully developed are *P. rugosa* and *P. mjobergi* Andersson, and *P. nichollsi* Loveridge. These three species must accordingly be removed from the genus and their generic relationships involve a reconsideration of the value of maxillary teeth as a generic character. The affinities of *P. rugosa* with *Uperoleia* have already been recognized, and Loveridge (1935 : 31) has recently reduced *rugosa* to the status of a subspecies of *U. marmorata*. This view is not entirely acceptable, for the question of teeth, which are absent in *rugosa* but present in *marmorata*, has been entirely neglected. But there can be no doubt that *rugosa* is closely allied to *marmorata*. Both species are characterized by the presence of large parotoid glands, and differ from any species of any of the allied genera *Pseudophryne*, *Crinia* and *Glauertia* in the closure of the fronto-parietal foramen. With "*Pseudophryne*" *nichollsi*, however, the case is rather different. The presence of a fully developed ear suggests affinity with *Crinia*, but the species differs from any member of that genus in its stout habitus and short limbs. It may, perhaps, be regarded as a toothless *Crinia*, but it has so little in common with the other species that it has obviously diverged a long way, and its relationships can best be expressed by referring it to a distinct new genus. "*Pseudophryne*" *mjobergi* possessing a fully developed auditory apparatus and teeth is allied to *Crinia*, but its webbed feet suggest that it may be more appropriately placed in the genus *Glauertia*.

The description of the type species of *Bufo* Girard is so reminiscent of the very characteristically marked *Pseudophryne australis* that it seems possible that the presence of a "tympanum," said to distinguish *Bufo*, may be due to an error of observation or an artifact.

SYNOPSIS OF THE SPECIES.

- I. Two large shovel-shaped metatarsal tubercles; a large inguinal, but no femoral, gland; inner toe with only a single phalanx *P. guentheri*.
- II. Metatarsal tubercles not shovel-shaped; no inguinal, but usually a post-femoral, gland; inner toe with two phalanges.
 - A. No gland behind the thigh *P. occidentalis* sp. nov.

¹ A vestige of the Eustachian tube may persist as a diverticulum from the mouth.

- B. A gland on the distal half of the hinder side of the thighs.
- (1) Snout pointed, prominent, the internarial space shorter than the distance between the nostril and the tip of the snout.
- (a) Nostrils directed vertically upwards. Belly and throat smooth; dorsal warts few; lower surfaces of the limbs brown, mottled and spotted with white. . . . *P. major* sp. nov.
- (b) Nostrils dorso-lateral. Belly and throat, especially in males, very coarsely granular; snout of male with a distinct digging edge; dorsum very warty; lower surfaces of the limbs and the inner digits uniformly flesh-coloured
P. semimarmorata.
- (2) Snout rounded, not prominent, the internarial space greater than the distance from the nostril to the end of the snout.
- (a) Tip of the fourth toe extending to the end of the snout or beyond.
- (i) Dorsum lighter than the flanks, the two colours sharply defined; lower surfaces dark brown with very large yellow marblings; a single, bold, orange bar across the lower surfaces of femur, tibia and tarsus *P. coviacea*.
- (ii) No sharp line of demarcation between the colours of the dorsum and flanks.
- (z) A bold red or orange marking on the top of the snout to the level of the hinder borders of the eyes and a coccygeal stripe of the same colour; white spots on the upper arm, in the groin and on the femoral gland *P. australis*.
- (β) No red or orange mark embracing the synciput but, at most, a light vertical bar on the tip of the snout; a faint yellow coccygeal stripe; a red or yellow spot on the upper arm *P. bibroni*.
- (b) Tip of the fourth toe extending to the shoulder or slightly beyond the eye. General colour of the dorsal surfaces black
P. dendyi.

Pseudophryne guentheri Boulenger.

Pseudophryne bibroni (part) Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 46, 137.

Pseudophryne guentheri Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 279, pl. 17, fig. 2 (Type localities:—Swan River; N.W. Australia; Australia); Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22: 680; Lucas & le Souef, 1909, *Anim. Austral.*: 285; Werner, 1914, *Fauna S.W. Austral.*, 4, 10: 419; Nieden, 1923, *Das Tierreich, Anura* 1: 151, fig. 198; Harrison, 1927, *Rec. Aust. Mus.* 15: 281, figs. 1–5; Waite, 1929, *Rept. Amph. S. Austral.*: 265; Barbour & Loveridge, 1929, *Copeia*, 180: 130; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 36.

Pseudophryne brooksi Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, 8: 59 (Type locality:—Manjimup, near Pemberton, W. Australia); *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 35.

Snout bluntly rounded, short, as long as, or very slightly longer than the eye; canthus rostralis rounded; loreal region slightly oblique; distance from nostril to tip of snout less than the internarial space, which is equal to the distance from nostril to eye. Fingers moderate, with well-developed subarticular tubercles, the first much shorter than the second, which is a little shorter than the fourth; third longer than the snout. Toes short, the third longer than the fifth, which is rather stout and fleshy proximally; subarticular tubercles well developed. Two

large transversely disposed metatarsal tubercles which, in adults, are compressed and shovel-like. Tip of the fourth toe reaching between the shoulder and the nostril in adult females, the nostril or somewhat beyond the tip of the snout in males and juveniles.

Skin with irregularly scattered small warts above, sometimes with a pair of folds convergent from the upper eyelid towards the scapular region; a large parotoid and a similar inguinal gland; no gland behind the thighs. Lower surfaces smooth or faintly granular on the throat, posteriorly and laterally on the abdomen and on the lower surfaces of the thighs.

Brown above, irregularly mottled with darker, and usually with more or less distinct traces of the following large, light blotches: one covering the upper surface of the snout from the anterior third of the upper eyelids, an oval one on each scapular region, a Λ -shaped one on the middle of the back and a broad line along the coccyx. These markings are more distinct in juveniles than in adults, and in the former there is often a very thin red line from snout to vent and a narrow light line along the hinder side of the thighs. Lower surfaces white, more or less heavily spotted or marbled with brown.

Male with a vocal sac opening by a slit on each side of the tongue.

Length from snout to vent: ♂ 31 mm.; ♀ 36 mm.

DISTRIBUTION: West Australia.

The paratypes of *P. brooksi* Loveridge which have been examined all appear to be young ones, and the differences in leg-length and the size of the metatarsal tubercles which were believed to characterize that species seem to be due to their immaturity.

SPECIMENS EXAMINED.			
B.M. RR.1936.12.3.131	♀	Australia.	(Cotype of <i>P. brooksi</i> and Cotype of <i>P. guentheri</i> .)
69.7.27.5	♀	N.W. Australia.	(Cotype of <i>P. guentheri</i> .)
58.11.25.50	♀	Swan River.	Sir A. Smith. (Cotype of <i>P. guentheri</i> .)
64.10.6.0	♀	Australia.	(Cotype of <i>P. guentheri</i> .)
95.6.21.8-12	♀♀	Chapman River.	Saunders.
95.6.21.13	♀ (cleared)	" "	" "
1929.12.11.1-2	♂, juv.	Lefroy River, near Pemberton.	Nicholls.
1927.8.30.3-4	2 juvs.	Manjimup, near Pemberton.	Brooks. (Paratype of <i>P. brooksi</i> .)
1931.7.1.24-29	♀, 2 juvs.	Baldwin's Lake, near Mt. Toolbrunup.	Baldwin.
1931.7.1.27-38	♂, ♀, juvs.	Mt. Toolbrunup.	" "
1931.7.1.39-45	♀ juvs.	W. Australia.	" "
M.C.Z. 18349-50	♂♂	Bruce Rock.	Nicholls.
13031	juv.	Manjimup.	Brooks. (Paratype of <i>P. brooksi</i> .)
Austr. Mus. R. 10004	♀	Tambellup.	

***Pseudophryne occidentalis* sp. nov.**

Pseudophryne australis (non Gray) Stirling & Zietz, 1892, *Trans. roy. Soc. S. Aust.*, **16**: 170. Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 31.

Holotype a male, number 1937.7.22.42 in the British Museum, collected at Bruce Rock, West Australia, by Prof. G. E. Nicholls in April, 1927.

Snout rounded, slightly prominent, a little longer than the eye; canthus rostralis rounded; loreal region oblique; internarial space a little greater than the distance from eye to nostril and once and a half as long as the distance from the nostril to the tip of the snout; interorbital space once and two-thirds as broad as the upper eyelid. Fingers rather short, bluntly rounded terminally, the first shorter than the second which is shorter than the fourth; third as long as the snout. Toes similar to the fingers, the third longer than the fifth; an oval inner and a small, flat, rounded outer, metatarsal tubercle. Tip of the fourth toe reaching the end of the snout when the hind limb is adpressed.

Skin regularly beset with small warts above, except on the snout; lower surfaces distinctly granular except on the pectoral region. A parotoid, but no inguinal or femoral glands.

Dull brown above with obscure lighter markings covering the upper surface of the snout, on the upper arm, the coccyx and the knee and heel. Lower surfaces white with bold brown marblings on the belly; infusate on the throat and limbs.

A vocal sac.

Length from snout to vent 26 mm.; hind limb 26 mm.

Paratypes a male and a female (B.M. 1937.7.22.43-44) collected at the same time and place as the type and a male and female (M.C.Z. 18301-18302) from Burara, south of Kalgoorlie, also collected by Prof. Nicholls. These examples agree well with the holotype except that the tip of the fourth toe may only reach the centre of the eye. The gular region of the male is more markedly granular than that of the female, there may be a pair of light, oval markings, one on each side of the vertebral line about the middle of the vertebral column, and the throat is marbled like the belly.

This is the West Australian species identified by Loveridge with *P. australis* Gray. But, though the type of the latter was originally said to have come from the Swan River, the specimen is undoubtedly conspecific with the eastern frogs usually referred to by that name; no name appears to be available for the western frog.

***Pseudophryne major* sp. nov.**

Pseudophryne bibroni (part) Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 278.

Holotype a female, number 67.3.4.56 in the British Museum, from Gayndah, S.E. Queensland.

Snout conical, rather pointed and somewhat prominent, once and a half as long as the eye; canthus rostralis rounded; loreal region oblique; nostrils directed vertically upwards; internarial space equal to the distance between the nostril and the tip of the snout, $\frac{2}{3}$ the distance from nostril to eye. Interorbital space once and a third as wide as the upper eyelid. Fingers moderate, with large subarticular tubercles; the first shorter than the second, which is shorter than the fourth; third a little longer than the snout. Toes moderate, with distinct subarticular tubercles; fifth shorter than the third; a distinct inner, and a small circular outer, metatarsal tubercle. Tip of the fourth toe reaching the tip of the snout when the hind limb is adpressed.

Skin with a few linear warts above; a series running from the upper eyelid converges on the scapular region towards its fellow and then diverges again, becoming indistinct posteriorly; another short lateral series from behind the large parotoid gland to the middle of the flanks. Smooth beneath except the lower

surfaces of the thighs which are granular; an oval gland on the hinder side of the thighs close to the knee.

Brown above, some of the warts faintly darker; loreal region darker; brown beneath with yellow spots, small beneath the limbs, large on the abdomen; a faint light spot on the upper arm.

Length from snout to vent 36 mm.; hind limb 36 mm.

The paratype is a male, bleached and soft, number 67.5.13.31 in the British Museum from Cape York. It agrees with the type except that the tip of the fourth toe only reaches the loreal region. Vocal sacs, opening by a slit on each side of the tongue, are present. Length from snout to vent 28 mm.; hind limb 27 mm.

This species is obviously one of the *bibroni-coriacea-semimarmorata* group but is distinguished by its much larger size, more pointed snout, more oblique lores and colour.

***Pseudophryne semimarmorata* Lucas.**

Phryniscus australis (part) Duméril & Bibron, 1841, *Erpét. Gén.*, 8: 725, pl. 100, fig. 2.

Pseudophryne australis Fitzinger, 1843, *Syst. Rept.*: 32.

Pseudophryne bibroni (non Günther) Krefft, 1865, *Pap. roy. Soc. Tasmania*: 17; Boulenger, 1882, *Cat. Bat. Sal. Brit. Mus.*, ed. 2: 278 (part); English, 1910, *Proc. zool. Soc. Lond.*: 631, pl. 51, fig. 7.

Pseudophryne semimarmorata Lucas, 1892, *Proc. roy. Soc. Victoria*, (2), 4: 61, 63 (Type localities:—Oakleigh; Heidelberg; Ringwood; Narre Warren; Waterloo; Grampians).

Pseudophryne bibroni var. *semimarmorata* Fletcher, 1898, *Proc. Linn. Soc. N.S.W.*, 22, 4: 665.

Pseudophryne blanchardi Loveridge, 1933, *Occ. Pap. Boston Soc. nat. Hist.*, 8: 61 (Type locality:—Millgrove, Victoria); *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, 78: 33.

Snout obtusely pointed, about once and a third as long as the eye, that of the male strongly prominent, with a blunt horizontal ridge terminally, caused by the development of a fibrous pad in front of the premaxillæ; canthus rostralis obtuse; loreal region oblique; distance from nostril to tip of snout equal to ($\frac{5}{7}$) or greater than ($\frac{5}{5}$) the interocular space, which is only very slightly less than the distance from nostril to eye. Interorbital space once and a quarter the width of the upper eyelid. Fingers rather short, with large, flat, subarticular tubercles, the first much shorter than the second, which is a little shorter than the fourth; third as long as the snout; outer metacarpal tubercle larger and more distinct than the inner. Toes with well-developed subarticular tubercles, the outer shorter than the third; two flat metatarsal tubercles, the outer the smaller. Tip of the fourth toe of the adpressed hind limb reaching the eye in females or the tip of the snout in males.

Skin thick and regularly beset with numerous warts above, of which some of the largest may form a curved dorso-lateral series on each side from the posterior corner of the eye. No clearly visible parotoid gland. Lower surfaces of the female smooth except for the lower surfaces of the thighs proximally which are markedly granular, and the posterior part of the abdomen and throat which are more feebly so; almost the whole of the lower surfaces of the body and the proximal parts of the thighs of the male, coarsely granular. A large oval gland occupies the distal half of the hinder side of the thighs.

Uniform brown above, or some of the warts somewhat darker. Lower surfaces yellow, heavily marbled and spotted with dark brown on the belly and throat. The chin, lower surfaces of the femora, tibiae, tarsi, inner half of the foot, lower surfaces of the arms and inner fingers always immaculate. This

light colour may also persist over the whole of the gular region, on the upper arm and over the backs of the thighs, including the femoral glands, but the anal region is often pigmented. The glandular secretion is rusty brown or orange in colour and marks the position of the femoral gland clearly. There may be a light coccygeal stripe and, where the anal region is pigmented, a light line above the vent.

In life the upper surfaces are olive-green, the sides blue-black; the under-surfaces of the limbs and throat are pale greenish yellow, greener near the axillae, whilst the unpigmented areas of the feet and hands are flesh-coloured. The belly is white with light olive-green marblings (Fletcher, 1892 : 63).

Breeding in March to May in Tasmania. Eggs laid singly under stones and in similar places in depressions where temporary pools may form after rain. Tadpole developing to an advanced stage in the egg in the absence of water, the operculum being fully formed. Hatching very rapid when the mature eggs are brought into contact with water. Tadpole with papillae at the sides of the mouth, horny, denticulate mandibles, a single long series of upper labial teeth, and three lower, of which the innermost is divided mesially and the lowermost the shortest.

Male with a vocal sac.

Length from snout to vent : ♂ 28 mm. ; ♀ 33 mm.

DISTRIBUTION : Tasmania, Victoria and ? southern New South Wales.

SPECIMENS EXAMINED.				
B.M.	65.3.4.3	♂	Van Dieman's Land.	Cutter.
	70.6.26.25	♂	?	Kreff.?
	1901.9.13.20-29	7 ♂♂, 2 ♀♀, 2 juvs.	Launceston, Tasmania.	English.
	1901.9.13.30-39	Eggs and larvae	" "	"
	1936.12.2.2	♂	Healesville, Victoria.	Blanchard.
	1936.12.2.1	♀	Millgrove, Victoria.	Blanchard. (Para- type of <i>P. blanchardi</i> .)
M.C.Z.	19259-1926c	♀, ♂	" "	Ditto.

This species, which for long was confused with *bibroni*, may be recognized by its longer, more pointed snout, more warty dorsum, and the immaculate lower surfaces of the limbs and inner digits. Loveridge was misled into describing *P. blanchardi* by comparison with specimens from New South Wales which were incorrectly determined as *P. semimarmorata*; some of these (Loveridge, 1935 : 34) have been examined and found to be examples of *Crinia* sp., probably *C. signifera*.

Pseudophryne coriacea Keferstein.

Pseudophryne (new species) Krefft, 1865, *Pap. roy. Soc. Tasmania* : 17.

Pseudophryne bibroni var. *australis* ? Krefft, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.* : 107.

Pseudophryne coriacea Keferstein, 1868, *Arch. Naturgesch.*, **34** : 272, pl. 6, fig. 15 (Type locality : —Clarence River, N.S.W.); Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 278; Fletcher, 1890, *Proc. Linn. Soc. N.S.W.*, (2), **5** : 600, 675; *idem*, 1892, *op. cit.*, (2), **7** : 8, 9; *idem*, 1894, *op. cit.*, (2), **8**, 1893 : 525, 529, 530; Nieden, 1923, *Das Tierreich*, *Anura* I : 149; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 33.

Pseudophryne australis forma *bibroni* (part) Andersson, 1916, *K. Svenska Vetensk.Akad. Handl.*, **52**, 9 : 13.

Snout rounded, not prominent, once to once and a quarter as long as the eye; canthus rostralis rounded; loreal region oblique; distance from nostril to the end of the snout appreciably less than the internarial space, which is very slightly shorter than the distance from nostril to eye; interorbital space a little greater

than the width of the upper eyelid. Fingers rather short, with large subarticular tubercles, the first shorter than the second which is shorter than the fourth; a large, round outer metatarsal tubercle, but the inner only faintly indicated. Toes short, with well-marked subarticular tubercles, the fifth much shorter than the third; a rounded inner, and minute outer, metatarsal tubercle. Tip of the fourth toe of the adpressed hind limb reaching the end of the snout in females or well beyond this point in males.

Skin thick and glandular, shagreened, with numerous flat warts above; smooth below except the proximal parts of the thighs which are granular. A flat oval gland behind the thigh on its distal half.

Pale brown to cream above, this area sometimes spotted with darker or lighter and clearly marked off from a dark lateral band which extends from the loreal region to the groin and sometimes encloses a lighter area along the middle of the flanks. Lower surfaces brown, with large white spots and vermiculations, or white with a few large black spots; sometimes a large light inguinal spot. Limbs dark brown with a large light spot each on the posterior side of the upper and lower arms, femur, lower surface of the tibia and tarsus and upper surface of the foot.

Male with a vocal sac.

Length from snout to vent: ♂ 28 mm.; ♀ 34 mm.

DISTRIBUTION: Eastern New South Wales; S. Queensland.

SPECIMENS EXAMINED.

B.M. 64.7.22.23-24	♀, Hgr.	Lake Macquarie.	Kreitt.
90.7.28.2	♂	Near Lismore, Richmond River, N.S.W.	Fletcher.
M.C.Z. 1941	♀	Clarence River, N.S.W.	COTYPE.
Mus. Leiden. 4255	♀	Queensland.	(Godeffroy Mus.)

***Pseudophryne australis* (Gray).**

Rombinator australis Gray, 1835, *Proc. zool. Soc. Lond.*, **3**: 57 (Type locality:—Swan River, Australia).

Phrynisus australis Gray, 1845, in Eyre, *Journ. Exped. Centr. Austral.*, **1**: 407, pl. 2, fig. 1; Gunther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 45; *Pseudophryne australis* Fitzinger, 1861, *S.B. Akad. wiss. Wien*, **42**: 415; Kreitt, 1865, *Pap. roy. Soc. Tasmania*: 17; *idem*, 1867, *Cat. Industr. Prod. N.S.W., Add.*: 107; Keferstein, 1868, *Arch. Naturgesch.*, **34**: 271; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2: 277; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4**: 394, 379; *idem*, 1890, *op. cit.*, (2), **5**: 670, 671; *idem*, 1894, *op. cit.*, (2), **8**: 1893: 530; *idem*, 1898, *op. cit.*, **22**: 679; Lucas & le Souef, 1909, *Ann. Austral.*: 284; Harrison, 1922, *Aust. Zool.*, **3**, 1: 26, fig.; Nieden, 1923, *Das Tierreich*, *Anura* 1: 148.

Phrynisus albifrons Dumeril & Bilron, 1854, *Eypét. Gén.*, **9**: 413, pl. 100, fig. 3 (Type locality not stated).

Pseudophryne albifrons Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 32.

?*Bufonella crucigera* Girard, 1853, *Proc. Acad. nat. Sci. Philad.*: 424 (Type locality:—New Holland); Keferstein, 1868, *Arch. Naturgesch.*, **34**: 272.

Snout rounded, scarcely prominent, once and a quarter as long as the eye; canthus rostralis rounded; loreal region oblique; internarial space greater than the distance from the nostril to the tip of the snout and equal to the distance from nostril to eye; interorbital space once and a quarter the width of the upper eyelid. Fingers rather short, with prominent subarticular tubercles, the first shorter than the second which is a little shorter than the fourth; third as long as the snout; a large outer metacarpal tubercle, but the inner is inconspicuous. Toes with large subarticular tubercles, the fifth much shorter than the third; a circular inner, and a very small outer, metatarsal tubercle. Tip of the fourth toe reaching

the end of the snout or, usually, beyond, when the hind limb is adpressed; the tip of the outer toe reaching the anterior corner of the eye or the nostril.

Skin smooth with a few rather inconspicuous warts above; a glandular thickening in the parotoid region. Smooth beneath, except the lower surfaces of the thighs, posterior part of the belly and flanks which are granular; a large oval gland on the distal half of the hinder side of the thighs.

Dark brown or blackish above with a few irregular reddish or orange dots tipping the warts and the following constant red or orange markings: a large subtriangular marking on the top of the snout embracing nearly the whole of the upper eyelids, and a coccygeal stripe. A band on the upper arm, a large inguinal spot on the anterior aspect of the femur and a similar spot on the femoral gland are white. Lower surfaces dark brown with a few very large white blotches on the throat and abdomen, and similar but smaller spots on the inside of the tibia and upper surfaces of the tarsus and foot. Hands and feet dark brown with the tips of the digits white.

Male with a vocal sac.

Length from snout to vent: ♂ 24 mm.; ♀ 27 mm.

DISTRIBUTION: New South Wales over the Hawkesbury sandstone beds (*vide* Harrison, 1921: 27).

Eggs, few in number (*circa* 20), laid throughout the year in an underground nest close to the edges of streams. Development proceeds within the egg until rudiments of hind limbs are developed; when brought into contact with water, through the overflowing of the nearby stream, hatching takes place rapidly, and the remainder of the development to metamorphosis takes place in about four weeks.

SPECIMENS EXAMINED.

B.M. RR.1936.12.3.132	♂	(Swan River.)	Wright. TYPE.
46.6.1.44	♀	Australia.	Parzudaki.
60.6.19.38	♀	Sydney.	Cuming.
62.8.1.13	♀	"	Stevens.
70.6.26.25	♀	"	Kreff.
1924.2.27.1-5	3 ♂♂, 2 ♀♀	Hornsby, N.S.W.	[Rosenberg.]
1930.3.2.1	♀	Turrumurra, N.S.W.	Ashburner.
M.C.Z. 1932	♂	Sydney.	—
Mus. Leiden 4254	♂	"	(Godeffroy Mus.)
" " 2056	2 ♂♂, 2 ♀♀,	"	(Sydney Mus.)
	2 Hgr.		

An attempt has recently been made to transfer the name *australis* from this well-known eastern species to the western form described in this paper as *occidentalis* on the ground that, since the type-locality was given as the "Swan River," the specimen must have belonged to the western species. But the original specimen, which agrees closely with Gray's description, is so obviously conspecific with eastern examples that there can be little doubt that the locality "Swan River" is either erroneous or the less known river of the same name in New South Wales was intended.

***Pseudophryne bibroni* Günther.**

Phrynisus australis var. Dnménil & Bibron, 1841, *Erpét. Gén.*, 8: 725 (part), pl. 100, fig. 4; *idem*, 1854, *op. cit.*, 9: 413 (part).

Pseudophryne bibroni Günther, 1858, *Cat. Batr. Sal. Brit. Mus.*: 46 (part) (Type localities:—Australia: van Diemen's Land); Peters, 1863, *Mber. Abad. Berlin*: 235; Kreff, 1865, *Pap. roy. Soc. Tasmania*: 17; *idem*, 1867, *Cat. Industr. Prod. N.S.W.*, *Add.*: 107; Steindachner, 1867, *Reise Novara, Zool., Amph.*: 34, pl. 5, figs. 1, 2; Günther,

1867, *Ann. Mag. nat. Hist.*, (3), **20** : 55 ; Keferstein, 1868, *Arch. Naturgesch.*, **34** : 271 ; Boulenger, 1882, *Cat. Batr. Sal. Brit. Mus.*, ed. 2 : 278 (part) ; Fletcher, 1889, *Proc. Linn. Soc. N.S.W.*, (2), **4** : 305, 370 ; *idem*, 1890, *op. cit.*, (2), **5** : 669-673 ; *idem*, 1891, *op. cit.*, (2), **6** : 271-274 ; *idem*, 1892, *op. cit.*, (2), **7** : 7-8 ; *idem*, 1894, *op. cit.*, (2), **8**, 1893 : 526-528, 530 ; Lucas, 1892, *Proc. roy. Soc. Victoria*, **4** : 91 ; Boettger, 1894, *Denkschr. med.-naturw. Ges. Jena*, **8** : 110 ; Lucas & le Somet, 1909, *Ann. Austral.* : 285 ; Andersson, 1913, *K. Svenska Vetensk.Akad. Handl.*, **52**, **4** : 17, pl. 1, figs. 3, 4 ; Harrison, 1922, *Aust. Zool.*, **3** : 29 ; Nieden, 1923, *Das Tierreich, Anna I* : 148, fig. 195 ; Waite, 1929, *Rept. Amph. S. Austral.* : 295, fig. 192 ; Blanchard, 1929, *Aust. Zool.*, **5**, **4** : 326 ; Loveridge, 1934, *Pap. roy. Soc. Tasmania*, 1933 : 60 ; *idem*, 1935, *Bull. Mus. comp. Zool. Harv.*, **78** : 33.

Pseudophryne australis forma *bibroni* (part) Andersson, 1919, *K. Svenska Vetensk.Akad. Handl.*, **52** : 9, 12.

Snout rounded, not prominent, once and a quarter to once and a third as long as the eye ; canthus rostralis obtuse ; loreal region oblique ; internarial space longer than the distance from the tip of the snout to the nostril, but shorter than the distance between the latter point and the eye ; interorbital space about once and a quarter the width of the upper eyelid. Fingers with distinct sub-articular tubercles, the first much shorter than the second which is a little shorter than the fourth ; third as long as, or a little shorter than, the snout ; two distinct metacarpal tubercles, the outer the larger. Toes with distinct subarticular tubercles, the fifth shorter than the third ; two metatarsal tubercles, the inner the larger. Tip of the fourth toe extending beyond the end of the snout, the tip of the fifth reaching to between the eye and the nostril when the hind limb is adpressed.

Skin with some small warts above which may be irregularly scattered, but, more usually, some of them form regular series, of which the most constant is a curved one on each side of the back from behind the upper eyelid, convergent towards its fellow on the scapular region and then diverging again ; a second series is less frequently present in a straight line from the posterior corner of the eye along the flanks. Lower surfaces smooth except the throat which, in males, may be feebly granular, and the proximal parts of the lower surfaces of the thighs which are always distinctly granular.

Brown above with obscure darker markings of which the most constant are a dark streak below the canthus rostralis, continued backwards behind the eye, and a dark line following the curved line of dorsal warts. There may be a light vertical line on the extreme tip of the snout and a rather obscure yellow line along the urostyle, the latter joining a transverse light spot above the vent which often extends on to the femoral glands. There is constantly a red or yellow spot on the upper arm. Lower surfaces brown with white spots, which are often so large on the throat and belly as almost to obliterate the dark ground-colour.

Male with a vocal sac.

Length from snout to vent : ♂ 26 mm. ; ♀ 27 mm.

DISTRIBUTION : Southern Queensland, New South Wales, Victoria, Tasmania and South Australia.

Eggs laid in April or May, a hundred or more to the clutch, in irregular masses close to permanent water. Development proceeds up to the development of the operculum within the eggs, but a long free larval stage of 5-6 months follows hatching. The larva is characterized by three transparent lymph spaces in the head. The mouth is bordered laterally by papillae, has horny mandibles, two rows of labial teeth in the upper jaw, the inner divided, and three in the lower jaw, all undivided and the outermost shortest.

SPECIMENS EXAMINED.

B.M.	62.8.1.11	♂, ♀	Sydney.	(Stevens.)
	64.10.0.8	♂, 4 ♀♀	Clarence River, N.S.W.	"
	64.10.27.52-53	♀♀	Brisbane.	"
	70.6.26.23	7 ♂♂, 10 ♀♀	—	"
	70.6.26.22 (part)	♂, ♀	Port Macquarie, Hastings R.	"
	74.4.29.1250-1261	5 ♂♂, 6 ♀♀	Sandhurst, Victoria.	Beddome.
	74.4.29.1262	Cleared.	" "	"
	88.10.23.3-12	3 ♂♂, ♀, larva, eggs	Paramatta.	Kreff.
	96.7.1.32-35	4 ♀♀	Walcha, N.S.W.	Porter.
	1923.11.11.1-2	♀, juv.	W. Kangaroo Island, S.A.	Wood Jones.
	1929.7.9.8-9	♀♀	Huskisson, Jervis Bay, N.S.W.	Rodway.
	1934.12.5.1	♀	Ditto.	"
	1935.4.2.1	♂	"	"
M.C.Z.	1930	♂	Sydney.	"
Mus. Leiden	2057	2 ♀♀	"	(Sydney Mus.)
"	6784	♀	"	(Godtfrey Mus.)
Austr. Mus.	7378-9 (part)	2 ♀♀	Burrawang, N.S.W., 2000 ft.	
	7397 (part)	♂, ♀	Yass, N.S.W.	
	7601 (part)	♀	Ulverstone, Tasmania.	
	8638 (part)	3 juvs., 2 larvae	Bundanoon, N.S.W.	
	8490 (part)	juv.	Tweed River, N.S.W.	
Mus. Brussels		♂♀	Adelaide.	

The four cotypes of this species were not all conspecific. One of them (*b*) was subsequently made a cotype of *P. guentheri* by Boulenger (1882 : 270, spec. *d*), but the others appear to have been destroyed or lost before 1882 ; none of them is listed under *bibroni* by Boulenger. What species they really belonged to it is now impossible to say ; two of them were from Tasmania, in which island *semimarmorata* occurs as well as the form usually known as *bibroni*. Duméril and Bibron's *Phryniscus australis*, which Günther quotes as a synonym of *bibroni*, also appears to have been a composite ; the specimen figured on plate 100, fig. 2, has the typical coloration of *semimarmorata*, whilst fig. 4 of the same plate, described as a " var." of *australis*, appears to represent the form now usually known as *bibroni*. The situation accordingly is as follows : there is only one surviving cotype of *bibroni* ; if the name were to be fixed on that basis, the species at present known as *guentheri* would in future have to be known as *bibroni* and another name found for this latter, well-known species. What species may have been represented by the other, lost cotypes we cannot tell ; they *may* have belonged to two different species. Certainly the *Phryniscus australis* Dum. & Bibr., considered by Günther to be the same as his *bibroni*, was a composite of two species and Boulenger's " *bibroni* " is also a mixture of the same two forms. The name must obviously be applied to one of these two ; there is no method whereby one or the other can be definitely excluded, for the original description is not sufficiently detailed. But the obvious choice is the one which involves least change, and accordingly the name *bibroni* is retained for the species figured under that name by Steindachner (1869 : pl. 5, figs. 1 and 2) and *semimarmorata* Lucas retained for the other.

Harrison (1927 : 286) has drawn attention to the existence of a very dark, coastal race of this species, and suggested that *P. dendyi* Lucas may have been based on it. But Loveridge (1935 : 34) has discovered a dark, montane form on the borders of Victoria (from whence *dendyi* was described) and this ought,

probably, to bear the name. Until much more material is available it does not seem advisable to use a trinomial for Harrison's melanic coastal race.

Pseudophryne dendyi Lucas.

Pseudophryne dendyi Lucas, 1892, *Proc. Roy. Soc. Victoria*, (2), **4**: 61, 62 (Type locality:—Upper Wellington River, N. Gippsland); Lucas & le Souef, 1909, *Anim. Austral.*: 285; Nieden, 1923, *Das Tierreich*, *Amura* 1: 149; Loveridge, 1935, *Bull. Mus. comp. Zool. Harv.*, **78**: 34.

Snout rounded, not prominent, once and a quarter to once and a third as long as the eye; canthus rostralis rounded; loreal region oblique; internarial space greater than the distance from the tip of the snout to the nostril, about equal to the distance from the latter to the eye; interorbital space once and a third as broad as the upper eyelid. Fingers with large subarticular tubercles; the first much shorter than the second, which is scarcely shorter than the fourth; third a little shorter than the snout; a large outer, and a much smaller inner, metacarpal tubercle. Toes with well-developed subarticular tubercles; the fifth much shorter than the third; two small, subequal metatarsal tubercles. Tip of the fourth toe of the adpressed hind limb reaching to the shoulder or beyond the eye.

Skin quite smooth or feebly granular above; a pair of curved folds from the posterior corners of the upper eyelids faintly indicated. Smooth beneath except the lower surfaces of the thighs and posterior part of the abdomen, which may be feebly granular. A feebly developed gland on the hinder side of the thighs distally.

Black above with or without small white dots which may be aggregated to form a supraocular line and some patches behind and below the eye. A yellow patch on the upper arm, and a yellow coccygeal stripe meeting a transverse line of the same colour above the vent. Lower surfaces black with large white blotches; limbs black, white marbled below; dorsal surface of the hand sometimes white; digits black-tipped and sometimes transversely banded with white.

Length from snout to vent ($\bar{\sigma}$) 32 mm.

DISTRIBUTION: North Gippsland and the mountains of New South Wales.

SPECIMENS EXAMINED.

B.M. 1939.10.2.3	imm. ♀	Hartley Vale, Blue Mts., N.S.W.	Darlington.
Austr. Mus. R.8973	♀	Barrington Tops, N.S.W.	

Harrison (1927: 268) has reported the type of this species to be lost.

MSS. recd. October 21, 1939.

PLATE I.

Photographs showing reduction of the inner finger and compensating enlargement of the metacarpal in the genus *Limnodynastes*.

- (a) *Limnodynastes tasmaniensis* ♂. Digit of normal proportions and the inner metacarpal shorter than the second.
- (b) *Limnodynastes salmini* ♀.
- (c) *Limnodynastes fletcheri* ♂.
- (d) *Limnodynastes peronii* ♀.
- (e) *Limnodynastes peronii* imm. ♂. An individual variant with the number of phalanges reduced.
- (f) *Limnodynastes peronii*, breeding ♂. Phalanges dislocated from the metacarpal which pierces the skin.



a



b



c



d



e



Limnodynastes spp.

NEOTROPICAL NEOEMPHERIA (DIPTERA,
MYCETOPHILIDAE)

By F. W. EDWARDS, F.R.S.,

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(With two plates and twelve text-figures.)

UNTIL recently comparatively little knowledge has been obtained regarding the species of fungus-gnats (Mycetophilidae) occurring in South America. The British Museum Expedition to the Patagonian Andes in 1926-7 resulted in the acquisition of material of some 250 species of this family (including Sciarinae), mostly undescribed. Since then efforts have been made to obtain further fungus-gnat material for the Museum from the American Continent, because it was felt that the value and interest of any report upon the Patagonian collection would be greatly enhanced if comparison could be made with the fungus-gnat fauna of other parts of America. The Museum has been especially fortunate in obtaining within the last few years extensive collections made by Dr. A. Dampf in Mexico and Mr. F. Plaumann in Southern Brazil, including material of perhaps 500 species of fungus-gnats, few if any of which are the same as those represented in the Andean collection. It therefore seems probable that the number of South American species of this family will eventually be counted by thousands.

The genus *Neoempheria*, which forms the subject of this paper, does not occur, so far as is known at present, in the Andean region, but is widely distributed throughout the tropics. Numerous species occur in the Ethiopian and Oriental regions, and a few in Europe and North America. Nearly all the species have conspicuously patterned wings, these patterns exhibiting great diversity but remaining constant in any one species. The synonymy of the genus is as follows:

NEOEMPHERIA Osten-Sacken.

1863. *Empheria* Wimmertz, *Verh. zool.-bot. Ges. Wien*, **13**: 783 (preoccupied by *Empheria* Hagen, 1859).
 1878. *Neoempheria* Osten-Sacken, *Smithson. misc. Coll.*, **16**, art. 2.
 1909. *Mycomya* subgenus *Neoempheria* Johannsen, in Wytzman's *Genera Insectorum*, **93** (Diptera, Mycetophilidae): 45.
 1911. *Pleonazoneura* Enderlein, *Stettin. ent. Ztg.*, **72**: 159.
 1911. *Neurocompsa* Enderlein, *Stettin. ent. Ztg.*, **72**: 158.
 1912. *Neoempheria* Johannsen, *Bull. Maine Agric. Exp. Sta.*, **180**: 157.

Genotypes: *Empheria* and *Neoempheria*, *Sciophila striata* Meigen (Europe); *Pleonazoneura*, *P. johannseni* Enderlein (S. Brazil); *Neurocompsa*, *N. ornatipennis* Enderlein (S. Brazil).

Only three neotropical species have hitherto been referred to this genus: *varipennis* F. Lynch Arribalzaga (Misiones Terr.), *maculipennis* Williston (St. Vincent, W.I.), and *apicalis* Kertész (Peru). To these however must be added *Sciophila formosensis* F. Lynch Arribalzaga (Chaco), *Pleonazoneura johannseni* End. and its "variety" *evanescens* Enderlein, and *Neurocompsa ornatipennis* Enderlein (Santa Catharina). Enderlein distinguished his genera *Pleonazoneura* and *Neurocompsa* from *Neoempheria* chiefly on account of the strong vein-like fold between R and M, and *Neurocompsa* further by

the possession of an extra cross-vein-like thickening between this fold and the radius. Actually however, the vein-like fold is traceable with greater or less distinctness in most if not all species of *Neoempheria*, and the additional "cross-vein" is not even a constant specific character in *N. ornatipennis*. The distinctions mentioned by Enderlein are therefore valueless. There are indeed some other characters by which the group to which Enderlein's species belong may be distinguished, but in my opinion these are hardly even of subgeneric value.

I have now examined over thirty neotropical species of this genus, mostly collected by Herr F. Plaumann at Nova Teutonia, Santa Catharina, Brazil. Through the kindness of Dr. Kästner of the Stettin Museum I have been able to re-examine Enderlein's type material collected by Lüderwaldt, and have ascertained that not two but six species were represented among the nine specimens. Figures and re-descriptions of all these are included in this paper.

Species of this genus, like those of the allied *Mycomyia*, are notable for the complexity of the male genitalia and for the very great differences often found in these organs in species which are obviously very closely allied, though it may also occur that species which on external features seem obviously distinct show only small differences in the genitalia. In examining genitalia of *Neoempheria* in the dry state it should be borne in mind that the whole hypopygium is usually twisted or inverted, so that dorsal structures may appear lateral or ventral and vice versa; it is however easy to decide which is the true dorsal surface by the presence on it of the anal segment. In the accompanying figures the dorsal aspect of half of the hypopygium is shown on the left, the ventral aspect on the right. The following parts may be recognized in most or all species: (1) the large ninth tergite (*t*), divided nearly to the base into two halves and often with the tip of each half produced into a long process (*pt*) of varied form; (2) the anal segment (*as*), composed of paired cerci and an unpaired but sometimes divided sternite, always pubescent; (3) the ninth sternite (*s*), divided to the base into two lobes which are almost always completely bare and membranous and may be difficult to see in the mount unless the specimen has been stained; (4) a pair of inner styles (*is*) lying beneath the tergite but articulated with the sternite, never very hairy but often bearing a few or rather numerous black spines or variously toothed; (5) a pair of outer styles (*os*) articulated with the sternite ventro-laterally, usually clothed rather densely with longish hair; (6) one or two pairs of processes of the sternite (*ps*), usually bare or only finely pubescent; (7) a pair of large fleshy parameres (*pm*) lying within or between the lobes of the sternite, always completely bare, usually pale in colour and appearing as broad flat plates in side view in the dry specimen; (8) some small structures connected with the aedeagus, visible only in the mounted specimen. In addition to the structures of the hypopygium proper, the eighth tergite (*8t*) and eighth sternite (*8s*) show noteworthy specific differences in shape and in the number of hairs (if any) on their posterior margins. The females as well as the males show very considerable differences in the genitalia, but I have not investigated these.

Differential characters applicable to both sexes are to be found not only in the markings of the thorax and wings, but also in venation, trichiation of the wing-veins, and chaetotaxy of the head. All the neotropical species known to me possess only two strong bristles on the scutellum, in this respect differing from the European species (including the genotype), which have four or more such bristles. The neotropical species may be classified in about eight groups,

based on the length of vein Sc₁, position of fCu (base of cubital fork), length of ocellar bristles (the pair immediately behind the black ocellar spot), presence or absence of minute setulae (macrotrichia) on Sc and on branches of media and cubitus, especially M₂, and nature of markings (if any) of thoracic pleurae. (The characters of the groups as defined below are not repeated in the specific descriptions which follow.)

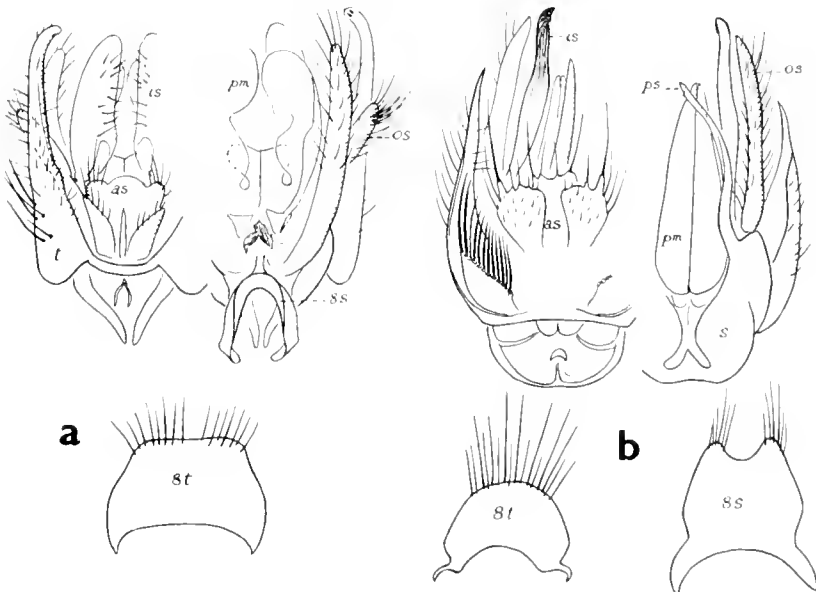
GROUP A.

Sc reaching almost to the end of the small cell, which is only about half as long as stem of median fork; Sc₂ transverse and well beyond base of Rs. Costa produced only a little beyond tip of R₅. fCu before base of Rs. Sc setose on more than its distal half; M₁, M₂, Cu, Cu₁ and Cu₂ all setose for the whole of their length. Costal and basal cells all dark. Ocellar bristles quite short. Thorax unicolorous. Halteres yellow.

The species of this group approach nearer to the genotype (*N. striata* Mg.) than do those of any of the other South American groups of the genus.

Neoempheria neivai sp. n.

♂. Head yellowish except for the black ocellar spot; antennal flagellum blackish; palpi largely dark. Thorax light yellowish on sides, rather more reddish-yellow above, with black hairs and bristles, but quite unmarked; a



TEXT-FIG. 1. —Hypopygia of *Neoempheria*: A, *neivai*; B, *bipunctata*.

pair of bare stripes between acrostichal and dorso-central hairs. Abdomen with tergites 1, 2, 4 and 7 yellow, 3, 5 and 6 black; venter yellowish. Legs yellow, including whole of hind femora; tibiae and tarsi darkened. Wings (Pl. I, fig. 1) with tip and whole anterior margin, including basal cell, dark; also with a large dark patch below tip of Cu₂. Hypopygium (text-fig. 1, A)

very different in structure from that of all the other South American species examined; a notable feature is the apparent absence of the eighth sternite, unless it is represented by a narrow bare strip of chitin fused on to the hypopygium.

♀. Differs from ♂ in colouring of abdomen and legs: tergites 2-6 are entirely black, only 1 and 7 being yellow; hind femora almost entirely blackish, contrasting with the others. Thorax and wings as in ♂.

Wing-length 6-7 mm.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂ (type), 2 ♀. BRITISH GUIANA: Kutari Sources (*G. A. Hudson*), 1 ♂.

At the suggestion of Father Borgmeier this fine species is named in honour of Dr. Arthur Neiva.

N. neivai corresponds in many respects with the description of *Sciophila formosensis* F. Lynch Arribalzaga,¹ and there seems to be little doubt from the description that Lynch's species is actually a *Neoempheria* of this same group. Lynch's definite statements as to the abdominal colouring of his type (a male from Formosa, Argentine Chaco) seem however to show that it is a different species; it is said to have the abdomen fuscous with the last two and part of the fifth tergites yellowish. Lynch also does not mention any dark area below the tip of Cu2.

N. apicalis Kertész,² described from one female from Callanga, Peru, must also belong to this group of the genus, but according to the description differs from both *N. neivai* and *N. formosensis* in having three darker stripes on the mesonotum and in details of abdominal markings. Kertész, like Lynch, does not mention the presence of a dark area below Cu2.

GROUP B.

Sc reaching to or beyond middle of the small cell, which is somewhat shorter than stem of median fork; Sc2 transverse and placed at base of Rs. Costa distinctly produced. fCu before base of Rs. Sc setose on distal half; M1, M2 and Cu1 setose except narrowly at base, Cu and Cu2 setose throughout. Wing-markings conspicuous, but costal and basal cells clear. Ocellar bristles short. Pleurae with longitudinal dark stripe. Halteres with dark knob.

Neoempheria bipectinata sp. n.

♂. Head mainly yellowish, darker behind, especially towards sides; ocellar spot black. Antennae brownish, scape lighter; seta on second segment rather long. Palpi entirely black. Thorax mainly brown above, without darker or lighter stripes, sides of mesonotum and most of pleurae yellowish; a dark brown band across base of postnotum, continued along each side across base of pleurotergite and upper margin of sternopleura to base of front coxa, leaving anepisternite entirely pale. Abdomen with tergites 1 and 7 yellowish, 2-4 each yellowish with a median dark stripe connected with a rather narrow dark posterior band, 5 and 6 mainly dark. Legs mainly yellowish but hind femora darker. Wings as figured (Pl. I, fig. 2); basal cell and base of cubital fork clear. CuP and An both strong. Hypopygium (text-fig. 1, B) remarkable for the pair of comb-like structures at base of tergite and the form of the anal segment.

¹ 1892, *Bol. Acad. Cient. Córdoba*, 12: 416.

² 1909, *Ann. hist. nat. Mus. Hung.*, 7: 140.

♀. Resembles ♂.

Wing-length 4.5-5.5 mm.

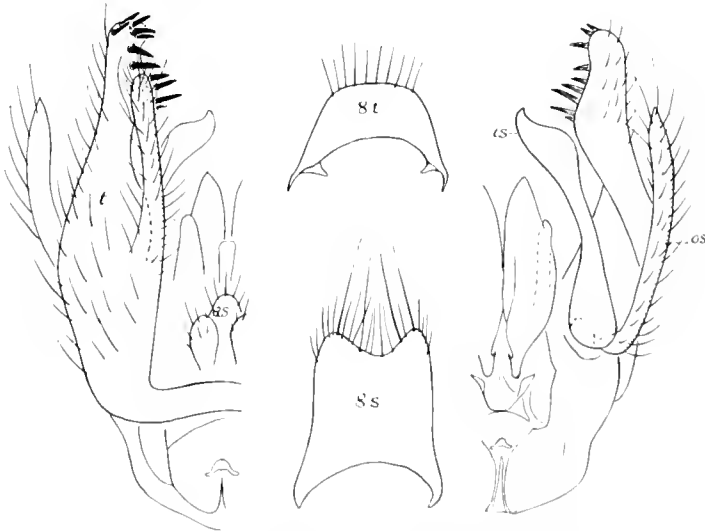
BRAZIL: Nova Teutonia (Plaumann), 1 ♂ (type), 1 ♀.

GROUP C.

Sc ending above base of Rs; Sc2 oblique and practically at tip of Sc. R4 above or just beyond base of median fork, the small cell long. Costa distinctly produced. 1Cu before base of Rs. M2 turned slightly downwards at extreme tip. Arrangement of setae on veins differing in the two sexes; in ♂ M1, M2 and Cu1 are setose except at base and Cu2 is entirely setose; in ♀ M1 is setose only at tip, M2 bare or with a few setae at tip, Cu1 bare, Cu2 setose only at base. In both sexes Sc is setose on most or all of the distal half, Cu sparsely setose. Wings highly adorned; basal cell with a dark spot at or near base. Ocellar bristles short. Pleurae with oblique dark stripe, extending from base wing across anepisternite to base of front coxa. A pair of bare stripes between acrostichal and dorso-central hairs. Halteres with dark knob.

Neoempheria spinosa sp. n.

♂. Head largely yellowish above, but dark brown behind and towards sides; also darkened between the black ocellar spot and base of antennae. Antennae with scape yellowish, flagellum black. Palpi wholly black. Thorax largely brown above, but with the bare stripes pale; sides of mesonotum broadly yellow,



TEXT-FIG. 2.—Hypopygium of *Neoempheria spinosa*.

also most of pleurae; scutellum dark above; postnotum broadly dark at base, somewhat lighter posteriorly; pleurotergites dark brown on posterior half. The oblique dark pleural stripe occupies anterior parts of anepisternite and sternopleurite and extends rather faintly over front coxa. Middle and hind coxae entirely yellowish; hind femora somewhat darker than the others, but not conspicuously so. Abdomen with tergites 1 and 2 largely pale, but both with a

median dark longitudinal stripe, sometimes reduced to spots; 3 mainly dark, with a moderately large pale spot towards each side at base, these spots leaving posterior and most of lateral margins broadly dark but just reaching sides at base; 4 mainly pale, but dark in middle above, the dark area broad basally but not or scarcely reaching posterior margin, lateral margin also dark; 5 and 6 mainly dark; 7 pale (but retracted). Wings as figured (Pl. I, fig. 7); notable features in the markings are the clear costal cell with a small dark area at its base, dark spot near but not quite at base of basal cell, and more intense darkening on inner edge of dark area at tip; dark area in cell Cu1 uniform in tint; pale area below Cu2 crossing CuP. Hypopygium (text-fig. 2) very large, with each half of tergite split into two parts, an upper finger-like part and a larger lower part with many strong black spines at tip.

♀. Resembles ♂ except in trichiation of veins, as noted in group diagnosis. Seventh tergite large and mainly pale, but with its posterior margin dark; setae on its posterior corners not specially numerous or strong. Hind margin of seventh sternite with some longish black hairs. Eighth sternite large, with uniform sparse pubescence.

Wing-length 4.5-5.5 mm.

BRAZIL: Nova Teutonia (Plaumann), 8 ♂ (including type), 2 ♀.

***Neoempheria brevicauda* sp. n.**

♀. Very similar to *N. spinosa*, with which it agrees in having the postnotum darker at the base and lighter distally, posterior coxae entirely yellow, dark area in cell Cu1 uniform in tint, and pale area below Cu2 crossing CuP. Trichiation of wings as in *N. spinosa* ♀. Differs from *N. spinosa* chiefly as follows: Wings (Pl. I, fig. 8) with the pale area at base of median fork smaller and dark area below Cu2 differently shaped. Abdomen with the yellow spots on tergite 3 larger. Tergite 7 shorter and more extensively dark. Sternite 7 with few or no long hairs on posterior margin. Sternite 8 shorter, with a loose tuft of dark pubescence near base on each side. The lateral flaps below tergite 7 (of uncertain homology) are smaller and much less pubescent than in *N. spinosa*.

BRAZIL: Nova Teutonia (Plaumann), 1 ♀.

***Neoempheria simplex* sp. n.**

♂. Closely resembles *N. spinosa* except in the following details: dark markings of mesonotum more intense, therefore contrasting more with the pale parts. Postnotum uniformly blackish. Wings (Pl. I, fig. 10) with the subapical pale area smaller; dark area in cell Cu1 rather more intense proximally; pale area below Cu2 inconspicuous and not crossing CuP. (Abdomen lost after mounting hypopygium; markings probably agreeing with ♀ as described below.) Hypopygium (text-fig. 3, A) very different in structure, the tergite narrower, undivided, with a small tuft of hairs but no spines at tip.

♀. Resembles ♂ in markings of thorax and wings. Abdomen with tergites 1 and 2 more extensively dark above than in *spinosa*, 3 and 7 nearly all dark. Structure of ovipositor quite different from that of *N. spinosa* and *brevicauda*; tergite 7 with many long dark hairs on its posterior margin and with about 6 long stout bristles on the part that is folded under on each side. Trichiation of wings as in *N. spinosa* ♀.

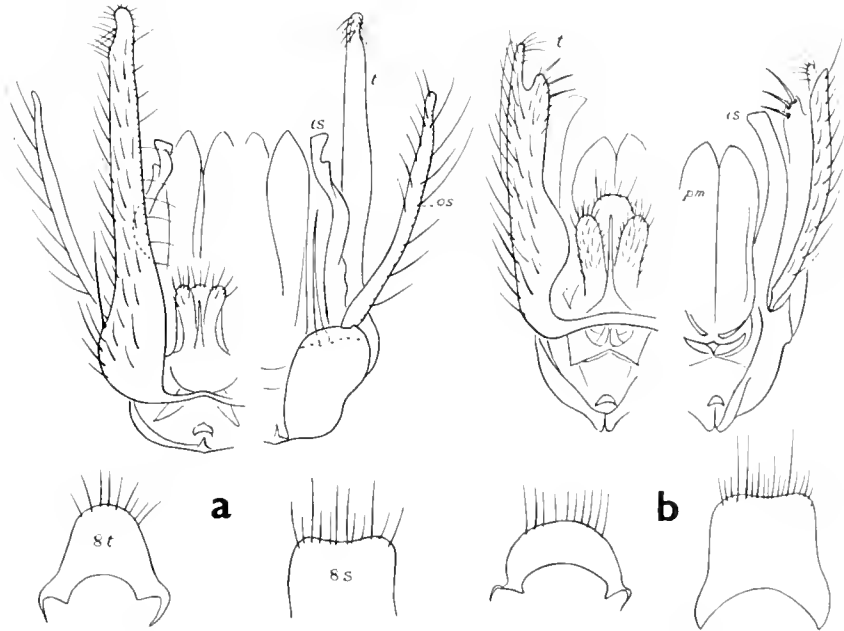
Wing-length about 5 mm.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂ (type), 1 ♀.

A second ♀ (of which the wing is figured, Pl. I, fig. 9) differs from the first in having the subapical pale area of the wings larger, thus more resembling *N. spinosa*; the structure of its ovipositor however is the same as that described above.

***Neoempheria bilobata* sp. n.**

♂. Very much resembles the last three species, but differs from all of them in having a dark streak running almost whole length of hind coxa. Postnotum all dark. Tergites 1 and 2 each with only a small dark area above, 3 extensively pale at sides. Wings (Pl. I, fig. 11) marked similarly to those of *N. simplex*,



TEXT-FIG. 3.—Hypopygia of *Neoempheria*: A, *simplex*; B, *bilobata*.

except that the subapical pale area is differently shaped. Hypopygium (text-fig. 3, B) quite different from that of *N. spinosa* or *simplex*: tergite bilobed at tip, with about three stout bristles on inner lobe.

Wing-length about 4.5 mm.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂.

***Neoempheria borgmeieri* sp. n.**

♀ (?). Head yellow; ocellar spot, palpi and flagellum black. Ocellar bristles reaching about half-way from their insertion to base of antennae. Thorax mainly yellow; mesonotum with three narrow parallel dark brown stripes running the whole length and connected on front margin, one along the inter-acrostichal space, the other two sublateral, no trace of additional stripes along the lines of dorso-central hairs; lateral stripes a little wider than the medial one. Pleural markings as in other species of Group C; the oblique stripe well marked,

pleurotergites indefinitely darkened posteriorly. Posterior coxae all yellow. Wings with the markings more suffused than in other species of this group; basal cell more than half dark; dark area in middle extending distinctly into base of median fork, which it does not in the other species. M1 setose on distal third, Cu1 on distal half; M2 bare; Cu2 setose throughout. R4 inwardly oblique instead of transverse as is normally the case in this genus.

Wing-length barely 4 mm.

BRAZIL: Bom Retiro, S. Cath., Prade, 20.i.29 (*Borgmeier*), 1 ♀ (?).

I have described this specimen in spite of its damaged condition because its colouring is quite distinct from that of all other Neotropical species of the genus known to me. The markings and trichiation of the wings will distinguish it from any species of Groups D or E.

GROUP D.

Venation as in Group C. Trichiation of veins alike in the two sexes; Sc bare or almost so; Cu setose except at base; M1, Cu1 and Cu2 setose throughout, but M2 completely bare. Branches of median fork rather widely divergent. M2 tending to be turned upwards at tip. Wing-markings conspicuous; basal cell dark at base. Two of the bristles immediately behind ocelli are long, extending forwards almost or quite as far as base of antennae; a second pair of ocellar bristles also somewhat longer than usual, but not nearly so long as the median pair. Bare stripes on mesonotum as in Group C. Pleurae with an oblique dark stripe from wing-base to base of front coxa; other dark pleural markings sometimes present but separate from this stripe; pleurotergite either entirely pale or with the anterior margin darkened instead of the posterior as in Group C. Knob of halteres dark (except in *N. puncticoxa*).

Neoempheria plaumanni sp. n.

♂. Head light brownish, ocellar spot black as usual. Antennae with scape yellowish, flagellum brown above, yellowish beneath on basal half or more. Palpi entirely black. Thorax brown above, darker (but not conspicuously so) along the stripes of acrostichal and dorso-central bristles and at the sides of the dark area; sides of mesonotum rather broadly pale; pleurae with yellowish ground, the oblique stripe broad and distinct; a dark brown band at base of postnotum extends on each side across the suture between pleurotergite and anepisternite. Abdominal tergites largely dark above, yellowish at sides, fourth more extensively so but with a considerable dark area. Pleural stripe extending on to front coxa; hind coxa also with a dark streak outwardly. Wings as figured (Pl. II, fig. 13); costal margin mainly yellow; tip of marginal cell broadly dark; brown spot over tip of Sc small; a brown spot fills basal third of upper basal cell, and a larger dark brown area fills base of cell R5; a brown patch connects R5 with M1 at about middle of fork. Halteres with dark knob. Hypopygium (text-fig. 4, A) elongate but not very stout; tergite ending in a long black finger; outer style dark, widened beyond middle; inner style entirely pale, bent but simple.

♀. Resembles ♂, but thorax usually darker above.

Wing-length, 5-6 mm.; body-length 6-7 mm.

BRAZIL: Nova Teutonia (*Plaumann*), numerous specimens of both sexes, including type ♂.

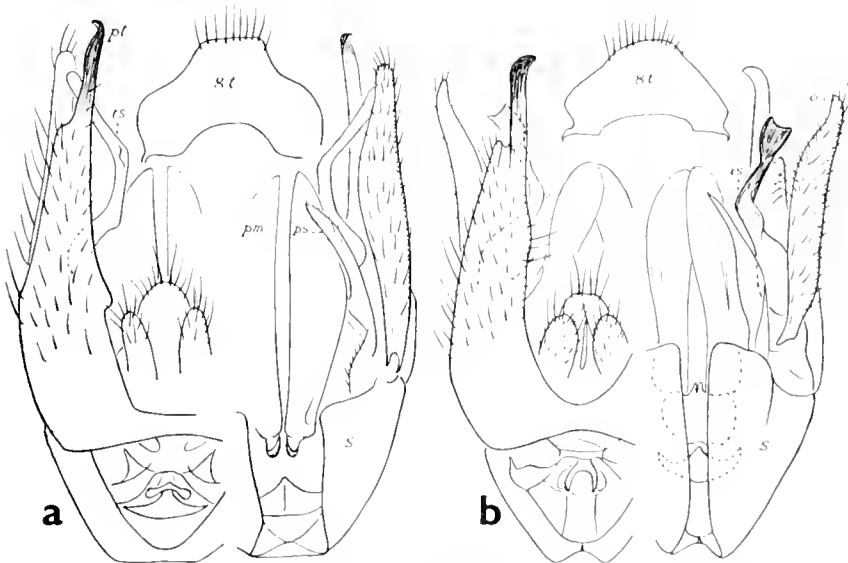
***Neoempheria plaumanni* var ?.**

♀. Resembles *N. plaumanni* in most respects, including the presence of a dark streak on outer side of hind coxa, but differs from that species and the other two described below in that the wings (Pl. II, fig. 14) have no dark areas in base of cell R₅ and immediately below iCu.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♀.

***Neoempheria flavicoxa* sp. n.**

♂. Very similar to *N. plaumanni*, except that the hind coxa is entirely yellow; the mesonotal markings might be described as five dark stripes separated



TEXT-FIG. 4.—Hypopygia of *Neoempheria* A, *plaumanni*; B, *flavicoxa*

by four yellow ones, all the dark stripes connected in front and the middle three convergent behind; the stripes are rather more definite than in *N. plaumanni*. Wings (Pl. II, fig. 15) almost as in *plaumanni*, but dark area below Cu rather differently shaped. Hypopygium (text-fig. 4, B) resembling that of *N. plaumanni*, but differing in various small details, notably in having the inner style blackened and truncate at the tip.

♀. Resembles ♂.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂ (type), 2 ♀.

***Neoempheria puncticoxa* sp. n.**

♂. Very similar to *N. plaumanni* and *N. flavicoxa*, but differs from both in having the last palpal segment mainly yellow, the postnotum with a dark spot in middle at base instead of a dark basal band, front coxa with a small separate dark spot in middle in front, and knob of halteres almost entirely yellow. Hind coxa all yellow as in *N. flavicoxa*. Mesonotum with five dark stripes as in the two

allied species, but the outer pair of stripes less sharply defined outwardly. Hypopygium (text-fig. 5) resembling that of *N. plaumanni*, but differing in having the inner style forked and in some other details.

♀?. Front coxa as in ♂, but postnotal dark band almost complete (palpi and halteres broken).

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂ (type), 1 ♀.

Neoempheria mülleri sp. n.

♂. Head yellow above, dark behind; palpi black as usual; scape yellow, flagellum blackish. Ocellar bristles practically reaching base of antennae; a longish bristle on second antennal segment. Thorax in darker specimens largely blackish-brown above, with a wedge-shaped median yellow stripe which is divided by an indistinctly darker line along the acrostichal hairs, and towards each side with a small oval yellow spot; in lighter specimens the sublateral pale spot may be longer. Scutellum pale yellowish. Sides of mesonotum yellowish but less broadly so than in some species; ground-colour of pleurae yellow, but dark markings more extensive than in most species, the usual oblique stripe being less definite on this account; whole anepisternite dark, also a large part of sternopleura, but upper part of latter pale. Abdomen with large yellow areas on sides of tergites; tergite 2 with its posterior margin rather broadly yellow; tergite 4 narrowly yellow at base and broadly so posteriorly, leaving a rather narrow dark band, which is widest in middle; 5 and 6 with large yellow lateral triangles which do not quite meet in middle of posterior margin. Front coxae mainly pale except at base; middle and hind coxae with or without small dark marks outwardly. Hind femur darkened on distal half or more, but pale at base. Wings (Pl. II, fig. 16) with costal and marginal cells alternately yellow and brown, a wide brown area before tip of Sc; basal half or more of basal cell dark; a dark cloud adjoins M₁ in middle of cell R₅, but does not nearly reach up to R₅ as it does in *N. plaumanni* and related species. Sc bare. Hypopygium (text-fig. 6, c) resembling that of *N. plaumanni* in that the tergite has a blackened finger-like process at the tip, and the outer style is broad and dark, but the sternite is more developed, forming a pair of large pale bare lobes. Inner style slender, darkened at tip, with a single small tooth near middle; inner processes of sternite with bifid tips.

♀. Resembles ♂. Sc usually with some setae at tip.

Wing-length 4-5 mm.

BRAZIL: Nova Teutonia (*Plaumann*), 4 ♂ (including type), 3 ♀.

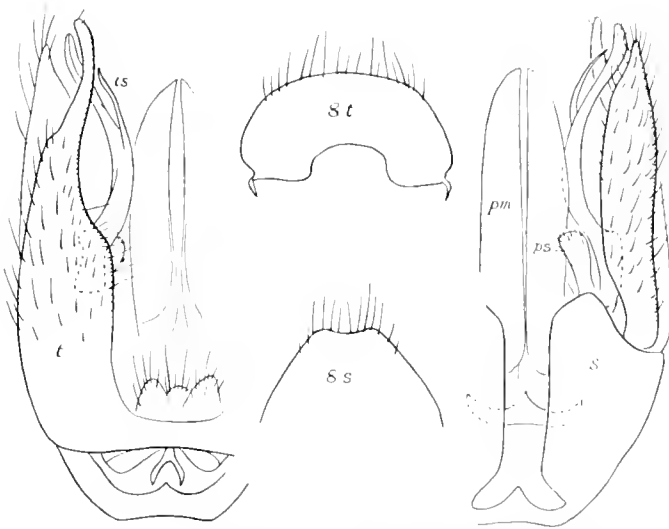
Dedicated to the pioneer Brazilian Dipterist Fritz Müller.

This species is closely related to *N. varipennis* F. Lynch A. (Misiones Terr.) and to *N. maculipennis* Will. (St. Vincent, W.I.), all three having very similar wing-markings, but differing in other details.

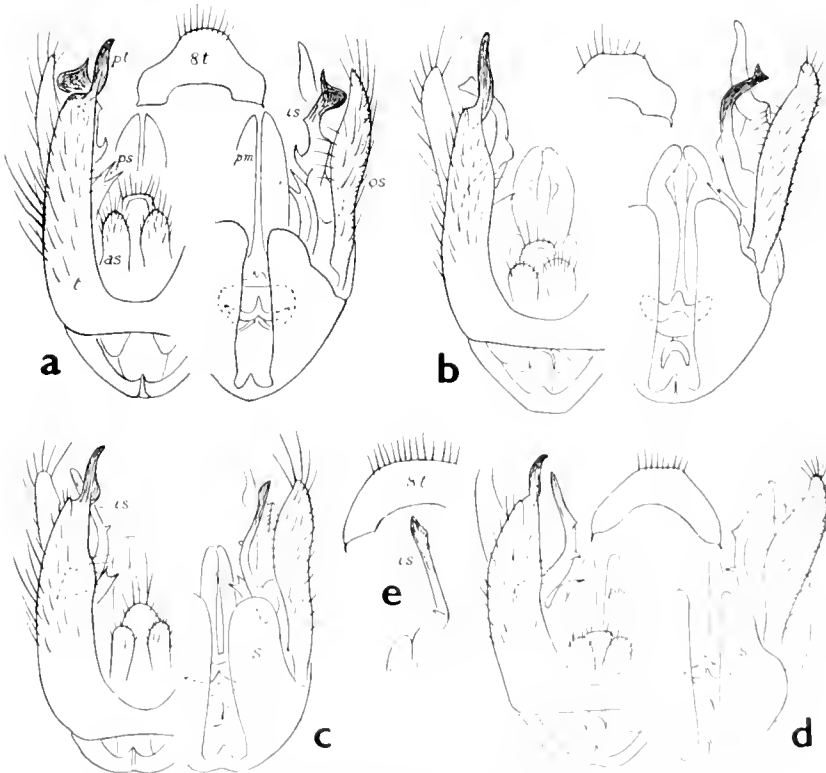
Neoempheria varipennis (F. Lynch Arribalzaga).

1802. *Empheria varipennis* F. Lynch Arribalzaga, *Bol. Acad. Cienc. Córdoba*, 12: 423.

A series of specimens in the Plaumann collection in the British Museum agree with the description of *N. varipennis*, and show the following differences from the new species described above: Mesonotum not so dark, and with the sublateral pale areas forming short stripes rather than spots. Fourth abdominal tergite more extensively dark, the dark area nearly reaching posterior margin



TEXT-FIG. 5.—Hypopygium of *Neompheria puncticola*.



TEXT-FIG. 6.—Hypopygia of *Neompheria*: a, *varipennis*; b, *laevi*; c, *mulleri*; d, *maculipennis*; e, *maculipennis* ssp. *bradleyi*.

in middle. Front coxa largely dark. Hypopygium (text-fig. 6, A) with tip of inner style expanded and blackened, and with some other small differences.

***Neoempheria maculipennis* Williston.**

1896. *Neoempheria maculipennis* Williston, *Trans. Ent. Soc. London*, 1896 : 262.

Three males (type and paratypes) of *N. maculipennis* in the British Museum show the following differences from *N. mülleri* sp. n. Thorax paler, striped as in *N. varipennis*; sternopleura not at all darkened. Hind femora entirely yellow. Fifth and sixth abdominal tergites, as well as the fourth, with complete pale apical bands. Wings (Pl. II, fig. 18) with a small pale area in base of median fork, otherwise as in *mülleri* and *varipennis*. Hypopygium (text-fig. 6, D) with finger-like process of tergite differently shaped; inner process of sternite simple, not bifid; inner style with two small teeth at some distance apart near middle.

***Neoempheria maculipennis* subsp. *bradleyi* subsp. n.**

♂. Mesonotum more shining than in the types of *maculipennis* and rather differently marked; a small dark area above each shoulder connected with the usual sublateral dark stripes and with very narrow dorso-central dark stripes, but no trace of acrostichal dark stripe, so that the resulting mesonotal pattern might be described as three rather broad yellow stripes narrowly outlined with dark. Tergite 5 narrowly pale-bordered, 6 dark. Hind femora rather broadly dark-tipped, but hind coxa entirely yellow, as in *maculipennis*. Sternopleura dark in middle. Wings as in *maculipennis*, with a small pale area in base of median fork. Hypopygium (text-fig. 6, E) very much as in typical *maculipennis*, the parameres having the same rather unusual form, but inner style rather differently shaped and with only one tooth; eighth tergite with a longer row of setae.

PERU: La Sombra, Putumayo District (*J. Chester Bradley*), 1 ♂, 22.viii.1920. Type in Cornell University Collection.

***Neoempheria* sp. n. ?**

♀. Resembles *N. mülleri* and *varipennis* in most respects, but differs from them and resembles the types of *maculipennis* in having hind femora entirely yellow; differs from all three in that the yellow mesonotal stripes are more distinct, all reaching back to the scutellum, and the dark area above M1 extends narrowly to R5, somewhat as in *N. plaumanni* and related species, though this dark area (and more obviously the pale area which precedes it in cell R5) is much more oblique than in those species. Fourth tergite with large apical lateral yellow spots, but dark area reaching posterior margin in middle; 5 and 6 with small apical lateral yellow spots.

Wing-length 5 mm.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♀.

This specimen may be a variation of *N. varipennis* or *mülleri*, but is more probably a distinct species.

***Neoempheria lanei* sp. n.**

♂. Head as in the allied species, but thorax much darker. Mesonotum mainly blackish brown, the usual three or four paler stripes barely distinguishable and the dark colour extending to the sides, leaving only a small yellow mark on

the margin some distance in front of the wing-base. Anterior pronotal lobes dark brown instead of yellow as in all the other species of this group. Sterno-pleura almost entirely dark, and pleuro-tergite more extensively dark than usual. Abdomen with complete though rather narrow pale apical bands on tergites 2, 4 and 5. Front coxae almost all blackish; posterior coxae also largely dark. Hind femur blackish on distal two-thirds; middle femur with a dark band before the tip. Wings (Pl. II, fig. 17) with the dark markings on the same plan as in the last three species, but less extensive; dark cloud in middle not involving **MI** or **CuI**. Hypopygium (text-fig. 6, B) very like that of *maculipennis*, but inner style blackened and truncate at tip, with one blunt prominence near base.

Wing-length 4 mm.

BRAZIL: Juquia, São Paulo (*J. Lane*), 1 ♂ (type), presented to British Museum by the collector.

GROUP E (*Neurocompsa* Enderlein).

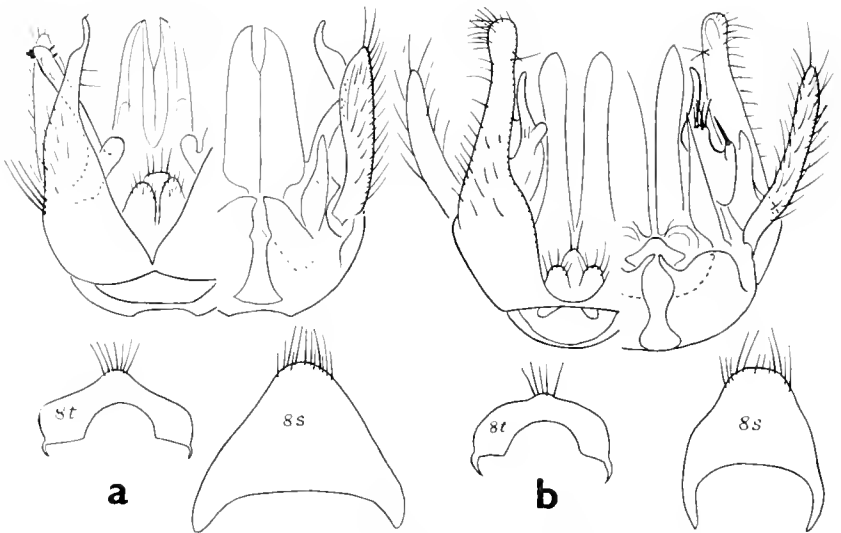
Venation and trichiation of wings as in Group D, except that **Sc** is usually setose for a short distance at tip, and **Sc1** is usually longer. Ocellar bristles long, as in Group D, though not always reaching to base of antennae. Bare stripes on mesonotum as in Groups C and D. Pleural markings as in Group D, but the oblique stripe sometimes faint. Wing-markings less conspicuous than in Group D; basal cell entirely clear except for the cloud over base of **Rs**. Halteres with knob mainly or all dark (except in *N. lüderwaldti*).

Neoempheria ornatipennis (Enderlein).

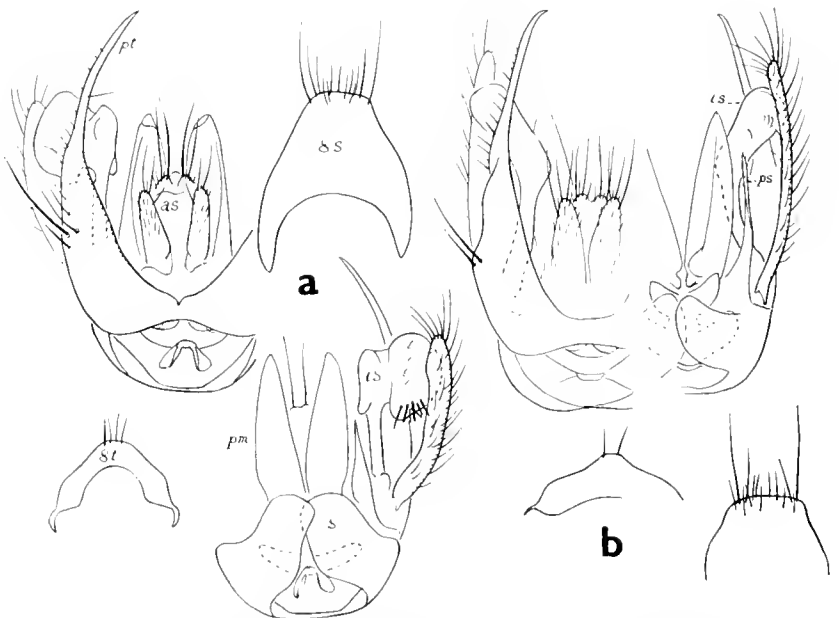
1911. *Neurocompsa ornatipennis* Enderlein, *Stettin. ent. Ztg.*, 72: 159.

In addition to Enderlein's type ♂ collected by Lüderwaldt, I have examined two males of this species collected by Plaumann at Nova Teutonia, and another collected by Lane, probably near São Paulo.

The species is well distinguished from all others of the genus by the abrupt sinuosity of the fold between **R5** and **M**, with a dark ridge or thickening connecting on to **R5** at the top of the bend. Apart from this peculiarity *N. ornatipennis* shows no very striking differences from others placed with it in this group. The ocellar bristles reach the base of the antennae. Flagellum dark almost to the base. Mesonotum mainly light brown, with three darker brown stripes connected by a narrow dark band on front margin; the sublateral pair of stripes broader than the median stripe, which is very narrow and fades out posteriorly. Oblique stripe of pleurae distinct. A narrow transverse brown band at base of postnotum and extending on each side over base of pleurotergite and on posterior edge of anepisternite. Abdomen with tergite 1 dark above, yellow at sides, 2 rather broadly pale at sides and on posterior margin, 3 yellow at sides at base but broadly dark posteriorly, 4 yellow with a dark area at base in middle, 5 and 6 mainly dark. Wings (Pl. II, fig. 16) with a rather large pale area in base of median fork; vein **MI** somewhat concave above in middle. All coxae yellow; hind femora somewhat darkened. Hypopygium (text-fig. 7, A) rather peculiar in that the two halves of the tergite are connected at a point instead of by a transverse band; inner style with a few black spines at tip; terminal finger of tergite short; outer style rather broad. Eighth tergite with about six setae in middle of distal margin.



TEXT-FIG. 7.—Hypopygia of *Neompheria*: A, *ornatipennis*; B, *evanescens*.



TEXT-FIG. 8.—Hypopygia of *Neompheria*: A, *kästneri*; B, *subclavata*.

***Neoempheria evanescens* (Enderlein).**

1911. *Pleomazoneura johannseni* var. *evanescens* Enderlein, *Stettin. ent. Ztg.*, **72**: 158.

♂. In most respects very similar to *N. kästneri* and other species described below, but is rather smaller and with fainter wing-markings; pleural stripe present as in other species of this group, and abdominal markings as in *N. kästneri*. Features which may distinguish it from other species of the group are the faintness of the acrostichal as well as the dorso-central dark stripes of the mesonotum and the complete absence of setae on vein Sc. Hypopygium (text-fig. 7, B) quite distinctive; tergite hairy at tip, without any definite process; inner style of unusual form; outer style rather short; lobes of sternite with a small finger-like projection.

BRAZIL: Santa Catharina (*Lüderwaldt*), 1 ♂ (lectotype, in Stettin Museum).

***Neoempheria kastneri* sp. n.**

♂. Colour and markings almost exactly as in *N. ornatipennis* except that the hind femora are not in the least darkened, but are yellow like the others; second abdominal tergite with the dark area above rather longer, nearly reaching posterior margin; pale area in base of median fork rather smaller; wings with fold between R₅ and M straight, M₁ also quite straight. Hypopygium (text-fig. 8, A): chiefly distinguished by the form of the inner style, which has a greatly enlarged tip (this collapses in drying and maceration is needed to restore its true form); outer style broadish; the slender terminal process of tergite almost as long as tergite itself. Anal segment with long setae. Eighth tergite with four setae.

Wing-length 4 mm.

BRAZIL: Santa Catharina (*Lüderwaldt*), 1 ♂ (type) in Stettin Museum, formerly a paratype of *Pl. johannseni* End. Nova Teutonia (*Plaumann*), 3 ♂ in British Museum.

Dedicated to Dr. Kästner of Stettin town Museum, in appreciation of his kind assistance during my visit there in 1933, and subsequently.

***Neoempheria subclavata* sp. n.**

♂. Closely resembles *N. kästneri* in all external features, hypopygium (text-fig. 8, B) also similar in type, having the tergite largely bare, with one or two long bristles at side in middle and with long terminal process; anal segment large, with long setae and with the sternite notched. Differs from *N. kästneri* in having the outer style much longer and more slender, and the inner style less swollen at the tip and without any black spines. Eighth tergite with only two setae.

BRAZIL: Nova Teutonia (*Plaumann*), 2 ♂ (including type).

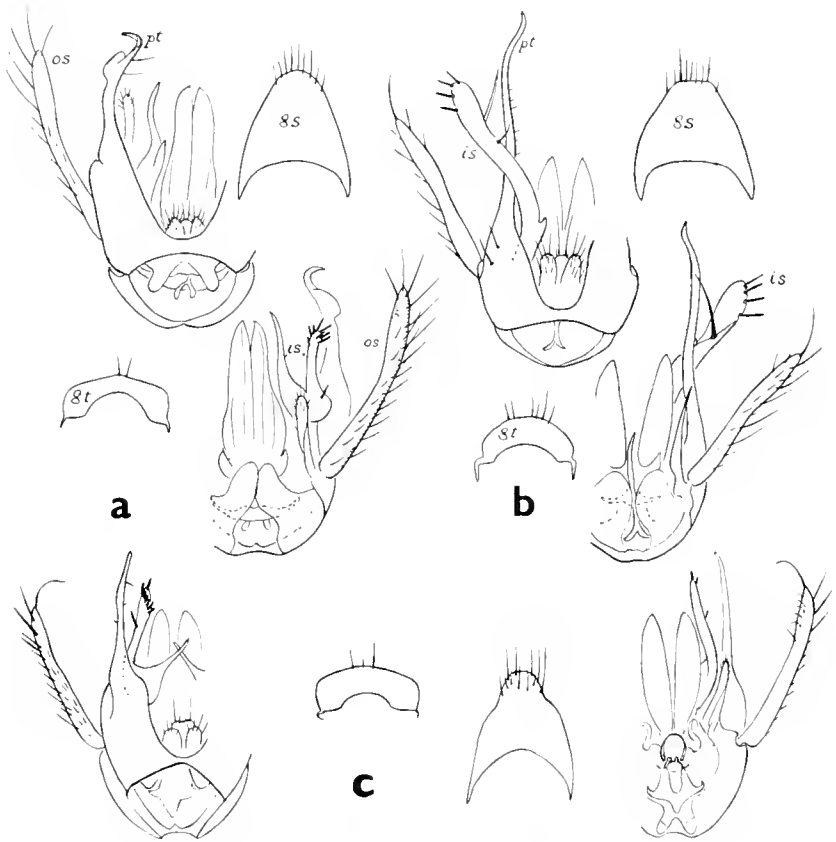
***Neoempheria luderwaldti* sp. n.**

♂. Closely resembles *N. kästneri* in all external features, except that the halteres are almost entirely yellow; wings as in Pl. II, fig. 20. Hypopygium (text-fig. 9, A) quite different; terminal process of tergite with a wide enlargement before tip; inner style divided almost to base into two arms, inner arm slender and pointed, outer arm ending in a tuft of black spines; outer style slender. Anal segment small, with short setae. Eighth tergite with two setae.

BRAZIL : Santa Catarina (*Lüderwaldt*), 1 ♂ (type) in Stettin Museum, formerly a paratype of *Pl. johannseni* var. *evanescens* End. Nova Teutonia (*Plaumann*), 1 ♂ in British Museum.

Neoempheria enderleini sp. n.

♂. Closely resembles *N. kästneri* in nearly all respects, but yellow areas on sides of third tergite occupying less instead of more than half its length, and



TEXT-FIG. 9.—Hypopygia of *Neoempheria* : A, *lüderwaldti* ; B, *enderleini* ; C, *smarti*.

cubital fork more parallel-sided, with *Cu* distinctly turned up at tip. Hypopygium (text-fig. 9, B) quite different : tergite without strong bristles and with the terminal process extremely long ; inner style not swollen at tip and with one long black bristle in addition to some shorter ones ; outer style less bristly ; anal segment small and with short setae ; aedeagus with a long median rod, which is not present in *kästneri*. Eighth tergite differently shaped and with six setae.

BRAZIL : Santa Catharina (*Lüderwaldt*), 1 ♂ (type) in Stettin Museum, formerly a paratype of *Pl. johannseni* var. *evanescens* End. Nova Teutonia (*Plaumann*), 1 ♂ in British Museum.

***Neoempheria smarti* sp. n.**

♂. Closely resembles *N. kästneri*, *enderleini* and related species described above, but smaller than any of them. Flagellum dark. Ocellar bristles nearly reaching base of antennae. Mesonotum with sublateral stripes distinct and median stripe fairly obvious, but dorso-central stripes not developed. Pleural stripe as usual; dark band at base of postnotum extending on to base of pleurotergite. Abdomen with tergite 1 dark above, 2 with lateral and posterior margins broadly yellow, 3 and 6 yellow laterally at base, 4 and 7 all yellow, 5 all dark. Coxae and femora entirely yellow. Wings with rather faint markings arranged as in the related species; a rather large pale area in base of median fork; cloud below Cu₂ indefinite. Sc completely bare. M₂ markedly bent upwards at tip. Hypopygium (text-fig. 9, c): tergite bare except for a few fine hairs on the long and simple terminal process; inner style broad at base and divided into two nearly to the base, dorsal part forming a long spine, ventral part longer and stouter, bearing 7-8 black spines at its tip; outer style slender. Eighth tergite with 3 setae in type (perhaps normally 2).

Wing-length scarcely over 2 mm.

BRITISH GUIANA: Mazaruni, secondary forest, 16.viii.37 (*O. W. Richards* and *J. Smart*), 1 ♂.

The structure of the hypopygium of this species is as nearly as possible intermediate between *N. lüderwaldti* and *enderleini*, the inner style resembling the former and the tergite the latter species.

***Neoempheria unispinosa* sp. n.**

♂. Closely resembles *N. kästneri*, but mesonotal markings somewhat different; the median stripe is faint and abbreviated posteriorly, and there is a pair of faint dorso-central stripes which are more distinct behind and unite in front of the scutellum. Hypopygium (text-fig. 10, A) comparatively small and of quite different structure: halves of tergite regularly tapering and with a single strong bristle outwardly near base; inner style slender, with one black spine at base, tip bare; outer style slightly clubbed; ventral process of sternite long. Eighth tergite with two setae.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂ (type).

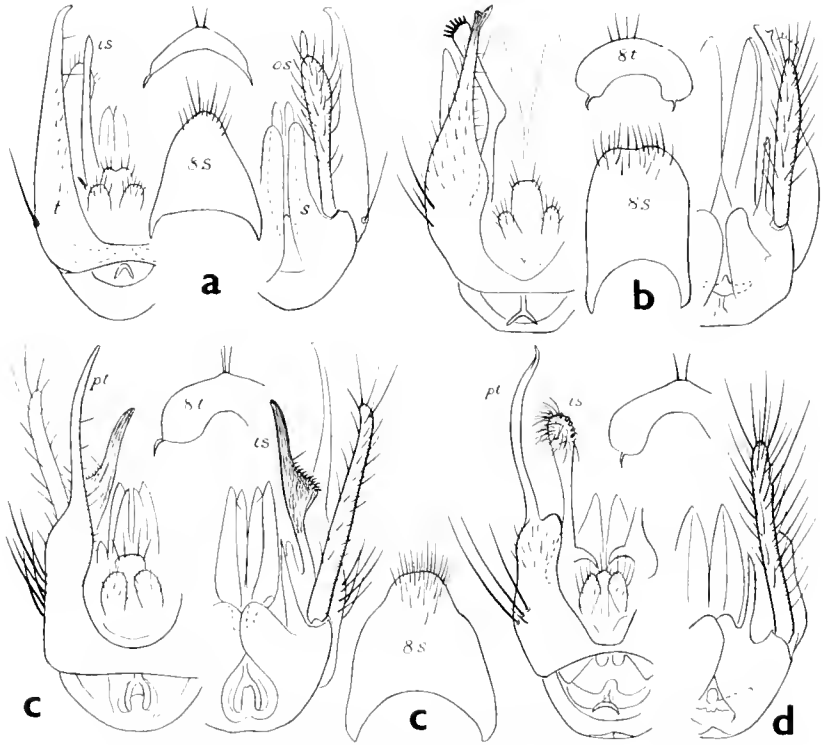
***Neoempheria flavicornis* sp. n.**

♂. Closely resembles *N. kästneri*, but ocellar bristles shorter (though still long) and pleurotergite entirely yellow, in these respects differing from all the last eight species described. Flagellum with only the distal half dark, base extensively yellowish. Wing-markings (Pl. II, fig. 21) as in the allied species, but cubital fork rather differently shaped. Second tergite rather broadly yellow posteriorly, third with yellow lateral patches occupying half its length, fourth with a small dark area above. Hypopygium (text-fig. 10, B) somewhat of the type of *N. kästneri*, but process of tergite not so long, with a small projection near tip; inner style elbowed but not swollen, with about six black spines in a row at tip; outer style rather short. Eighth tergite with four setae.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂ (type).

Neoempheria rostrata sp. n.

♂. Closely resembles *N. flavicornis* and *pilosa*, and like them with the pleurotergite completely yellow; small external differences which may not be constant are that the dark dorsal area of tergite 2 extends almost to the posterior margin, and vein Sc1 is noticeably longer than Sc2 instead of only about as long. Hypopygium (text-fig. 10, c) quite different: tergite with the basal part almost bare except for a group of stout lateral bristles, process long, slender and pointed, no shoulder at its origin; inner style blackened, widened in middle and with an



TEXT-FIG. 10.—Hypopygia of *Neoempheria*: A, *unispinosa*; B, *flavicornis*; C, *rostrata*; D, *pilosa*.

irregularly double row of short black spines on distal margin of the wide part, a single fine hair in addition to the spines, but the long beak-like tip bare; parameres each ending in two points.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂ (type).

Neoempheria pilosa sp. n.

♂. Closely resembles the last species in all external features, having the oblique pleural stripe distinct as in other species of this group but the pleurotergite entirely pale. Hypopygium (text-fig. 10, D) very distinctive owing to the structure of the inner style, which is slightly clubbed, the club clothed with a tuft of hair. Tergite with three long bristles on basal part, the long terminal

process arising abruptly from a shoulder. Outer style moderately long and very hairy. Eighth tergite with two setae.

BRAZIL: Nova Teutonia (*Plaumann*), 2 ♂ (including type).

Females of this group cannot at present be associated with their respective males, and there are probably many other species in addition to those described above. One such is represented in the British Museum by a damaged male from Manaos (*G. J. Fredenberg*).

GROUP F (*Pleonazoneura* Enderlein).

Wings and mesonotum as in Group E, but ocellar bristles shorter, reaching only a little beyond front edge of the black spot, and pleurae lacking the oblique stripe, at most with a small dark area immediately in front of wing-root. Halteres with dark knob.

Neoempheria lindneri sp. n.

♂. Head with the area between ocellar spot and base of antennae darker than usual. Ocellar bristles longer than in other species of this group. Mesonotal colouring as in *N. ornatipennis* and *kästneri*, except that the dark band on postnotum is sharply defined, broadly V-shaped and distinctly removed from base of postnotum; pleurotergites with a sharply defined dark patch at base, which does not extend on to anepisternite. Immediately below and in front of wing-root is a small and rather ill-defined dark area which does not cross the anepisternite. All coxae yellow. Abdominal markings as in *N. kästneri*, tergites 2 and 4 being broadly pale on posterior margin. Wings (Pl. I, fig. 6) with the dark markings stronger than in the species of Group E, and peculiar in having no darker area below Cu₂, but a slight cloud in basal half of basal cell. Hypopygium (text-fig. 11, A): in many respects very similar to that of *N. enderleini*, but inner style rather differently shaped and darkened, with two black bristles at middle and only two or three black spines at tip; eighth tergite otherwise.

Wing-length 4 mm.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂ (type).

Dedicated to my friend Dr. E. Lindner of Stuttgart, who made a collecting expedition to the Chaco in 1925-26.

Neoempheria shannoni sp. n.

♂. Head largely pale above, dark at sides and on space between ocellar spot and base of antennae. First few antennal segments yellowish; palpi black as usual. Mesonotum with acrostichal and dorso-central dark stripes equally distinct and obviously darker than the ground colour, but sublateral stripes rather wider and darker as usual; postnotum with an ill-defined and indefinitely darker band at base, not or scarcely extending on to pleurotergites. Pleurae entirely yellow, no trace of darkening in front of wing-root. Abdomen with a continuous blackish median longitudinal stripe, not interrupted on posterior margins of tergites 2, 4 or 7; yellow areas at sides of tergites as usual, 3 and 5 with whole posterior margin broadly dark. Wings (Pl. II, fig. 22) with the dark areas of more intensive tint than in *N. kästneri* and related species, but similar in arrangement; a pale area completely fills base of median fork; a dark area present below Cu₂ as usual. Hypopygium (text-fig. 11, C): tergite with each half long and narrow but somewhat truncate at tip, with several strong bristles near base;

inner style of rather complex form, with a long outwardly directed tooth at middle and about four small black teeth at tip. Eighth tergite square-ended, with about 10 setae.

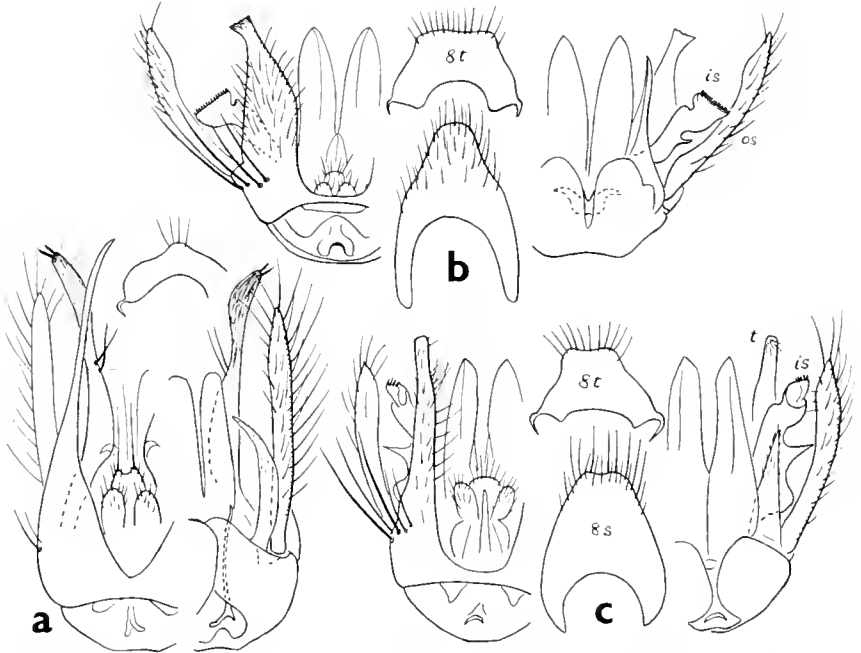
♀. Resembles ♂.

Wing-length 4 mm.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂ (type), 1 ♀.

Dedicated to my friend Dr. R. C. Shannon.

This species seems to be rather nearly related to the North American *N. illustris* Johannsen, but in a female of the latter which I collected in Washington



TEXT-FIG. 11.—Hypopygia of *Neoempheria*: A, *lindneri*; B, *johannseni*; C, *shannoni*.

in 1928 the mesonotal markings are more sharply defined, and Johannsen's figure shows differences in the hypopygium, notably in the form of the inner style.

Neoempheria johannseni (Enderlein).

1911. *Pleonazoneura johannseni* Enderlein, *Stettin. ent. Ztg.*, 72: 156.

The lectotype male in the Stettin Museum closely resembles the last species in external features and the hypopygium (text-fig. 11, B) is also similar, but differs in detail: the tergite is much broader, and the inner style has a regular comb of ten or more small black teeth at the tip. Eighth sternite more hairy.

BRAZIL: Santa Catharina (*Lüderwaldt*).

Neoempheria costa-limai sp. n.

♂. Head largely pale above as usual; antennae with first five or six segments yellowish, rest dark; palpi black. Mesonotum with sublateral and acrostichal

stripes connected on front margin as usual, but dorso-central stripes not indicated. Postnotum with rather faint dark basal band indistinctly extending on to pleurotergites; pleurae otherwise entirely yellow. Abdominal tergites 2 and 4 almost all yellow, with a small dark area at base above. Wings (Pl. II, fig. 23) differing from those of all other species of Groups E and F described above in having the small cell shorter, with R₄ only a little beyond level of middle of stem of median fork. Dark areas of wing rather faint, but cloud at tip completely filling median fork. Hypopygium (text-fig. 12, A) in several respects very different from all the other species: tergite with twisted tip set with dense patches of setae; inner style bare and with bifid tip, parameres also with bifid tips; sternite on each side with a long bare pointed process, as long as the long and slender outer style. Eighth tergite larger than usual, with a row of about 16 setae.

Wing-length 3.5 mm.

BRAZIL: Nova Teutonia (*Plaumann*), 3 ♂ (including type).

Dedicated to Dr. A. Costa Lima.

Neoempheria biflagellata sp. n.

♂. Very similar to the last described species, differing mainly if not solely in structure of hypopygium (text-fig. 12, B). Like the last species this has the parameres divided at the tips and the lobes of the sternite drawn out into long bare whip-like processes as long as the outer styles, but the tergite has a completely different shape, as has the inner style, and other details also differ; the eighth tergite is smaller.

Wing-length barely 3 mm.

BRAZIL: Nova Teutonia (*Plaumann*), 1 ♂ (type).

GROUP G.

Sc ending above base of Rs; Sc₂ at its tip and transverse. R₄ near level of middle of stem of median fork, which is longer than usual, the small cell short. Costa strongly produced. fCu beyond base of Rs. Trichiation of veins alike in the two sexes, M₁ and Cu₂ setose throughout, M₂ completely bare, Cu₁ setose except at base; Sc completely bare; Cu bare except for a short distance before the fork. Wings with dark markings at middle and tip, but costal and basal cells clear except for the dark area over base of Rs. Ocellar bristles long, and bristle on second antennal segment longer than usual. Pleurae with dark longitudinal stripe or with lower part more extensively darkened, but upper part pale. No definite bare stripes between acrostichal and dorso-central hairs. Halteres yellow.

Neoempheria vogeli sp. n.

♂. Head yellowish except for the ocellar spot; antennae with first four or five segments pale, rest dark; palpi black. Mesonotum uniformly brown above, without stripes, but with the side margins rather narrowly yellow. Pleurae yellow, with a dark stripe crossing middle of pleurotergite and upper margin of sternopleura. Abdomen with tergites 2, 3 and 4 similarly coloured, with a continuous median dorsal dark stripe and with the posterior and lateral margins of each narrowly dark; 5 more extensively dark. Coxae and femora all yellow. Wings (Pl. I, fig. 3) slightly darkened at base, with the dark area in middle leaving much of the small cell clear, but covering basal half of stem of median fork. Apical dark area leaving base of fork clear but extending below base of

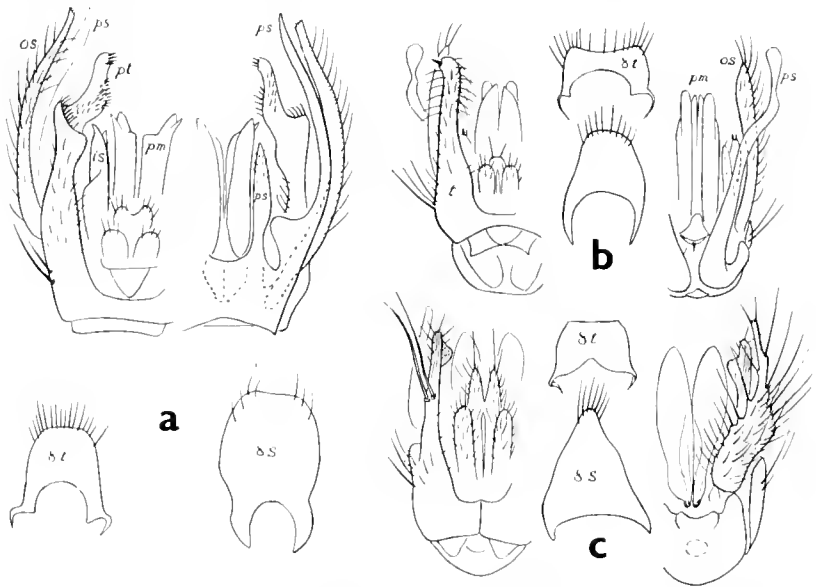
M₂. Vein An reduced to a short stump. Hypopygium (text-fig. 12, c) : tergite broad at base, the terminal process expanded and blackened at tip and with a pair of long stout bristles ; anal segment large, the sternite deeply bifid ; apparently there is no inner style ; outer style forming a broad flat dark plate with a finger-like termination. Eighth tergite truncate and bare.

Wing-length 3.5 mm.

BRAZIL : Petropolis (*Vogel*), 1 ♂ (type), presented to British Museum by Father Borgmeier in 1931.

Neoempheria lutzi sp. n.

♀. Differs from *N. vogeli* as follows : Pleurotergite wholly dark ; sternopleura with a short dark stripe above. Abdomen with tergites 2 and 4 mainly



TEXT-FIG. 12.—Hypopygia of *Neoempheria* : A, *costa-limai* ; B, *biflagellata* ; C, *vogeli*.

yellow, with the anterior and posterior margins narrowly dark ; 3 (as well as 5-7) mainly dark. Hind coxa slightly darkened outwardly. Wings (Pl. I, fig. 4) not at all darkened at base, with the dark area in middle completely filling the small cell. Vein An long, but pale.

Wing-length 4.5 mm.

BRAZIL : Nova Teutonia (*Plaumann*), 1 ♀ (type).

Dedicated to Dr. Adolpho Lutz.

GROUP H.

Sc ending a little beyond base of Rs ; Sc₂ a short distance from its tip and transverse. R₄ before fM, stem of fork hardly longer than usual. Costa strongly produced. fCu before base of Rs. Sc, M₂ and Cu₁ completely bare ; stem of Cu bare except for a short distance before the fork ; M₁ and Cu₂ setose throughout. Wings dark in middle and at tip, basal half clear. Ocellar bristles short. Mesonotal bristles scantier than usual ; dorso-centrals irregularly uniserial ;

acrostichals few. Scutellum with two strong bristles as in other Neotropical species of the genus. Pleurae dark above, pale below. Halteres dark.

***Neoempheria pereirai* sp. n.**

♀. Head mainly dark brownish; scape brown, flagellum and palpi black. Thorax uniformly dark brown above and somewhat shining. Pleurae mainly blackish brown, but lower part of pleurotergite and whole of sternopleura whitish yellow, the two colours abruptly separated. All coxae whitish yellow, with the tips pale brownish yellow; femora and tibiae slightly darker than coxae, tarsi dark. Abdomen mainly blackish; tergite 2 with a rather narrow yellow transverse band beyond middle but with whole of posterior margin dark; 4 with a yellow spot on each side at about the middle; 7 mainly yellowish. Wings (Pl. I, fig. 5) narrower at base than in any of the other species, with the dark areas in middle and at tip broadly connected on hind margin, leaving base only of cell *Cu1* clear. Veins *CuP* and *An* both obsolete.

Wing-length 3 mm.

BRAZIL: Salobra, Matto Grosso, vii. 1939 (*J. Lane*), 1 ♂ (type), presented to the British Museum by the collector.

Dedicated to Dr. Clemente Pereira, Director of the Clube Zoologico Brasileiro, under the auspices of which the expedition to Salobra was organized.¹

¹ A description of this species has also been included in a report on the Mycetophilidae collected by the Salobra Expedition; this report is being sent (January, 1940) for publication in *Boletim Biologico, S. Paulo* (n.s.).

(*MSS. recd. Jan. 20, 1940.*)

PLATE I.

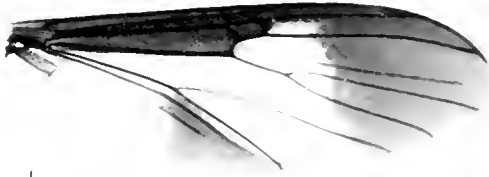
Wings of *Neoempheria* spp.

- | | |
|---------------------------------|---------------------------------------|
| 1. <i>N. neivai</i> sp. n. | 7. <i>N. spinosa</i> sp. n. |
| 2. <i>N. bipectinata</i> sp. n. | 8. <i>N. brevicauda</i> sp. n. |
| 3. <i>N. vogeli</i> sp. n. | 9. <i>N. simplex</i> sp. n., ♀ var. ? |
| 4. <i>N. lutzi</i> sp. n. | 10. <i>N. simplex</i> sp. n., ♂ type. |
| 5. <i>N. pereirai</i> sp. n. | 11. <i>N. bilobata</i> sp. n. |
| 6. <i>N. lindneri</i> sp. n. | 12. <i>N. borgmeieri</i> sp. n. |

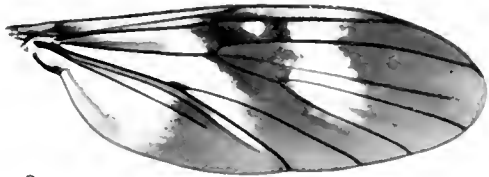
PLATE II.

Wings of *Neoempheria* spp.

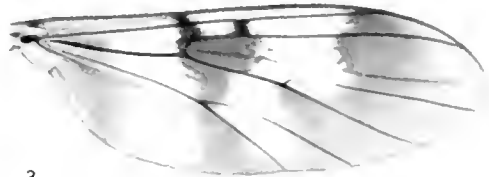
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|--|---------------------------------------|
| 13. <i>N. plaumanni</i> sp. n. | 19. <i>N. ornatipectennis</i> (End.). |
| 14. <i>N. plaumanni</i> sp. n., var. ? | 20. <i>N. lüderwaldti</i> sp. n. |
| 15. <i>N. flavicoxa</i> sp. n. | 21. <i>N. flavicornis</i> sp. n. |
| 16. <i>N. mülleri</i> sp. n. | 22. <i>N. shannoni</i> sp. n. |
| 17. <i>N. lanei</i> sp. n. | 23. <i>N. costa-limai</i> sp. n. |
| 18. <i>N. maculipennis</i> Will. | 24. <i>N. biflagellata</i> sp. n. |



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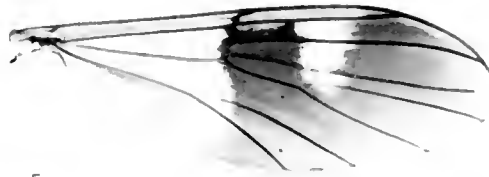
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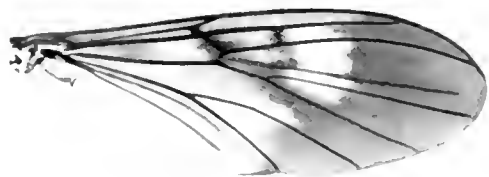
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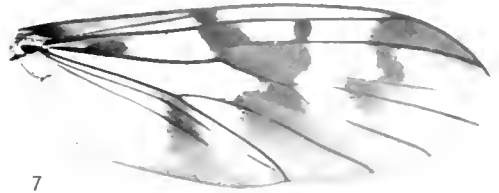
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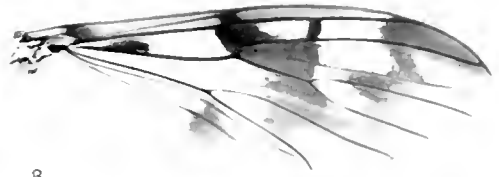
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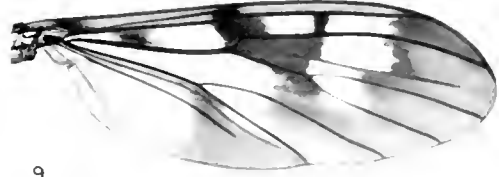
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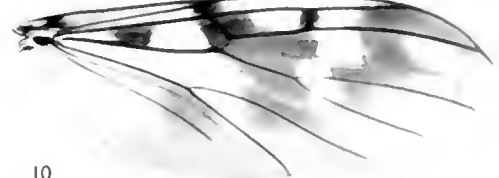
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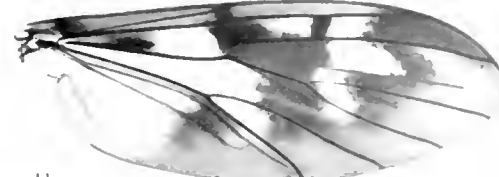
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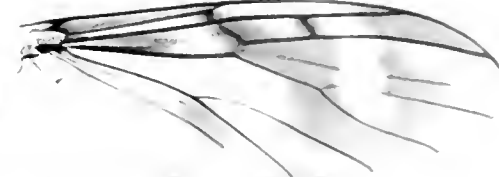
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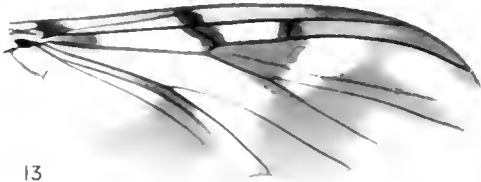


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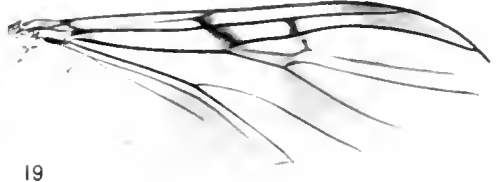


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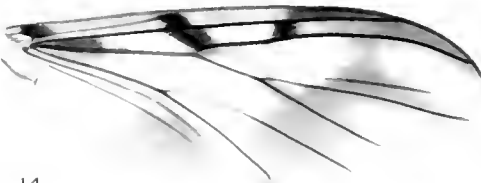
Wings of *Neompheria* spp.



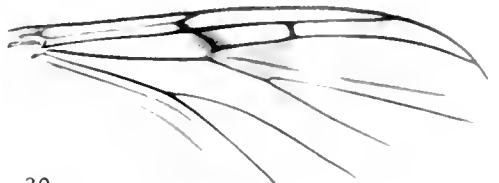
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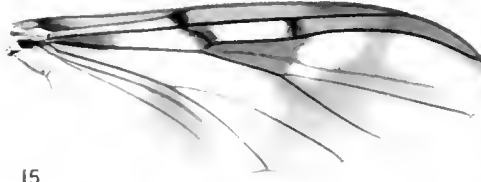
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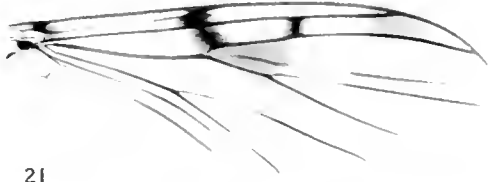
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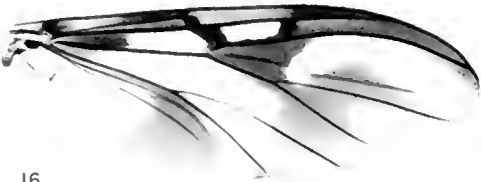
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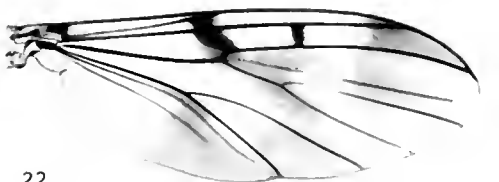
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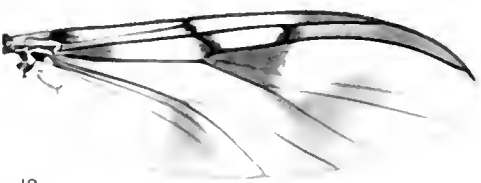
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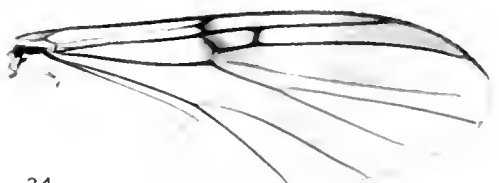
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24

Wings of *Neompheta* spp.

SOME SAPROMYZIDAE (DIPTERA) FROM THE SOLOMON ISLANDS AND NEW CALEDONIA

By JOHN R. MALLOCH.

(With one plate.)

THERE are two papers by Curran dealing with the Sapromyzidae of these islands.¹ Species recorded here which were described by him or listed from either group, are referred to in those papers. Only three species were recorded from New Caledonia, but from the Solomons Curran recorded 4 genera and 18 species, 10 of the latter new. Where I am able to do so, I have identified his species and made suggestions as to their status.

The materials on which this paper is based were kindly submitted for identification by the Imperial Institute of Entomology. All the material will be placed in the British Museum (Natural History).

STEGANOPSIS de Meijere.

1910, *Steganopsis* de Meijere, *Tijdschr. Ent.*, **53** : 145.

In 1929² I published a complete key to the species of this genus. Curran described two species from the Solomon Islands in the paper referred to above. There are four species in the present collection and below I present a synoptic key to them.

KEY TO THE SPECIES.

1. Face glossy fulvous or orange-yellow, with a few deep black glossy marks ; wings slightly yellowish brown clouded, with no definite black and hyaline markings, the apical edge from near apex of second to apex of fourth vein whitish hyaline ; all femora and most of tibiae fulvous yellow 2.
- Face black, with or without pale dust ; wings black, with two oblique hyaline fasciae on apical portion beyond the outer cross vein, and usually some less distinct hyaline or subhyaline spots or streaks on basal half ; femora and tibiae black, tarsi partly yellow or white 3.
2. Face with two dark marks on each side, the upper one glossy black, the lower one smaller and dark brown, and no central dark mark ; frons merely shiny on the interfrontalia, and with a large velvety black mark covering the ocelli and extending to at least midway between anterior ocellus and anterior margin (New Caledonia) *melanogaster* (Thomson).
- Face with a large oval glossy black central mark that extends from epistome to between antennae and covers half the width of face, and a small round black-brown spot against each eye margin near middle ; frons entirely glossy except the narrow dull orbits and a central line, and with a small blackish mark over the ocelli *tripunctifacies*, sp. n.

¹ 1929, *Amer. Mus. Nov.*, **375**. New Caledonia.

1936, *Proc. Calif. Acad. Sci.*, (4), **22**, no. 1 : 32-41. Solomon Islands.

² 1929, *Proc. U.S. nat. Mus.*, **74**, art. 6.

3. Head, thorax and abdomen glossy black, the frons with a distinct greenish-blue lustre; fore tarsi white, apical three segments and a narrow basal mark on the metatarsus deep black; wing as fig. 1.

varimana, sp. n.

Head and thorax black, with dense whitish-grey dusted markings, centre of frons rather dull pale grey, with slight grey dusting; fore tarsi yellow, extreme base of the metatarsus and all of the apical two segments black *solomensis* Curran.

***Steganopsis melanogaster* (Thomson).**

1868, *Lauxania melanogaster* Thomson, *Eugenies Resa (Insecta)* : 567.

This species occurs in Australia and New Guinea. Curran recorded it from New Caledonia. I have some specimens before me that apparently belong to the same material as his, having been collected by Prof. T. D. A. Cockerell.

***Steganopsis tripunctifacies* sp. n.**

♂. *Head* glossy fulvous yellow except the narrow orbits and a central frontal line, third antennal segment almost entirely dark brown, palpi infuscated at apices. Bristles black. Frons wider than long, glossy on its entire width above the upper orbital bristles, both the bristles on the edge of the glossy portion subequal in length, ocellars merely short hairs, divergent and proclinate. Basal antennal segment longer than second, third about nine times as long as wide, and as long as height of head; longest hairs on the arista not as long as width of third antennal segment. Eye higher than long, tapered below, not three times as high as the gena. Face quite prominent centrally and evenly convex in profile.

Thorax in type-specimen discoloured, fulvous yellow in front, showing three broad blackish-brown vittae on the mesonotum that are apparently fused behind, pleura mostly blackened, scutellum glossy black. Bristles weak, only the posterior one of the four pairs of dorsocentrals well developed, the acrostichal hairs minute, biseriate as in *melanogaster*. The sternopleura and mesopleura each with one bristle.

Legs fulvous yellow, bases and apices of fore tibiae fuscous, apical four segments of fore tarsi black. Preapical dorsal bristle on fore tibia slender, as long as the metatarsus, the one on mid tibia stout, much shorter, that on the hind tibia slender, but shorter than the metatarsus.

Wings (fig. 1) brownish yellow, more yellowish on basal half of the costa. Second wing vein evenly arched, running parallel with the costa from apex of first vein to its forward curve to connect with the latter. White apical margin linear. Halteres with the knobs blackish brown.

Abdomen thick, broadly ovate, and glossy black.

Length : 3.5 mm.

TYPE : San Cristobal, Solomon Islands (*R. A. Lever*).

In *melanogaster* the mesonotum has a number of yellowish-brown vittae that are more or less distinctly margined with black so that there may be eight or ten partial black lines or vittae in evidence in some specimens.

Steganopsis varimana sp. n.

♀. A glossy black species, with greenish-blue lustre on frons, the basal three segments of all tarsi yellow or white, the other segments and narrow base of the fore metatarsus black, and the halteres black. Wing as fig. 2.

Frons entirely glossy, wider than long, depressed on posterior lateral angles, posterior ocelli on edge of vertex, orbitals very near eye-margins, quite closely placed at middle, ocellars microscopic. Antennae fulvous yellow, tip of third segment slightly infuscated, aristaе much longer than entire antennae, the longest hairs nearly twice as long as width of third antennal segment, the latter about six times as long as wide, and not as long as height of head. Eye higher than long, narrowed below, emarginate on lower half behind, and about eight times as high as gena. Postocular orbits silvery white dusted. Palpi black. Face slightly convex in profile at middle, depressed below convexity, the epistome projecting slightly.

Thorax glossy black, with black hairs and bristles, undusted. Mesonotum with four pairs of dorsocentrals and acrostichals, the anterior pairs of both small and presutural, and a series of fine hairs between the acrostichals and dorsocentrals on each side. Scutellum slightly convex on disc, obtusely rounded in outline, the edge thin.

Legs black, tarsi as described in the foregoing key to the species. Fore tibia with a very short moderately strong preapical dorsal bristle, mid-tibia with longer, and stronger, and hind tibia with a very short such bristle.

Wings black, with hyaline markings (fig. 2). Second vein undulated, not parallel with costa on its entire extent, the submarginal cell comparatively narrower than in *tripunctifacies*. Halteres black.

Abdomen thick, broadly ovate, glossy black, with black hairs and bristles and very slight greyish dusting.

Length: 4 mm.

TYPE: Solomon Islands, Kolombangara, 5000 feet, at summit, II. X. 1933 (*H. T. Pagden*.)

Steganopsis solomensis Curran.

1939, *Steganopsis solomensis* Curran, *Proc. Calif. Acad. Sci.*, (4), 22: 32.

This species is readily distinguished from the others in this paper by the densely grey dusted frontal orbits, the slightly metallic grass-green, rugose, interfrontal area, and the grey dusted and black dotted and vittate mesonotum. The frontal bristles are much stronger and more evenly spaced than in the other species, while the genae are not one-fourth as high as the eyes. The halteres are yellow, and the wings though marked much as in *varimana* have more evident subhyaline markings on the basal half.

Length: 3-4 mm.

Originally described from Santa Catalina Is. I have specimens from Tulagi, 12. viii. 1933 (*H. T. Pagden*), 23. iii. 1934 (*R. A. Lever*).

Steganopsis ceres Curran.

1939, *Steganopsis ceres* Curran, *Proc. Calif. Acad. Sci.*, (4), 22: 32.

A careful study of the description of this species discloses no characters that enable me to embody it in the key given above, except possibly the smooth instead of transversely rugose interfrontal area of the head. A teneral specimen of *solomensis* before me has no frontal rugae.

Described from a single specimen from Guadalcanal Is.

DIOIDES Kertész.

1915, *Dioides* Kertész, *Ann. hist.-nat. Mus. hung.*, **13** : 491.

This genus is very similar to *Cestrotus* Loew, differing in having the arista very short haired. The frons is humped up, but not armed with a tubercle in the middle, the sternopleura has two bristles in the species before me, though the genotype is described as having but one, and the costal vein is as in *Homoneura*, the short dense black setulae being continued to the apex of the third vein, where they cease abruptly. In the species of *Cestrotus* (*Turriger* Kertész) known to me the costal vein is as in *Sapromyza*.

Dioides fuscoapicata, sp. n.

♀. *Head* testaceous yellow, distinctly shiny at the bases of the orbital bristles only. Frons with brown tinge on the upper orbits, a blackish brown elongate mark over the ocelli, and another, drop-like, one in front of it that does not extend to anterior margin, a dark brown streak on centre of face that begins just above the apex of the facial elevation and continues down to epistome, a black line in the suture between the face and parafacial, and a dark brown mark on each gena close against the eyes. Antennae brownish black, third segment and arista fulvous yellow; palpi fulvous yellow. Head in profile as figured by Kertész, the eye, however, not emarginate below on hind margin. Ocelli in line between the upper orbitals, the ocellar bristles rubbed off in the type.

Thorax shiny testaceous yellow, largely blackened, the pleura yellow only on the sutures, and slightly whitish grey dusted, the mesonotum with six blackish vittae, the central pair carried over disc of the scutellum, the others largely fused and indistinctly defined; postnotum blackened. Bristling as in typical *Homoneura* species, the mesonotum with 8-10 series of short hairs between the dorso-centrals, and no acrostichals but the prescutellar pair, the propleural quite strong.

Wing as fig. 3. The general colour brownish hyaline, inner cross vein narrowly, outer one more broadly, clouded with dark brown, especially above. Halteres brownish yellow.

Legs testaceous yellow, all femora with a broad fuscous to black mark on basal halves and a narrower black mark at apices, extreme bases of all tibiae black and a dark-brown ring near middle. Fore femur without an apical antero-ventral comb and with the posteroventral bristles confined to the apical half, mid femur with one apical posterior bristle; all tibiae with a preapical dorsal bristle, the one on hind tibia the weakest; fore tarsi much longer than their tibiae; rather slender.

Abdomen dull testaceous yellow, with a narrow blackish apical line on each tergite, the hairs and short apical bristles on tergites dark brown.

Length : 6 mm.

TYPE : Solomon Islands : Vello Lavetta, Parasso, 22. v. 1934 (*H. T. Pagden*).

The genotype, *pictipennis* Kertész, from Formosa, has the wings more extensively spotted with black, some marks being on the basal half, and the outer cross vein is in a hyaline and not a dark mark.

MONOCERA van der Wulp.

1898, *Monocera* van der Wulp, *Természetr. Füzet.*, **21** : 425.

This genus was erected for the reception of a species that has in the male a long forwardly projecting and downwardly curved thorn on the anterior margin

of the frons. Kertész in 1915¹ presented a revision of the species, describing two as new, and included one that has the process or thorn on the epistome instead of on the frons. I have seen the genotype, *monstruosa* van der Wulp, from New Guinea, and have before me now a pair of *furcata* Kertész, the aberrant species with the furcate epistomal process.

The general characters, including the type of costal armature, are as in *Homoneura*, the thoracic bristling being identical with normal forms in that genus, but the arista is very regularly short haired, the ocellar bristles are directed straight outward, the head is broader, the eyes are more narrowed below, the fore femur has a very fine anteroventral comb on the apical half, and there are two short black curved anterior spurs on the apex of the hind tibia.

Monocera furcata Kertész.

1915, *Monocera furcata* Kertész, *Ann. hist.-nat. Mus. hung.*, **13** : 505.

Like all the other known species this one is testaceous yellow in colour, with dark spots on the wings. The frons has four dark marks in the male, in the female but one or none, the gena has a brown mark, and the mesonotum has four dark brown vittae, the central pair linear, the outer pair broader, all four fused about one-third from posterior margin. The abdomen has dark brown spots or streaks on sides of the tergites, and the legs are yellow. Wings in the genotype and *furcata* with, in *cornuta* Hendel and *rhinoceros* de Meijere without, dark spots on apical section of the fourth wing vein. In *furcata* there are two such spots, one at the apex and the other at the middle of that section of the vein, while in *monstruosa* there is but the apical spot present. In *monstruosa* the thorn is on the anterior part of the frons, in *furcata* it is on the epistome, projecting forward and ending in two equally long laterally directed branches (fig. 4).

Originally described from New Ireland. Solomon Islands: ♂, Bougainville, Teopasina, 28.i.1936 (*R. A. Lever*); ♀, Guadalcanal Is., Kovagoumbi, 1.v.1936 (*R. A. Lever*).

HOMONEURA van der Wulp.

1891, *Homoneura* van der Wulp, *Tijdschr. Ent.*, **34** : 213.

This genus contains more species than all the others that occur in the Old World, and is almost cosmopolitan, occurring in all countries from which I have seen Sapromyzidae except New Zealand and Patagonia.

Curran has recorded two species from New Caledonia and twelve from the Solomon Islands.

In 1929² I erected several new subgenera in *Homoneura*, and in this paper I erect another. There is a great probability that some student of the family will later accept these as distinct genera.

KEY TO THE SPECIES.

1. Fourth wing vein slightly but quite noticeably curved forward at apex so that the first posterior cell is narrowed at tip; mesonotum with a strong but short prealar bristle just in front of the strong and long supra-alar, and a long strong posterior intra-alar (subgenus *Solomonina* novum) *leverii*, sp. n.
- Fourth wing vein not appreciably curved forward at apex 2.

¹ *Ann. hist.-nat. Mus. hung.*, **13** : 502.

² *Proc. U.S. nat. Mus.*, **74**, art. 6 : 12-15.

2. Head black, with a conspicuous brownish-yellow anterior margin to the frons; thorax and abdomen glossy black; knobs of halteres black; arista with the longest hairs as long as width of the third antennal segment *signatifrons* (Kertész).
 Head rarely entirely black, never marked as above, and the thorax and abdomen never entirely glossy black 3.
3. Thorax and scutellum black, densely covered with whitish-grey dust, the mesonotum with two broad dark brown vittae laterad of the lines of dorsocentral bristles, the outer one on the extreme lateral edge; coxae and femora black, tibiae and tarsi testaceous yellow, aristae plumose *viatrix* (de Meijere).
 Thorax shiny or glossy fulvous yellow or orange-yellow, the mesonotum not vittate as above; legs yellow, or other characters not as above 4.
4. Longest hairs on the aristae as long as or much longer than width of the third antennal segment; wings without dark markings except sometimes a faint narrow infuscation on the outer cross vein 5.
 Longest hairs on the aristae not nearly as long as the width of the third antennal segment, or the wings with distinct brown markings, sometimes on costa and cross veins 8.
5. Face black, lightly grey dusted, but glossy; frons brown or fuscous, shiny, upper orbits brownish yellow; outer cross vein not clouded; a short but strong prealar bristle present; fore femoral comb consisting of closely placed and moderately long setulae . . . *atrifacies*, sp. n.
 Face entirely orange-yellow; frons concolorous to brownish yellow 6.
6. Prealar bristle present; fore femoral comb consisting of rather irregular setulae that are thick at bases and very fine and hair-like at apices; outer cross vein narrowly brownish clouded; abdomen without paired black spots on the tergites *immaculiventris*, sp. n.
 Prealar bristle represented by a few short setulae; fore femoral comb consisting of very short regular stout spinules; outer cross vein not or very indistinctly brownish clouded; abdomen with or without one or two pairs of small black spots, usually one on the fifth and one on the sixth tergite at the lateral curves 7.
7. Antennae entirely yellow; fifth and sixth abdominal tergites with a pair of spots each on lateral curves, or the fifth with such spots; longest hairs on the aristae longer than the width of the third antennal segment; anterior pair of orbital bristles much shorter than the posterior pair *russelli*, sp. n.
 Antennae yellow, third segment blackened at apex; abdomen without paired black spots on dorsum; longest hairs on aristae about as long as the width of the third segment; anterior pair of orbital bristles about as long as the posterior pair *suspensa*, sp. n.
8. Wing with distinct dark markings in addition to any clouds over the cross veins 9.
 Wing with at most faint clouds on the cross veins 11.
9. Anterior of the three pairs of dorsocentral bristles on the mesonotum in front of the suture; face very wide *Trypanoides confusa*, sp. n.
 Anterior pair of dorsocentral bristles slightly behind the mesonotal suture 10.

10. Wing with a brown suffusion over the costa that extends to third vein, outer cross vein clouded narrowly with brown; antennae and palpi yellow *laticosta* (Thomson).
Wing with brown marks on both cross veins and apices of veins 2 to 4 *horvathi* Kertész.
11. Mesonotum with one or more pairs of well-developed acrostichal bristles in front of the prescutellar pair 12.
Mesonotum with no outstanding acrostichal bristles but the prescutellar pair 15.
12. Mesonotum fulvous yellow, slightly shiny, with slight even grey dust on entire surface, the scutellum similarly dusted; hind tibia with the preapical dorsal bristle short and strong, subequal to the slightly curved apical anterior hind tibial spur; seventh abdominal tergite short, with a few fine black hairs (4-6) on centre near apex, eighth with a few similar scattered surface hairs, cleft V-shaped at apex; fourth to sixth tergites with three deep black marks, the first two with the marks elongate, extending the entire length of exposed surface, those on sixth more spot-like *subnuda*, sp. n.
Mesonotum glossy fulvous yellow or orange-yellow, without a trace of dust, the scutellum also undusted; preapical dorsal bristle on the hind tibia much longer than the apical anterior hind tibial spur; seventh and eighth abdominal tergites not as above, with much more numerous fine hairs; the black abdominal markings when distinct not as above 13.
13. Small species, about 3.5 mm. in length; male with a ridge or elongate brush of dense stiff dark brown hairs or setulae on the entire extent of the anteroventral surface of the basal segment of the hind tarsus, higher on the apical half; abdomen with three deep black spots on the fifth tergite, the sixth almost concealed in type so that it is impossible to detect any black spots; seventh and eighth tergites with many erect fine hairs of moderate length; basal segment of the hypopygium with two short forwardly directed points at apex *notativentris*, sp. n.
Larger species, over 4 mm. in length; male with no ridge or elongate brush of hairs as described above; other characters not as above 14.
14. Basal segment of the hypopygium with the apical thorn black and beak-like *acrostichalis* (de Meijere).
Basal segment of the hypopygium with the apical thorn pale and less acute at apex *crockeri* Curran.
15. Head dull yellowish brown, the frontal orbits yellowish grey dusted, the postocular orbits greyish white dusted; thorax yellowish brown, densely grey dusted, the humeri, postalar callosities and margin of the scutellum brownish yellow; abdomen brownish yellow, the apices of tergites paler, third and fourth tergites each with a wide central black fascia, the fifth, and sometimes the sixth with a pair of large, and sometimes rather diffuse black spots; femora usually browned or infuscated, the tibiae and tarsi testaceous yellow; inner cross vein of the wing darker than the outer but not margined with dark colour *haacaiensis* Malloch.
Head, thorax, and abdomen shiny to glossy fulvous yellow, without conspicuous grey dust, the abdominal tergites without distinct black fasciae; legs yellow; inner cross vein of the wing not noticeably darker than the outer one 16.

16. Wing epaulets yellow ; longest hairs on aristae about as long as width of third antennal segment ; apex of third antennal segment blackened

suspensa, sp. n.

- Wing epaulets black ; longest hairs on aristae about half as long as width of third antennal segment ; third antennal segment entirely orange-yellow

diversa, sp. n.

Subgenus SOLOMONIA novum.

This subgenus differs from typical *Homoneura* in having the fourth wing vein slightly curved forward at its apex, the posterior intra-alar very long and strong, and the prealar bristle present though short and strong.

TYPE SPECIES : *Homoneura (Solomonina) leveri*, sp. n.

***Homoneura (Solomonina) leveri*, sp. n.**

♂ and ♀. *Head* black, the frons more brownish, face with distinct whitish-grey dust, frons with faint greyish dust, the orbits and narrow triangle shiny, remainder dull. Antennae yellowish brown, third segment blackened apically ; palpi yellowish brown. Frons subquadrate, slightly narrowed in front, all the bristles long and strong, the two pairs of orbitals subequal in length, surface hairs microscopic. Antennae of moderate size, third segment about 2.5 times as long as wide, rounded at apex, second with one bristle above and two or three below at apex, the former and central one below longer than width of third segment ; arista with the longest hairs distinctly longer than the width of third antennal segment, about equally long, but more sparsely haired below. Palpi normal. Face convex, slightly more protruded to epistome, the foveae distinct. Hairs ascending to about middle of lateral suture. Eye higher than long, tapered below, not emarginate behind, and about ten times as high as gena. A number of long bristles on back of head below.

Thorax black, shiny, with even, but not very conspicuous, whitish-grey dust, most distinct on scutellum when seen from in front against the light, the humeri sometimes yellowish brown. Mesonotum with three pairs of dorsocentrals, two supra-alars, the posterior intra-alar long and strong, and a short strong prealar, the latter sometimes duplicated, the other bristles as in typical *Homoneura*, the sternopleurals 2. Intradorsocentral hairs in at least twelve rows ; only the prescutellar acrostichals developed. Scutellum slightly flattened on disc, broadly rounded in outline, the basal bristles very near base. Prosternum and disc of pteropleuron bare.

Legs black, extreme apices of femora, all of tibiae, and tarsi, testaceous yellow. Fore femur with the anteroventral comb fine but evident, and a complete series of long posteroventral bristles ; mid femur with a series of short strong bristles on apical half of the anterior surface and two strong curved bristles at apex on posterior surface ; hind femur with a series of bristles on more than the apical half, all tibiae with preapical dorsal bristle, the one on mid pair the longest and strongest, that on hind pair the weakest and shortest ; apical anterior curved spur on hind tibia very short.

Wing brownish hyaline, veins brown, rather ovate in shape. Inner cross vein a little beyond apex of first vein and at about two-fifths from base of discal cell ; outer cross vein at a little over half its own length from apex of fifth vein. Knobs of halteres brown to black.

Abdomen glossy brownish black to deep black, without distinct dusting. Each tergite with an apical transverse series of quite strong black bristles.

Length : 6–8 mm.

TYPE : ♂, Solomon Islands : Tulagi, 23.iii.1934. *ALLOTYPE* : Santa Isabel, iii.1933. *PARATYPES* : Guadalcanal, Popanu, 1500 feet, 16.xii.1934, and San Isabel, Fate, ii.1933. All taken by *R. A. Lever*, to whom the species is dedicated.

***Homoneura (Homoneura) signatifrons* (Kertész).**

1900, *Sapromyza signatifrons* Kertész, *Természeti. Fuz.*, **23** : 264.

This apparently common and very widely distributed species is represented by a series of specimens from the Solomons, many from Tulagi, and a single specimen from Russell Island. There are also four from Admiralty Island (*Froggatt*).

Originally described from New Guinea, this species has already been recorded by Curran from the Solomon Islands.

***Homoneura (Homoneura) viatrix* (de Meijere).**

1910, *Lauxania viatrix* de Meijere, *Tijdschr. Ent.*, **53** : 123.

This very distinct species was originally described from the East Indies, and has also been recorded from the Solomons by Curran.

One specimen : Tulagi (*Lever*).

I examined the type-specimen when I wrote my paper on the Oriental species in 1929.

***Homoneura (Homoneura) atrifacies*, sp. n.**

♀. A large glossy fulvous yellow species with the head preponderantly black. It runs down to section 38 in Kertész's key to the species.¹ It differs from the only two species in that segregate as follows : from *nigrifrons* Kertész in having the legs entirely fulvous yellow, and in having the mesonotum with several pairs of acrostichals that are as long and strong as the dorsocentrals ; and from *limbata* in having no black spots on the scutellum.

Head shiny black, with slight whitish dust, most distinct on the parafacials, the entire occiput glossy fulvous yellow ; antennae brownish yellow ; palpi fuscous. Frons about 1.25 times as long as wide, all the bristles except the ocellars long and strong, the latter about half as long as the postvertical pair ; surface hairs microscopic and very few in number. Eye about 1.5 times as high as long, much tapered below, the hind margin not emarginate, height about ten times that of the blackened gena. Antennae inserted slightly above middle of eye in profile, reaching about half the distance to epistome, third segment about 2.5 times as long as wide, rounded at apex ; longest hairs on aristae as long as third antennal segment, almost as long below as above. Face slightly convex, almost vertical, the foveae distinct.

Thorax glossy fulvous yellow, the scutellum concolorous and rather duller than the mesonotum. Bristling normal, no well-developed acrostichals except the prescutellar pair, the intradorsocentral hairs in ten rather irregular series, the intra-alar short, prosternum with a few minute black hairs, pteropleura bare, sternopleurals 2.

Legs fulvous yellow. Fore femur with a distinct comb of short regular

¹ 1900, *Természeti. Fuz.*, **23** : 255.

setulae on the apical half of the anteroventral surface and a series of long posteroventral bristles, mid-femur differing from that of *leverii* in having but one apical posterior bristle, hind pair with one or two quite strong preapical anteroventral bristles; all tibiae with a preapical dorsal bristle, as in *leverii*.

Wing brownish hyaline, veins brown, unclouded. Venation as in *leverii* except that the fourth vein is not bent forward at apex, and the outer cross vein is at less than half its own length from apex of fifth vein. Halteres yellow.

Abdomen concolorous with thorax, one or two of the apical tergites with a blackish central spot, the genital processes black and finely black haired. All tergites with an apical transverse series of black bristles, longest on third tergite.

Length: 7 mm.

TYPE: Solomon Islands: San Isabel, 28.ii.1934 (*R. A. Lever*).

Homoneura (Homoneura) immaculiventris, sp. n.

♀. Very similar in general colour and features to *atrifacies*, differing mainly in having the head entirely fulvous yellow.

Frons hardly longer than wide, the ocellar bristles as long and strong as the postvertical pair, eye hardly 1.25 times as high as long, less tapered below than in *atrifacies*, and about nine times as high as the yellow gena. Antennae and palpi fulvous yellow. Arista long haired.

Thorax as in *atrifacies*, the intra-alar bristle minute.

Legs and wings as in *atrifacies* except that the inner cross vein is very slightly proximad of the apex of first vein and the outer cross vein has a slight but evident brownish suffusion. Halteres fulvous yellow.

Abdomen concolorous with the thorax, and without any black tergal spots. Structure as in *atrifacies*.

Length: 7 mm.

TYPE: Solomon Islands: Tulagi, 5.xii.1934, *Hibiscus* (*R. A. Lever*).

PARATYPE: same locality, 20.ii.1935, same collector.

Homoneura (Homoneura) russelli, sp. n.

♂ and ♀. A smaller species than *immaculiventris*, differing from it as stated in the foregoing key to the species, and in having the fifth and sixth, or at least the fifth tergite with a pair of deep black spots.

This species will run down to *signata* van der Wulp or *neosignata* Malloch in my key to the Oriental species of this genus, but it differs from the former in having only two pairs of black spots on the abdomen, the outer pair on the fifth and sixth tergites lacking, and from *neosignata* in having the fifth and sixth instead of only the fifth tergite in the male with a pair of black spots. The outer cross vein of the wing has a slight brown clouding. In Kertész's key (1900) it runs down to *signata* van der Wulp, and in Curran's (1936) to *orientis* Hendel. Curran records the latter from the Solomons, but the species now before me is not the one I accepted (1929) as *bioculata* (de Meijere) from an examination of the type. I have not seen the latter from the Solomons.

Length: 4-5 mm. Hypopygium of male as fig. 5.

TYPE: ♂, Solomon Islands: Russell Is., 18.ii.1934. ALLOTYPE: Tulagi, 3.xii.1934. PARATYPES: Russell Is., 22.ii.1934, Tulagi, 25.xi.1934, and Guadalcanal Is., Lunga, 29.iii.1934 (*R. A. Lever*).

Homoneura (Homoneura) suspensa, sp. n.

♀. Another very similar species, but with no black spots on the abdomen, and the third antennal segment blackened at the apex. The hairs on the arista are not as long as the basal width of the third antennal segment, though the longest are about as long as the central width.

The face is noticeably white dusted, which it is not in the next preceding species, the inner cross vein is just beyond the apex of the first vein and very little basad of the middle of the discal cell, and the outer cross vein is slightly brownish clouded. There are no hairs on the pteropleura, there are some on the prosternum, and the mesosternum has a number of quite strong erect black hairs but no pair of stronger downwardly directed anterior bristles as in some other species.

Length: 4.5 mm.

TYPE: Solomon Islands: Guadalcanal Is., Lunga, 9.vii.1933 (*R. A. Lever*).

Except for the fact that Curran states that the species he distinguished as *distincta* Kertész has some pteropleural hairs, I might assume that this was that species. I have not been able to find *distincta* amongst my material.

Homoneura (Homoneura) laticosta (Thomson).

1869, *Geomyza laticosta* Thomson, *Eugenies Resa (Insecta)*: 598.

Two specimens of this easily identified species from the Solomon Islands: Guadalcanal Is., Lunga, 28.v.1936 (*R. A. Lever*).

Curran records the species from the Solomons; I have recorded it from the East Indies, where it is widespread and common.

Homoneura (Homoneura) subnuda, sp. n.

♂. A smaller species than any of the others in the group, with anterior acrostichals, and readily distinguished from nearly all the yellow species by the even, though not dense, grey or yellowish-grey dust on the mesonotum and scutellum. This dust may be easily removed by damp, so that other characters should be used in segregations to insure accurate identification.

Head entirely orange-yellow except a greyish mark in centre of occiput low down, just above neck. Frons about 1.5 times as long as wide; ocellar and post-vertical bristles shorter than the others, subequal in length. Eye higher than long, tapered below, and about seven times as high as gena. Antennae inserted slightly above middle of eye in profile, third segment not infuscated, about 2.25 times as long as wide, rounded at apex; arista slender, with the longest hairs a little longer than the basal diameter; palpi yellow. Face slightly white dusted, the parafacials more noticeably so, foveae distinct.

Thorax orange-yellow, the mesonotum and scutellum rather dull because of the presence of a coating of greyish dust, no vittae present. Bristling normal, one pair of rather strong acrostichals midway between the prescutellar pair and the suture; intra-alar and prealar lacking; sternopleurals 2, the anterior one much the shorter. Prosternum with some microscopic hairs, no evidence of hairs on the pteropleura.

Legs entirely yellow. Fore femur with the anteroventral comb on apical half rather well developed, mid-femur with one apical posterior bristle, hind femur with some very short fine anteroventral bristles; all tibiae with a preapical dorsal bristle, the one on the mid-pair the longest and strongest, that on hind pair not longer nor stronger than the apical anterior curved black spur.

Wings greyish hyaline, veins brownish yellow, paler basally, the cross veins not clouded. Inner cross vein almost directly below apex of first vein and at about five-sixths from base of discal cell; outer cross vein at about half its own length from apex of fifth vein. Halteres yellow.

Abdomen glossy fulvous or orange-yellow, with hardly a trace of dust, fourth, fifth and sixth tergites each with three black spots, those on the first two in centre extending from base to apex, vittiform, the laterals on sixth below curve and seen only from below. Other characters as noted in the key.

Length: 3.5 mm.

TYPE: New Caledonia: Bourail, 22.v.1928 (*W. P. Cockerell*).

The only species of this genus recorded by Curran from New Caledonia in the Cockerell collection are *varia* Kertész and *horvathi* Kertész. The former is unknown to me but has the aristae long haired and only one abdominal tergite with a pair of black spots (the fifth), so is quite distinct from the present species; for the latter see p. 144.

Homoneura (Homoneura) notativentris, sp. n.

♂. A species of the same size as the one just dealt with above, but readily distinguished from it by the peculiarly haired basal segment of the hind tarsi of the male, which has a ridge or elongate brush of dense dark brown stiff hairs from base to apex on the anteroventral edge that is highest on apical half.

Head crushed in type, but apparently similar to that of *subnuda*, though the ocellar bristles are finer, and shorter than the postvertical pair.

Thorax slightly discoloured in type, with two or three shorter pairs of acrostichals in front of the additional central postsutural pair, otherwise as *subnuda*.

Legs entirely yellow. In addition to the hind tarsal distinction from *subnuda* the preapical dorsal bristle on the hind tibia is fine and about three times as long as the short stout apical anterior spur.

Wing greyish hyaline, veins pale brown. Inner cross vein slightly proximad of apex of first vein and at middle of discal cell. Halteres yellow.

Abdomen fulvous yellow, glossy, with three rather large black spots on the apical margin of the fifth tergite and none visible on the other tergites though the apex of the seventh, all of eighth and base of ninth tergites are infuscated. Possibly this is abnormal. The apex of the abdomen is quite stout, the seventh and eighth tergites are furnished with more and finer erect hairs than in the related species, and the apex of the ninth tergite is blackened and has the tip with a slight production of its anterior angle similar to that shown by Curran in *sikaiiana*. Curran.

Length: 3.5 mm.

TYPE: Solomon Islands: Russell Is., Kaylan, 8.xi.1934 (*R. A. Lever*).

This may be *sikaiiana* Curran, but it differs from Curran's description in so many characters, besides belonging to a different group containing many closely allied species, that I do not believe it wise to refer it to that species. The type-locality of *sikaiiana* is Stewart Islands (Sikaiiana Is.).

Homoneura (Homoneura) acrostichalis (de Meijere).

1915, *Lauvania acrostichalis* de Meijere, *Tijdsch. Ent.*, **58** (suppl.) : 51.

I have seen no specimens of this species from the Solomon Islands, though Curran has recorded it from Anuda Island and also from Stewart Islands (Sikaiana Is.). I examined the type-specimen when working on my 1929 paper and have seen the species from several localities in the Pacific Islands region and East Indies, but not from the Solomons.

Homoneura (Homoneura) crockeri Curran.

1939, *Homoneura crockeri* Curran, *Proc. Calif. Acad. Sci.*, **22** : 49.

This species, as I accept it, averages a little larger than *acrostichalis*, but, like it, has considerable variation in the black spotting of the abdomen. Usually there are three dark spots or marks on the fifth to seventh tergites, or these spots may be confined to one tergite, or even two spots only may be visible. Both species have usually one or two very minute black hairs on the upper part of the pteropleura, and the hypopygia are very similar.

Originally described from a single male taken on Guadalcanal Island. I have a series of specimens from the type-locality, Tulagi, Russell Is., Stewart Is. (Sikaiana Is.), and Admiralty Is.

Homoneura (Homoneura) hawaiiensis Malloch.

1927, *Homoneura hawaiiensis* Malloch, *Proc. Hawaii. ent. Soc.*, **6** : 383.

This is probably *anuda* Curran, agreeing with it in all essential characters. Two specimens from the Solomon Islands : Tulagi, and Guadalcanal Is.

Homoneura (Homoneura) diversa, sp. n.

♀. A small glossy fulvous yellow species, with no dust on the mesonotum, a pair of small deep black spots on the fifth abdominal tergite, the sixth partly concealed in the type, so that it is impossible to say whether there are spots present or not, but they are not on the apex as on the fifth tergite. The deep black epaulet of the wing is distinctive amongst the yellow species in this report.

Head much as in *suspensa*, the longest hairs on the arista about half as long as width of third antennal segment ; ocellar bristles shorter than the post-vertical pair, the latter much shorter than the other frontal bristles. Eyes about 1.25 times as high as long, not much tapered below.

Thorax as in *suspensa*, the intradorsocentral hairs in about ten irregular series, the presutural pair only of the acrostichals well developed, a distinct bristle mesad of the presutural, sternopleurals 2, no pteropleural hairs evident.

Legs yellow. Fore femur with distinct anteroventral comb on apical half ; all tibiae with a preapical dorsal bristle, the one on hind tibia short, but longer than the apical spur.

Wings yellowish hyaline, veins pale brown, neither cross vein clouded. Inner cross vein almost directly below apex of first vein and slightly proximal of middle of the discal cell, outer cross vein about three-fourths of its own length from apex of fifth vein.

Abdomen glossy fulvous yellow, with a pair of small round black spots at apex of fifth tergite ; genital processes dark brown, finely haired.

Length : 3 mm.

TYPE : Solomon Islands : Guadalcanal Is., 26.ii.1935 (*R. A. Lever*).

Homoneura (Homoneura) horvathi (Kertész).

1900, *Sapromyza horvathi* Kertész, *Természetr. Füzet.*, **23** : 260.

This is the only species with five dark brown marks on the wing, i.e. one over each of the cross veins, and one at apex of each vein from second to fourth inclusive, the last being removed slightly from the tip of the vein. The apices of third antennal segment and of the palpi are black, and the longest hairs on the arista are about as long as the width of the third antennal segment. The mesonotum has six narrow brown vittae, the lateral marginals very indistinct.

This is probably the species listed by Curran from Catalina Island as *punctipennis* de Meijere. It is possible that the two names apply to the same species.

Solomon Islands: Tulagi, 4.vii.1933 (*R. A. Lever*).

Recorded from Mueo Island under this name by Curran.

MINETTIA Robineau-Desvoidy.

1830, *Minettia* Robineau-Desvoidy, *Mém. prés. acad. Sci. Inst. France*, **2** : 646.

Curran (1936) recorded two species under this generic name. He also placed in his key two species that he apparently considered later to belong to *Homoneura*. It is the type of costal armature and not the presence or absence of the intra-alar bristle that is the criterion for the separation of these two genera. Whether the two species he described and left in *Minettia* belong here I am unable to say, as I have not seen his material and have no other from the Solomons before me at present.

The two species are *Minettia surda* Curran, which is a small species, 3.5 mm. in length, mainly shiny black in colour, with plumose arista; and *Minettia ethelia* Curran, slightly larger and mainly rusty reddish yellow in colour, with a pair of broad brown vittae on the mesonotum that are mesad of the dorsocentral lines of bristles and extend faintly on to the scutellum.

MAQUILINGIA Malloch.

1929, *Maquilingia* Malloch, *Proc. U.S. nat. Mus.*, **74** (6) : 35.

There are no species of this genus in the material before me from the Solomons. In 1936 Curran recorded two new species in the genus. They are *M. malaita* Curran and *M. matema* Curran from the islands after which they are named.

TRYPANEOIDES Tonnoir and Malloch.

1926, *Trypaneoides* Tonnoir and Malloch, *Rec. Canterbury [N.Z.] Mus.*, **3** : 20.

This genus was erected for the reception of a species from New Zealand and afterwards I placed 11 additional East Indian species in it when I dealt with the Oriental Sapromyzidae in 1929. Subsequently several other species have been added, one or two from Australia. Also in 1929 I dealt with the Sapromyzidae of Samoa¹ and placed in this genus *Sapromyza caniventris* Bezzi and *S. leucosticta* Bezzi, with two additional new species from Samoa. Bezzi's species were described from Fiji. Now over 20 species are known to belong to the genus. Below I describe one more.

¹ *Insects of Samoa*, (British Museum (Nat. Hist.)), **6** : 201-213.

Trypaneoides confusa, sp. n.

♀. A black, densely pale grey dusted species, with two chocolate-brown transverse bands on the face, some black marks on the dorsum of the thorax, the most conspicuous being a broad band across the mesonotum distinctly behind the suture, and one on apex of the scutellum between the bases of the apical bristles.

Head brownish yellow, densely grey dusted, the genae and lower postocular orbits silvery white dusted, the dust on face more yellowish, face with two chocolate-brown bands, the upper one broadest and enclosing antennal insertions, the lower one above epistome, the latter narrowly yellowish grey; prelabrum dark brown; antennae broken except the basal two segments which are blackish, with dense dark grey dust; palpi brown. Head wider than thorax, frons over one-third of the width, wider than long, the vertex rounded, ocelli on the rounded vertex, very small and closely placed, the ocellar bristles closely placed and strong, proclinate, postverticals below vertical margin, cruciate, and fully as long as the ocellars; anterior orbital moderately long, close to anterior margin. Face widened below; eye almost round, about five times as high as gena, the latter with a series of fine rather long hairs.

Thorax black, densely dark grey dusted, the mesonotum with a curved mark above each of the humeri, a broad cross band behind the suture, and a narrow transverse stripe on centre of the posterior margin, black; scutellum with a black mark across apex between the apical pair of bristles; pleura without black marks. Mesonotum with four pairs of long dorsocentrals, the anterior pair in front of suture, and four smaller pairs of acrostichals; sternopleura with two bristles, the anterior the shorter; mesopleura with one strong posterior marginal bristle, and two fine discal bristles below middle that are curved downward.

Legs testaceous yellow, all coxae and femora infuscated, the legs shrunken in the type, so that it is impossible to give minute details. Hind femur with the usual long anteroventral bristle beyond middle; no definite anteroventral comb on fore femora; all tibiae with a preapical dorsal bristle.

Wings whitish hyaline, with brownish-black markings as in fig. 6, a hyaline mark in apex of first posterior cell. Inner cross vein at middle of discal cell; first posterior cell widened at apex. Halteres broken off in type.

Abdomen black, with dense grey dust, three series of irregular black spots, and the apices of tergites yellowish.

Length: 3 mm.

TYPE: Solomon Islands: Guadalcanal Is., Papanu, 500 feet, 15. xii. 1934 (*R. A. Lever*).

CEPHALOCONUS Walker.

1801, *Cephaloconus* Walker, *Proc. Linn. Soc. Lond.*, 5: 200.

I recently published a paper on this genus, giving the synonymy known to me.¹ One of the two known species is amongst the Solomon Islands material before me.

Cephaloconus cyrinus (de Meijere).

1913, *Ichthyomyia cyrinus* de Meijere, *Nova Guinea*, 9: 382.

Tulagi, viii. 1933 (*R. A. Lever*).

¹ 1930, *Ann. Mag. nat. Hist.*, (11), 3: 447.

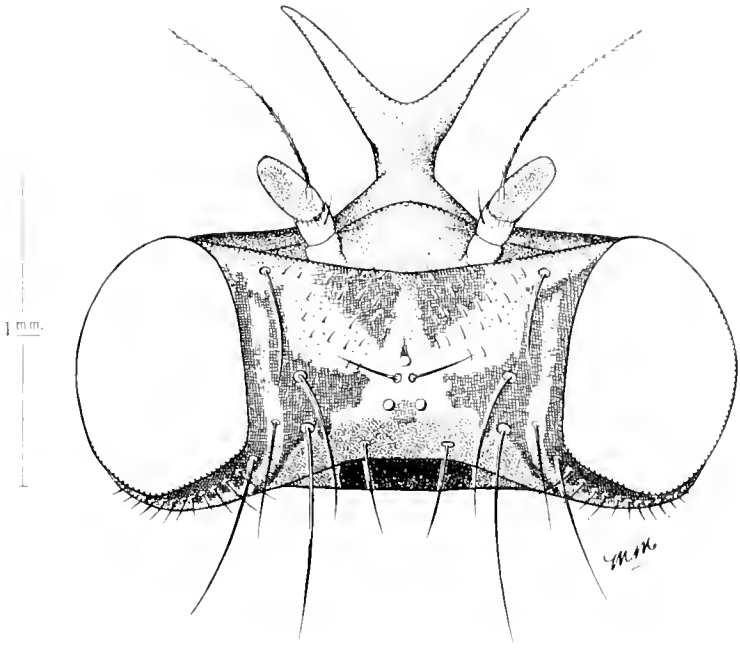
In addition to the foregoing list of species there are several damaged specimens of the genus *Homoneura* of which I do not care to offer identifications.

One of these specimens that had come loose in transit and which has lost the head, legs and wings, but can be placed amongst those with bipunctate abdomen, has a parasite embedded in the membrane of the venter of the abdomen. I cannot identify this parasite, and cannot remember any similar occurrence in the family in my rather extensive examinations from any part of the world.

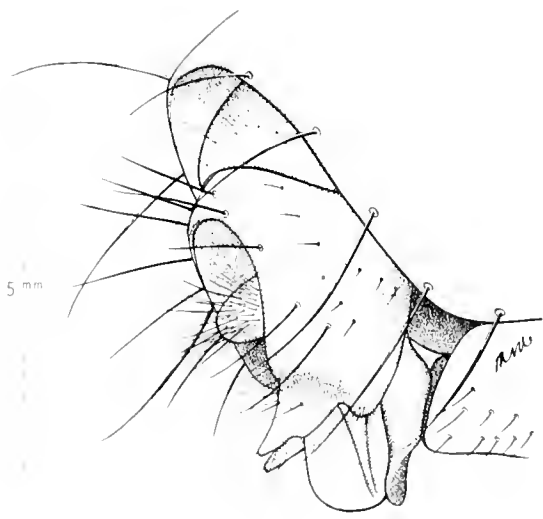
(MSS. recd. June 22, 1939.)

EXPLANATION OF PLATE I.

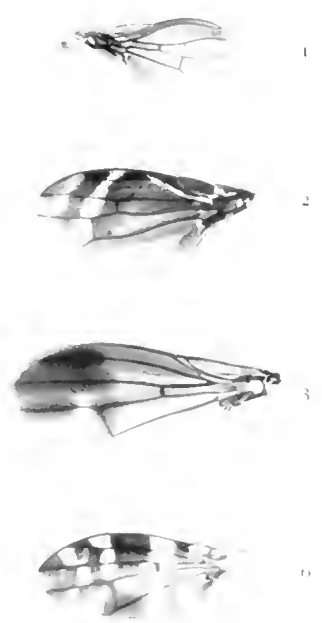
- FIG. 1.—*Steganopsis tripunctifacies*, sp. n., wing.
FIG. 2.—*Steganopsis varimana*, sp.n., wing.
FIG. 3.—*Dioides fuscoapicata*, sp. n., wing.
FIG. 4.—*Monocera furcata*, Kertész, head from above (♂).
FIG. 5.—*Homoneura russelli*, sp. n., hypopygium of male.
FIG. 6.—*Trypaneoides confusa*, sp. n., wing.



4



5



Solomon Islands Saproinychidae

STUDIES ON DIOPSIDAE (DIPTERA)

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(With one plate and six text-figures.)

THE Stalk-eyed Flies have from time to time attracted the attention of many systematists, but since no critical revision of the whole group has been completed during the last century the literature is confused, and of the 160 species named many must be regarded as synonyms.

For present purposes it is regarded as most expedient to treat the Diopsidae as a family and to recognize eight genera; the following short formal definition suffices to distinguish this family from others:

MUSCIDAE-ACALYPTERAE, in which the head is produced laterally in both sexes; not only the eyes but also the antennae are borne on these processes ("eye-stalks"). The thorax bears two, sometimes three, pairs of spines.

Full keys indicating the position of this family are to be found in the works of Imms (1938), Curran (1934), Lindner (1925), Hendel (1922), etc. A more detailed subdivision of the Acalypterae has been given by Frey (1921), basing his system on the structure of the mouth-parts. In his scheme Diopsidae were placed in the Sciomyzaeformes, close to the families Sepsidae and Megamerinidae. This agreed with a system suggested by Hendel (1916), who later (1922) grouped these three families together as Sepsoidea-Sepsaridae.

This paper is intended to serve as an introduction to a series of papers at present in preparation, in which the species of Diopsidae will be systematically revised and their nomenclature brought up to date. The first part reviews the most important contributions to our knowledge of these insects and the determination of the genera, and in the second part the genus *Cyrtodiopsis* Frey is revised and extended.

I. THE FAMILY DIOPSIDAE.

(i) HISTORICAL SURVEY OF TAXONOMY.

The genus *Diopsis* was established by Linnaeus (1775) for his single species, *D. ichneumonea*; he pointed out that despite its apparent affinities with various Hymenoptera, it must belong to the Diptera. Shortly afterwards further species were described by Dalman (1817) and others, and were placed in this genus.

Fabricius (1805) established a new genus of Stalk-eyed Flies, *Achias*, which fell within the original definition of *Diopsis* Linn.—"capite bicorni, oculis terminalibus"—but from which it can readily be separated by the position of the antennae on the eye-stalks. The original distinction in the form of the antennae given by Fabricius was not correct; in his key (*loc. cit.*, p. 13) *Achias* is placed in the section "Antennis parum articulatis dellexis" while *Diopsis* is quite unjustifiably placed in the section "Antennis minutis uniaarticulatis."

Say (1817) described as *D. brevicornis* an American species which was apparently an intermediate form and which was not infrequently regarded as

an *Achias*, but for which Say himself later (1828) erected, as a new genus, *Sphyracephala*, adding to his definition, "to be placed between *Diopsis* Linn. and *Achias* Fab."

One of the earliest attempts at forming natural groups of these genera was by Billberg (1820) in the catalogue of insects in his collection; he arranged a group ("natio") Diopsides consisting of four genera, *Loxocera*, *Calobata*, *Achias* and *Diopsis*, placing it between similarly constituted groups, Muscaedes and Conopsides.

The first comprehensive account of these insects was that of Westwood (1837), in which he gave an excellent summary of both the historical and morphological aspects of the genus *Diopsis*, to which he added several new species, making a total in his list of 31 species. On the status of *Sphyracephala*, however, he did not give a decided opinion, though later (1848) he adopted the name, not however without some misgivings.

In his first paper, which preceded Westwood's memoir, Macquart (1835) separated *Achias* from *Diopsis*, grouping the former with the Muscidae and the latter with the Sepsidae. Later (1843) he pointed out that this grouping was for convenience only and that he regarded the differences as sufficient to justify the erection of a new tribe Diopsidae, though in later papers he did not carry out his other projected modifications.

Walker (1856, etc.) in his catalogues described some species of *Diopsis* and included them in a sub-family of his own creation, Diopsides, ignoring Billberg's use of this name.

Rondani (1875) published a key to nine genera of his sub-family ("stirps") Diopsidinae in which he grouped together all the Stalk-eyed Flies—"character communi capitis ad latera in pedunculos ocelliferos sat aut valde producti"—and Bigot (1880), in his second and more important paper on these insects, followed this principle and added two further new genera. An interesting contrast is afforded by a more modern interpretation of the affinities of the genera then grouped together (Table I):

TABLE I.—*Classification of Stalk-eyed Flies included in the DIOPSIDINAE of Rondani and Bigot.*

I. Genera still retained in DIOPSIDAE :

Diopsis Linnaeus.

Sphyracephala Say.

Synonyms : *Hexechopsis* Rondani.

Zygocephala Rondani.

Teleopsis Rondani.

Diasemopsis Rondani.

II. Genera now assigned to other families :

Achias Fabricius and its synonym *Plegiocephala* Rondani in ORTALIDAE.

Zygothrica Rondani in DROSOPHILIDAE.

Laglaisia Bigot in ORTALIDAE.

Anaeropsis Bigot in MICROPEZIDAE.

N.B.—*Achias* (*s. str.*) excludes at least two species originally placed in that genus but now grouped with different genera in Trypetidae, namely, *Achias maculipennis* Westwood (now *Themara*) and *A. ichneumonea* Westwood (now *Pelmatops*). In addition to the genera mentioned above, stalk-eyed flies have been described in the following genera of Ortalidae : *Paragorgopsis*, *Richardia*, *Megaluthoraca* and *Asyntona*.

Subsequent research having exposed the artificiality of Rondani's grouping, it was discontinued and the true Stalk-eyed Flies have latterly been treated either as a family, Diopsidae, or as a sub-family, Diopsinae, according to the status given to the Muscidae-Acalypterae.

Although no attempts have been made to revise the whole family, several important partial revisions have been published and new genera have been added since Bigot's time. Loew (1873) had produced a short summary of the small genus *Sphyracephala* and allocated to it a fossil species which he described from Baltic amber; his paper was the basis of Osten-Sacken's remarks (1882) on this genus, which in turn led to further revisions by Bezzi (1922) and by Curran (1928a) (African species only).

The South Asian species were catalogued by van der Wulp (1896) and this list was extended by Brunetti (1907); a later revision of the genera *Teleopsis* and *Sphyracephala* by this author was published posthumously (1928) by which time it was already more out of date than its editors had realized, for Hendel (1917) had recognized a fifth genus, *Pseudodiopsis* (for *Diopsis colturnata* Bigot —till then grouped with *Sphyracephala* by Osten-Sacken, Brunetti, etc.).

Eggers (1915a) discussed the characters and relationships of the African genera and later (1925) published an important paper, again restricted to the African species, in which he summarized the literature relating to the region, gave a catalogue of species and concluded with a general discussion of the problem of "stalk-eyedness."

Frey (1928) gave a key in which he added the genera *Cyrtodiopsis* (for *D. dalmanni* Wiedemann) and *Megalabops* (for *D. quadriguttata* Walker) to the five genera already established.

Curran (1928b) established a genus *Diopsina* for a new species from Africa, and he also (1928c) published a key to the five African genera; in another paper (1931) he repeated this key to the genera (with one modification), and also gave a key to the species of *Diasemopsis* along with descriptions of fourteen new species.

Subsequently Curran (1934) extended his generic key, ostensibly to cover all the known genera and also a new genus *Microdiopsis*, which he immediately recognized as a synonym of *Pseudodiopsis* Hendel (*loc. cit.*, p. 495 in corrigenda), but he omitted *Megalabops* and *Cyrtodiopsis*.

At the present time the following eight genera may be regarded as well established:

Diopsis Linnaeus, 1775.

Sphyracephala Say, 1828.

Synonyms: *Hexecheopsis* Rondani, 1875.

Zygocephala Rondani, 1875.

Teleopsis Rondani, 1875.

Diasemopsis Rondani, 1875.

Pseudodiopsis Hendel, 1917.

Synonym: *Microdiopsis* Curran, 1934.

Cyrtodiopsis Frey, 1928.

Megalabops Frey, 1928.

Diopsina Curran, 1928.

The following suggestions have been made for subdividing these genera: Westwood (1837) classified the species in his genus *Diopsis* into four groups according to the wing pattern. Eggers (1925) extended this classification by

employing additional characters to form eight groups, mainly as an aid to identification and without in any way labelling these groups as sub-genera.

Frey (1928) however introduced a sub-genus, *Eurydiopsis*, for species of *Diopsis* (*s. str.*) having short, blunt teeth on the oral margin; Brunetti (1928) also suggested such a division, but hesitated to adopt the principle, since intermediate forms had been described. Curran (1931) also pointed out the possibility of dividing *Diasemopsis* in a similar manner.

(ii) GEOGRAPHICAL DISTRIBUTION.

Until fuller records, based on more accurate identification, are available, it is not possible to give more than the following rough outline of the distribution of the various genera:

Sphyracephala.—Both Old World (Ethiopian, Oriental and Palaearctic Regions) and North America (Nearctic Region). Also recorded in fossil form in amber (Oligocene-Palaearctic Region).

Diopsis, *Teleopsis* and *Megalabops*.—Oriental and Ethiopian Regions.

Diasemopsis and *Diopsina*.—Exclusively from the Ethiopian Region.

Cyrtodiopsis.—Oriental and Ethiopian Regions. (The only record from Africa is a new species described below, see p. 160.)

Pseudodiopsis.—Malay Archipelago and Ceylon (Oriental Region) and also Papua and New Guinea (Australian Region).

Our knowledge of the localities in which the last-mentioned genus is known to exist has been extended recently; Malloch (1938) has recorded a specimen from Mt. Lamington in Papua, but the following records have not hitherto been published:

1. Examination of the holotype of *T. bipunctipennis* Senior White (1922)—type locality Ceylon—has shown that this species is undoubtedly congeneric and possibly conspecific with *Pseudodiopsis cothurnata* (Bigot).

2. A series of specimens of *P. cothurnata* (now in the British Museum (Natural History)) was taken by Miss Cheesman in the Mount Cyclops region of Dutch New Guinea in 1932.

These records from the Australian region provide an interesting exception (the only one known to the writer) to the rule propounded by Osten-Sacken (1883) which relates to the distribution of the various stalk-eyed flies:

“New Guinea, with its dependencies is the home of the wonderful forms of *Achias*, *Anacropsis* and *Laglaisia*, while *Diopsis*, so abundantly represented in South Eastern Asia (even in Celebes), has not yet been found in New Guinea.” (It is obvious that Osten-Sacken here means *Diopsis* (*sensu lato*).)

(iii) STRUCTURE AND HABITS.

Very little has been published on this aspect of the Diopsidae; Eggers (1915*b*) gives a full account (in Russian with English translation) of histological studies on the eyes of Diopsidae, from which he concludes that the higher differentiation of the anterior cells gives the insect binocular vision of moving objects in front; those cells which are so situated that they cannot see objects in the field of view of the other eye are not so specialized. In this connection, it may be recalled that Wiedemann (1830) gave these flies the name “*Perspectiv-fliegen*.” Eggers implies that sexual differences are not observed in the eyes of Diopsidae.

Morphological studies of a more comparative nature include those of Peterson (1916) on the head of *Sphyracephala brevicornis* Say, of Young (1921) on the thorax and abdomen of the same species, and of Frey (1921) on the mouth-parts of *D. ichneumonea*, while Querner (1924) has dealt with the external morphology of the head in *D. apicalis* Dalmann.

Concerning the habits of Diopsidae, it is interesting to note that they are often found on windows, while the species from Transcaucasia described under the name of *Sphyracephala babadjanedesi* by Zaitzev (1919) was collected at a light; their normal habitat is the vegetation adjacent to streams. Species of *Sphyracephala* appear more especially to choose sunny rocks in streams, from which they have often been taken in large numbers; several observations collected by Sen (1921) tend to emphasise the gregarious nature of these flies.

Of their feeding habits nothing is known; Sen (*loc. cit.*) fed specimens on sugar solution, but it has generally been suggested that they are predaceous—a supposition based on the structure of the fore-femora but not confirmed by observation in the field. The structure of the eye-stalks and their function in providing binocular vision is discussed by Eggers (1915*b* and 1925) and is regarded by him as additional support for the predacity theory. Specimens have also been taken on human faeces by Gibbins in Uganda (MS. note with specimens—1935), but it was not recorded if they were actually feeding on them.

The first record of breeding habits was that of Mally (1920), who quoted several instances of specimens being bred from maize stalks but, in answer to the suggestion that Diopsid larvae are parasitic on maize stem-borers gave as his impression “. . . the larvae live in decaying vegetable matter such as is commonly left by floods on the banks of streams. The parent flies are probably attracted to maize stalks by decay induced by the borer.”

The details of the life-history of *Sphyracephala hearseiana* Westwood have been worked out by Sen (1921), who succeeded in rearing this insect under laboratory conditions. As his paper is rather inaccessible the following summary of his method is given here.

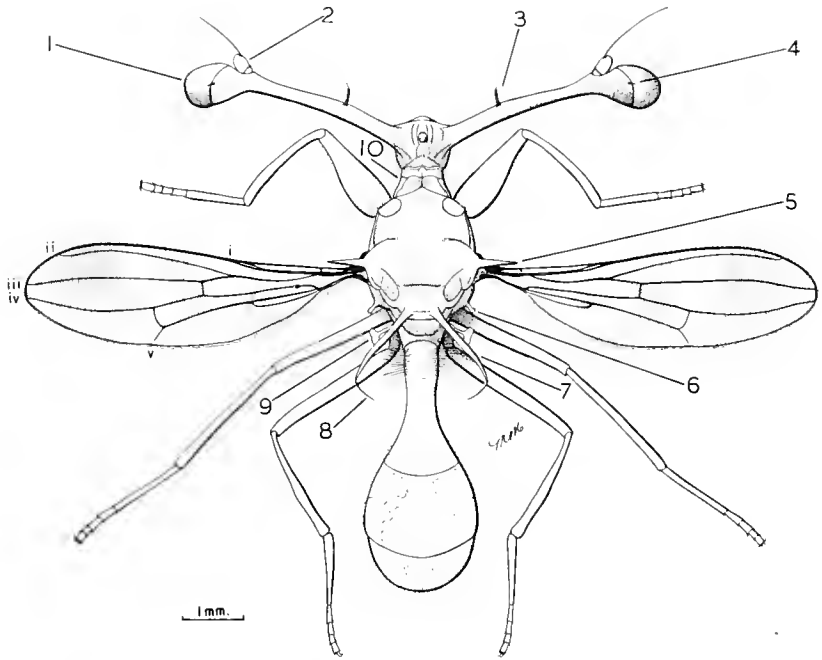
Several adults were placed in a glass jar, on the bottom of which was a layer of earth covered by a large quantity of grass—this was kept very wet; sugar solution was fed to the flies when necessary, the jar being kept in a shady place.

Under these conditions the eggs were laid on the grass about the tenth day and the remainder of the life-cycle took about three weeks; the larvae fed on the decaying vegetation and were found to be particularly susceptible to drying out.

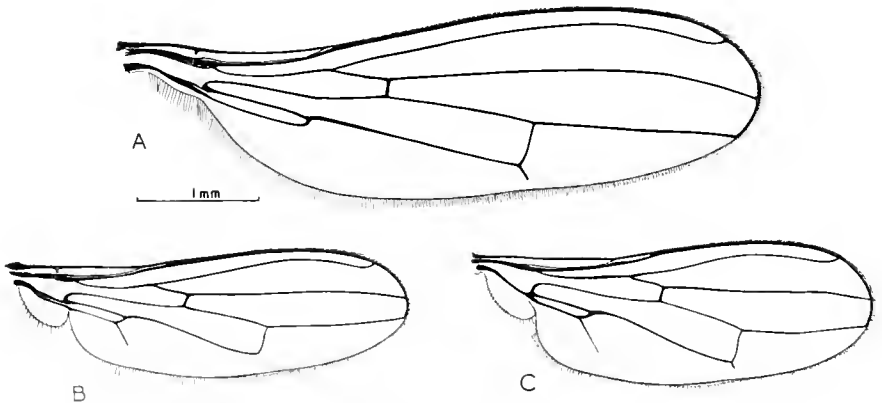
Sen also described the larval and pupal stages, paying special attention to the tracheal system, which he regarded as specially adapted to semi-aquatic conditions of life.

(iv) DETERMINATION OF THE GENERA.

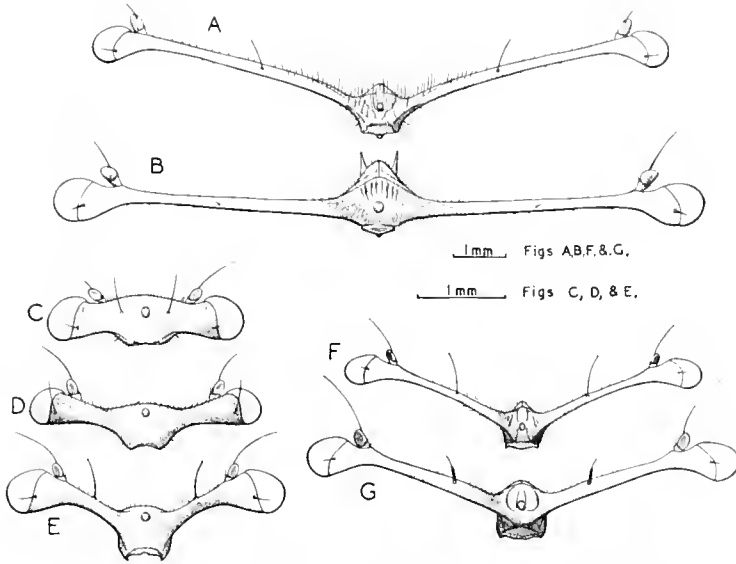
Generic distinctions in the Diopsidae are based on wing structure and on the ornamentation of the thorax. There has been considerable divergence in the nomenclature of spines and bristles, both in keys and in descriptions, and the lateral thoracic spines which have been variously called hypopleural, pteropleural, metathoracic, etc., are here classed as PLEUROFERGAL, following Young (1921) (see text-fig. 1, 6). Brunetti's term SUPRA-ALAR for the paired spines present only in species of *Teleopsis* and *Megalobops* is retained (see text-fig. 1, 5). Linnaeus (1775) had stated that such spines were not known



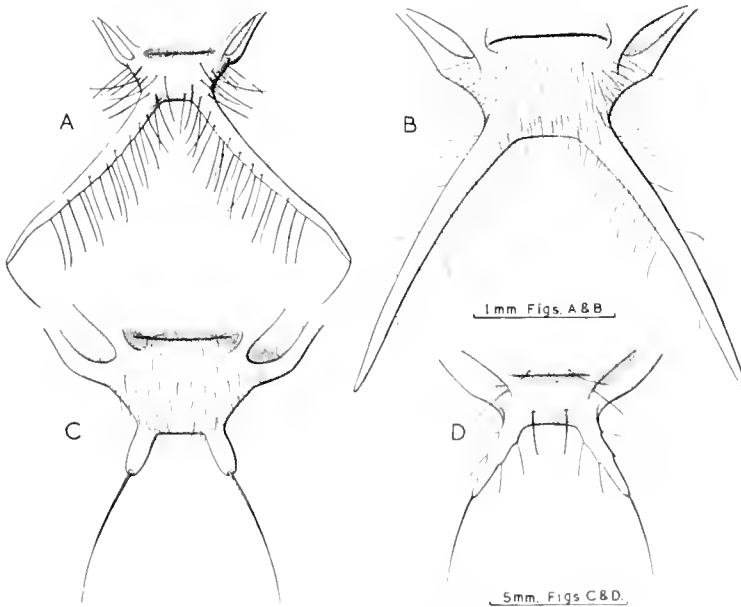
TEXT-FIG. 1.—*Teleopsis* sp., showing taxonomic characters. 1, Eye; 2, antenna; 3, inner orbital bristle; 4, outer orbital bristle; 5, supra-alar spine; 6, pleurotergal spine; 7, scutellar spine; 8, apical bristle; 9, haltere; 10, collar. i-v, longitudinal veins.



TEXT-FIG. 2.—Wings of Diopsidae to show venation (markings omitted).
A, *Diaseopsis*; B, *Pseudodiopsis*; C, *Sphyracephala*.



TEXT-FIG. 3.—Heads of Diopsidae. A, *Cyrtodiopsis*; B, *Diopsis* (slightly turned to show facial teeth); C, *Sphyracephala*; D, *Pseudodiopsis*; E, *Diasemopsis*; F, *Megalabops*; G, *Teleopsis*.



TEXT-FIG. 4.—Scutella of Diopsidae. A, *Cyrtodiopsis*; B, *Diopsis*; C, *Sphyracephala*; D, *Diopsina*.

in other Diptera, but it may be noted that scutellar spines occur in several genera of the Stratiomyiidae, and that species belonging to the genera *Ephippium* and *Negrilomyia* of the sub-family Clitellariinae also have well-developed supra-alar spines comparable with the spines characteristic of *Teleopsis*. The Asilid genera *Chrysopogon* and *Codula* are characterized by a pair of pre-sutural spiny bristles. Pleurotergal spines have, as far as can be ascertained, no counterpart in other families of Diptera.

Names for the bristles cannot be so accurately decided, but it would seem that the two pairs generally found are best described as NOTOPLEURAL and INTRA-ALAR. In *Diopsina* there may also be a pair of dorsocentral bristles, but the specimens of this genus now available for study are too badly damaged to enable a final decision to be made at the present time.

The following key was originally adapted from Frey's paper (1928) by Dr. John Smart of the British Museum (Natural History), and I am indebted to him for permission to include it here in a slightly modified form.

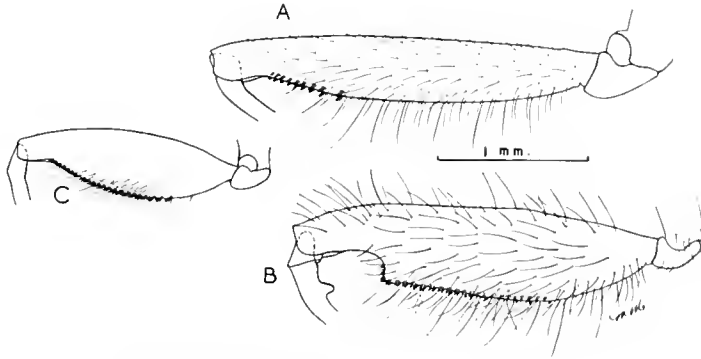
DIOPSIDAE—♂♂ AND ♀♀ (see text-figs. 1, 2, 3 and 4).

1. ALULA present; scutellar spines truncate and bearing a bristle which is much longer than the spine 2.
ALULA absent; scutellar spines long—their bristles, if present, short, not longer than the spine (in *Diopsina* spine and bristle are subequal) 3.
2. FIFTH VEIN extending beyond the discal cell (1st M₂); both inner and outer orbital bristles present SPHYRACEPHALA.
FIFTH VEIN not extending beyond the discal cell; only outer orbital bristles present PSEUDODIOPSIS.
3. THORAX with paired pleurotergal and supra-alar spines 4.
THORAX with paired pleurotergal but no supra-alar spines 5.
4. INNER ORBITAL BRISTLE set on a small tooth in the middle of the eye-stalks; supra-alar spines short MEGALABOPS.
INNER ORBITAL BRISTLE set on a truncate cone towards the base of the eye-stalks; supra-alar spines long TELEOPSIS.
5. THORAX bearing paired bristles on dorsum 6.
THORAX without paired bristles on dorsum 7.
6. SCUTELLUM truncate with a pair of discal bristles DIOPSISINA.
SCUTELLUM normal, without discal bristles DIASEMOPSIS.
7. BODY covered with coarse hairs; inner orbital bristle strong; scutellar spines markedly curved CYRTODIOPSIS.
BODY with but few sparse hairs; inner orbital bristle weak; scutellar spines not markedly curved DIOPSIS.

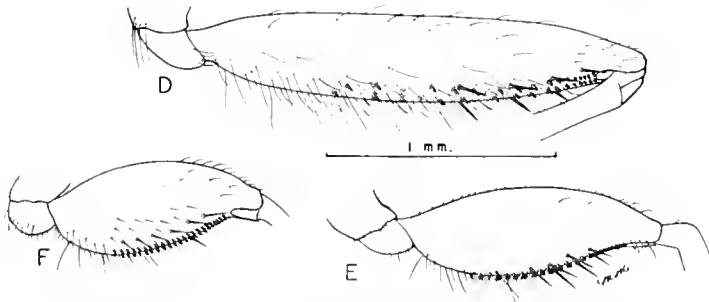
With the assistance of the figures illustrating characteristic features, undamaged specimens should be readily determined by this key, but valuable confirmatory evidence may be obtained by examining the fore-femora, either *in situ*, or preferably after clearing and mounting (text-fig. 5*a* and 5*b*). Various authors have made reference to the ornamentation of the fore-femora without apparently realizing the value of this character as a diagnostic feature in determining the genus—especially in differentiating between *Diopsis* (text-fig. 5*a*, A) and *Diasemopsis* (text-fig. 5*b*, D).

In all the Diopsidae examined by the writer, the ventral surface of the

fore-femora bears a double row of small peg-like teeth, which vary considerably in size and position in the different species. In addition to these, species belonging to *Diasemopsis*, *Sphyracephala* and *Pseudodiopsis* (text-fig. 5*b*) bear spiny bristles alongside the small teeth. Brunetti (1926) was therefore correct in assuming that his *Diopsis fuscivenis* would be more correctly grouped with *Diasemopsis*, while an examination of Bigot's cotypes of *D. dubia* has shown that this species too must be regarded as a *Diasemopsis* (cf. Brunetti (1928) and Curran (1931)).



TEXT-FIG. 5*a*.—Fore-femora of Diopsidae. A, *Diopsis*; B, *Cyrtodiopsis*; C, *Teleopsis*.



TEXT-FIG. 5*b*.—Fore-femora of Diopsidae (cont.). D, *Diasemopsis*; E, *Sphyracephala*; F, *Pseudodiopsis*.

All species of *Cyrtodiopsis* and some species of *Teleopsis* have distinctly hairy fore-femora, the hair being much coarser in the former than in the latter. The extraordinary specialized structure (text-fig. 5*a*, B) found on the fore tibiae and the corresponding modification of the femora of some males of *Cyrtodiopsis dalmanni* (Wiedemann) will be dealt with in a subsequent paper.

Owing to the damaged state of the type specimen of *Diopsina ferruginea* Curran (1928*b*) no description of the scutellar spines was given. Specimens from the British Museum (Natural History) were sent to Dr. Curran, who very kindly confirmed that they were congeneric; the drawing of the scutellum (text-fig. 4, D) was made from one of these specimens and a fuller description will be given later in this series.

The accompanying table (Table II) summarizes the data relating to chaetotaxy, the nomenclature of spines and the bristles of the fore-femora given above :

TABLE II.

Genus.	Orbital bristles.		Thoracic bristles.				Fore-femora.
	Inner.	Outer.		Pleuro-tergal.	Supra-alar.	Scutellar.	
<i>Diopsis</i>	Weak	+ ¹	—	+	—	Simple	Without spiny bristles.
<i>Cyrtodiopsis</i>	Strong	+	—	+	—		
<i>Teleopsis</i>	Strong	+	—	+	+	With apical bristle which is not longer than the spine	
<i>Megalabops</i>	„	+	—	+	+		
<i>Diopsina</i>	Strong	+	SA, IA, ? DC	+	—		
<i>Diasemopsis</i>	„ ²	+	IA always NP occasionally	+	—	With spiny bristles on ventral surface.	
<i>Sphyracephala</i>	Strong	+	IA, NP	+	—		
<i>Pseudodiopsis</i>	Absent	+	IA, NP	+	—	Apical bristle much longer than spine	

IA, intra-alar; SA, supra-alar; NP, noto-pleural; DC, dorsocentral.

¹ Except *D. absens* Brunetti, in which the outer bristle is stated to be absent.

² Except *D. aethiopica* Rondani, in which the inner bristle is weak (*vide* Curran (1931)).

II. THE GENUS *CYRTODIOPSIS* FREY.

(i) TAXONOMY.

The only direct reference to this genus in the literature is its definition by Frey (1928) in his paper on the Philippine Diopsidae; the genus was defined in the key and a short note added about the "peg and hollow" structures of the fore-leg (see text-fig. 5, B) in certain males of *C. dalmanni* (Wiedemann), the genotype.

A study of the literature and an examination of material in the British Museum (Natural History) has brought to light the following important facts:

1. *D. quinqueguttata* Walker and *D. villosa* Bigot belong to this genus; the description of the former (Walker, 1856) is characteristically inadequate, but the type is in good condition (in the British Museum) and shows the covering of hairs that is characteristic of this genus, which is so clearly emphasized by Bigot in his description of *D. villosa*—"Sparsim et undique villosa." The description of *D. villosa* contains the statement "ore bispinosa," whereas in fact Bigot's co-types (now in the collection of Mr. J. E. Collin) show no facial teeth and there is therefore no justification for separating these two species.

2. Curran (1936) was apparently unaware of Frey's paper, and two species mentioned in his paper, the one identified as *D. ferruginea* Roder (1893) and the other which he named *D. whitei* as a new species, both recognized by him as related to *D. dalmanni* Wied., must also belong to *Cyrtodiopsis*.

Specimens agreeing well with the published data of both these species have been found mixed with *C. dalmanni* in the British Museum. However it is quite obvious that the specimens referred by Curran (*loc. cit.*) to *D. ferruginea* Roder were misidentified, since that species, of which the writer has, through the courtesy

of Dr. W. Ludwig of the Zoologisches Institut, Halle, examined the type, belongs to *Megalabops* (as Frey (1928) suggested) and is not related to *dalmanni*. This species is re-described below as *C. currani* sp. n.

3. It is very surprising that Brunetti (1928) should have described a typical specimen of *C. dalmanni* (Wiedemann) as a new species, *Teleopsis truncata*, especially since he drew attention to that specialization in structure of the fore-leg which had been figured in previous accounts of *dalmanni*.

4. Also, in a collection of Diopsidae made by the author in Uganda, a new species has been found which must be attributed to this genus; this represents the first record of this genus from the African continent, the other species being exclusively from the Oriental Region.

(ii) GENERIC CHARACTERS.

The species now added to the genus do not call for any modifications of the generic characters given by Frey (1928). The following formal definition may be given:

Cyrtodiopsis Frey.

DIOPSIDAE characterized by a coating of comparatively coarse hairs on most parts of the body. The wings are without an alula; the thorax bears pleurotergal but no supra-alar spines and it is free from bristles; the scutellar spines are strong curved, hairy, occasionally with a very weak bristle or hair terminally situated. The inner orbital bristle is strong. The abdomen is markedly clavate.

GENOTYPE: *Diopsis dalmanni* Wiedemann (1830).

In many respects this genus is intermediate between *Diopsis*, which has straighter scutellar spines and very weak inner orbital bristles, and *Teleopsis*, which has supra-alar spines. Certain species of *Diasemopsis* have been described as hairy, but these all have spines on the ventral surface of the fore-femora and bristles on the dorsum of the thorax.

The following five distinct species fall within the above definition of the genus:

1. *C. dalmanni* (Wiedemann).
2. *C. quinqueguttata* (Walker).
3. *C. whitei* (Curran).
4. *C. currani* sp. n.
5. *C. africana* sp. n.

(iii) KEY TO SPECIES OF *Cyrtodiopsis* (see Plate I, figs. A-G).

1. Head and body mainly black *quinqueguttata* Walker
- Head and body brownish, never black 2.
2. 1st posterior cell (R_5) with no median pale spot *africana* sp. n.
- 1st posterior cell (R_5) with median pale spot 3.
3. This wing spot small, isolated, distinct; the sub-apical brown band on the wing greater than the apical pale bands in width *currani* sp. n.
- This wing spot larger and part of the transverse pale band; the dark sub-apical band on the wing not greater than the apical bands in width 4.
4. Dorsum brown pollinose; inner orbital bristle on a strong tubercle *whitei* Curran
- Dorsum glossy, not pollinose; inner orbital bristle on a weak tubercle *dalmanni* Wiedemann

(iv) DESCRIPTIVE NOTES ON THE SPECIES OF *Cyrtodiopsis*.I. *Cyrtodiopsis dalmanni* (Wiedemann).

- Diopsis dalmanni* Wiedemann, 1830, *Auss. Zweifl. Ins.* 2 : 560.
Diopsis dalmanni Wiedemann, Westwood, 1837, *Trans. Linn. Soc. London*, 17 : 399, 547.
Diopsis attenuata Doleschall, 1856, *Natuurk. Tijdschr. Ned.-Ind.*, 10 : 413.
Diopsis latimana Rondani, 1875, *Ann. Mus. Stor. Nat. Genova*, 7 : 444.
Diopsis lativola Rondani, 1875, *Ann. Mus. Stor. Nat. Genova*, 7 : 445.
Diopsis albimana Rondani (in error for *latimana*), 1875, *Ann. Mus. Stor. Nat. Genova*, 7 : 445.
Diopsis dalmanni Wied., van der Wulp, 1897, *Tijdschr. Ent.*, 40 : 184.
Diopsis dalmanni Wied., de Meijere, 1908, *Tijdschr. Ent.*, 51 : 115.
Teleopsis truncata Brunetti, 1928, *Ann. Mag. Nat. Hist.*, (10), 2 : 277.
Cyrtodiopsis dalmanni (Wied.), Frey, 1928, *Notul. ent. Helsingfors*, 8 : 70

Of the descriptions listed above, van der Wulp's (in Dutch) and de Meijere's (in German) are so complete that it is not necessary to redescribe this species here.

The species is very variable and this no doubt is responsible for the list of synonyms given above. It is possible that it could be sub-divided into geographical races, but until much longer series are available, such sub-division is not practicable. From the British Museum material, however, it is apparent that there is considerable variation in the wing pattern. Specimens from Java (the type locality) show two forms (Plate I, figs. A, B) with intermediates, while specimens from the F.M.S., Siam and Sarawak (Plate I, fig. E) are slightly different from both—the sub-apical pale band, usually composed of three spots, is absent and the transverse dark band is both darker and wider than usual, thus approaching in form the pattern of *C. currani* sp. n. (Plate I, fig. F).

The variation of this species is being studied biometrically, and series from as many different localities as possible are required, but it is more especially important to know if the species exists in Burma, and if so, in which form it is found.

2. *Cyrtodiopsis quinqueguttata* (Walker).

- Diopsis quinqueguttata* Walker, 1857, *J. Linn. Soc. London*, 1 : 36.
Diopsis villosa Bigot, 1871, *Ann. Soc. Ent. Fr.*, 5 : 4, 114.

This species is readily distinguished from others in the genus by its black appearance—in which it bears a superficial resemblance to *D. subnotata* Westwood, which is found in the same region but which is generically distinct.

Rondani (1875) pointed out that the species he was describing as *D. lativola* sp. n. and which is now regarded as synonymous with *C. dalmanni* (Wiedemann), was apparently related to *D. quinqueguttata* Walker, but he did not give his reasons.

The type of *quinqueguttata* is in fair condition, but it has been thought advisable to give the following re-description from fresh material, collected by *Hobby & Moore* in Sarawak in 1932 and now preserved in the British Museum.

♂ and ♀. Length : 8 mm. Eye-stalk : 5 mm. Wing : 5½ mm.

Head : black, face glossy black, not markedly protuberant, as in *dalmanni* ; epistomium orange, facial teeth absent. The eye-stalks are darker at the base, considerably lighter at the tips except behind the eyes—sparsely hairy all over. Antennae typical in form, brownish with black arista. Inner orbital bristle long, erect, slightly curved ; outer orbital bristle strong and long.

Thorax : dull black with pale pollinose triangular patches just before the wings on the dorsum, also before and behind the wings on the pleura. Collar very pale pollinose. Scutellar spines strong and hairy.

Wing: venation typical, though careful examination of the wing shows that the fifth vein ($M_4 + Cu_1$) and the discal cell (1st M_2) differ slightly from the standard form (see Plate I, fig. D). Wing pattern as follows: distal third dark except for a pale apical spot, middle third not quite so dark with a light spot at the foot of the discal cell and a similar spot on the anterior margin opposite.

Legs: fore coxa pale yellowish, femur yellowish basally, but darker apically and not very incrassate. Tibia black and tarsus, except for 1st segment, light. Middle legs dark brownish except for the apical half of the femur, which is light. Hind legs dark brown except for the basal tenth of the femur, which is distinctly paler.

Abdomen: mainly black with a sparse covering of hairs and with markings as follows: first two segments very pale pollinose, third segment with a pair of clear silvery-white patches on sides, fourth segment pale brown pollinose on most of the basal half and two silver-white patches on the sides. Sixth segment pale pollinose.

3. *Cyrtodiopsis whitei* (Curran).

Diopsis whitei Curran, 1936, *Amer. Mus. Nov.*, 833: 1.

A single specimen in the British Museum with the following data: "In jungle, Assam-Ganhati 21.x.1920 R. Senior White" agrees exactly with the original description, but unfortunately it has lost its abdomen (Plate I, fig. C). There is nothing to add to the complete description given by Curran.

4. *Cyrtodiopsis currani* sp. n.

D. ferruginea Curran nec Roder, 1936, *Amer. Mus. Nov.*, 833: 2.

This species is similar to *C. dalmanni* (Wiedemann), but is not so hairy; the wing pattern is slightly different, but the inner orbital bristle is its most distinguishing feature, its structure resembling that of species of *Telcopsis*.

Length: 5 mm. Eye-stalk: 6 mm. Wing: $4\frac{1}{2}$ mm.

♂ and ♀. *Head*: face yellow-brown, darker above the dark transverse suture and black behind the eye-stalk. Antennae pale brown, with pale pilosity, arista long. Inner orbital bristle on short conical base, stout; outer orbital bristle short, erect.

Thorax: brown, darker posteriorly, slightly brown pollinose anteriorly; collar shining brown with dark sutures; scutellum pollinose, scutellar spines basally concolorous with scutellum but darker apically, hairy.

Wing: mainly dark, hyaline at base; tip tinged with brown, a narrow band of three spots separating this from the dark portion of the wing; three median pale spots distinctly separate; a pale band nearer the base (Plate I, fig. 1).

Legs: fore coxa and femur reddish brown, tibia much darker, first tarsal segment dull; dark, the remaining segments much lighter. Middle and hind legs similar, femora darkened distally, tibiae very dark brown, tarsi dark with black hairs.

Abdomen: first segment dark brown, second somewhat darker, matt; third light brown basally, darker where it widens; fourth dark brown, nearly black at edges with white spots on either side; fifth and sixth segments blackish brown.

SIAM—Bang Kloi, 19.xi.1933. Holotype, ♂.

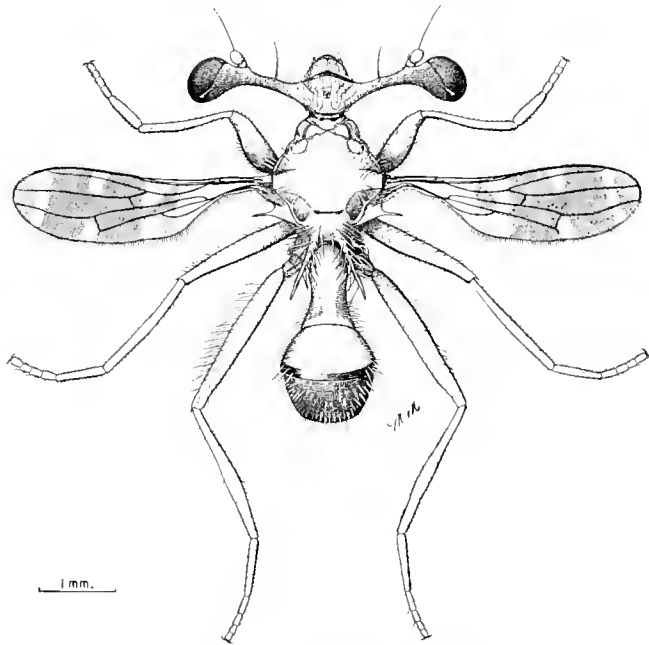
SIAM—Non Guri, 21.xi.1933. Allotype, ♀.

Both collected by W. R. S. Ladell and now in the British Museum.

Cyrtodiopsis africana sp. n. (Text-fig. 6.)

This is the only African species of this genus known at present; it can readily be distinguished from the Oriental species by its much smaller size, and by the form of the wing-markings (Plate I, fig. 6), in which it closely resembles *Diopsina ferruginea* Curran (1928a), though this latter species has (as shown by a specimen in the British Museum) setigerous scutellar spines and is generically distinct.

♂ and ♀. Dark reddish brown. Length: about 5 mm. Eye-stalks: 4 mm. Wing: 4 mm.



TEXT-FIG. 6.—*Cyrtodiopsis africana* sp. n.

Head: dark reddish brown and markedly hirsute; upper parts of the face prominent, roughened; lower parts glossy, with two small but distinct teeth. The black suture on the lower side of the eye-stalks extends nearly to the oral margin. Eye-stalks strong, glossy yellow-brown in the middle but darker apically, with a sparse covering of hair on all surfaces. Ocellar spot black, prominent, ocelli showing light by contrast. Inner orbital bristle strong, arising from a small black conical base; outer orbital bristle much stronger but not so long, and with a similar base. Antennae brownish, the third segment covered with fine light-coloured pile.

Thorax: glossy brown, showing the sutures clearly, somewhat darkened; hairs long, black, arranged in rows on dorsum. Pleurotergal spine strong with black tip. Scutellum distinctly convex, deeper than long (as in *Diopsina*, but bearing hairs and not distinct bristles); scutellar spines strong, slightly curved

distally—proximal third light, median third dark, distal third lighter than the middle but darker than the basal third; more than 15 long black hairs on each spine, evenly distributed.

Wing: mainly brown, showing seven clear spots arranged as shown (Plate I, fig. 6) (*cf.* also the illustration of the wing of *Diopsina ferruginea* Curran (1928b: 183), i.e. a subapical row of three contiguous spots, two centrally placed spots, one from the anterior margin crossing the second vein and extending to the third vein; the other on the posterior margin at the end of the discal cell. The other two spots form a nearly complete white band across the basal third of the wing.

Legs: conspicuously hairy; fore: coxa brown, slightly white pollinose on the lower surface, which is somewhat flattened; femur not very incrassate, much darker brown, with black hairs on the ventral surface, which also bears two rows each of five very small teeth on the distal fifth; tibia very dark brown uniform all over; tarsus very dark on dorsal surface, but with a golden pubescence on the underside. Middle legs resemble the hind legs, but have no pubescence on the tarsi. Hind femur dark brown with dark spot apically and a terminal spine; tibia dark brown and tarsus dark on upper surface, golden pubescence on lower.

Abdomen: strongly clavate with terminal segments reflexed under (in dried specimens). First segment slightly pollinose and therefore appears lighter than the body. Second segment brown, blacker towards the edges distally. Third segment glossy brown except on the distal margin, which is dark-banded; this segment is considerably wider distally. Fourth segment appearing more or less hemi-spherical from above, shining dark brown, rather more hirsute than the third segment. Other segments not normally visible.

UGANDA, W.P., Nyakasura, Toro. Holotype, ♂, 29.i.1935.

UGANDA, W.P., Mpanga Bridge, nr. Fort Portal. Allotype, ♀, 5.iv.1936.

Paratype, ♂, same data as holotype.

All collected by the author and now in the British Museum.

In life this Diopsid has a strong resemblance to an ant, the eye-stalks giving the illusion of strong antennae and the wings held flat over the abdomen serve to exaggerate the petiolation—an illusion that is more marked in the case of *D. circularis* Macquart, in which the two circular marks on the wings coincide when the wings are held in their normal resting position.

ACKNOWLEDGMENTS.

In conclusion, it is my privilege to express my thanks to the British Museum (Natural History) for granting me facilities for carrying out this study, and more especially to Dr. F. W. Edwards, F.R.S., and to Dr. John Smart for the interest they have shown in the work and for the helpful advice they have so willingly offered. Also to Mr. H. Oldroyd, M.A., of the British Museum, and to Dr. F. van Emden, of the Imperial Institute of Entomology, for information relating to other families of Diptera. Mr. G. H. E. Hopkins, M.A., Senior Entomologist, Medical Dept., Uganda Protectorate, very kindly referred me to Mally's paper (1920), which I should otherwise have overlooked. For the loan of types I am very much indebted to Mr. J. E. Collin, who now has part of the Bigot Collection, and to Dr. W. Ludwig of the Zoologisches Institut, Halle, who sent Roder's type of *D. ferruginea* for examination.

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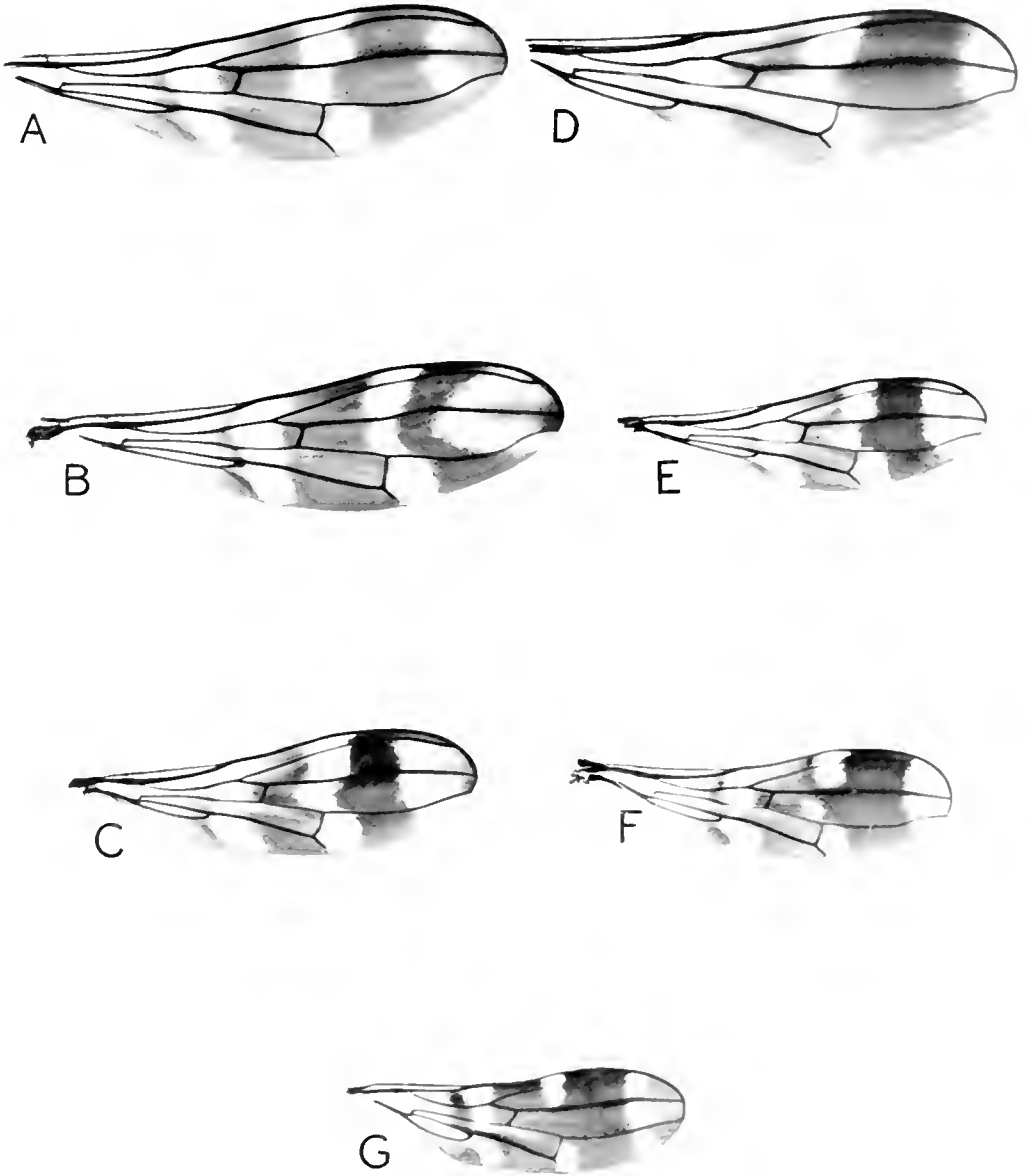
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PLATE I.

Wing pattern of species of *Cyrtodiopsis*. ($\times 12$.)

- A, B. *C. dalmanni* (Wied.) from Java.
- C. *C. whitei* (Curran).
- D. *C. quinqueguttata* (Walk.).
- E. *C. dalmanni* (Wied.) from Sarawak.
- F. *C. currani* sp. n.
- G. *C. africana* sp. n.



Wing pattern of *Cyrtodiuspis* spp.

A REVISION OF THE OSMYLID SUBFAMILIES
STENOSMYLINAE AND KALOSMYLINAE
(NEUROPTERA)

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(With eight plates and twenty-eight text-figures.)

THE Osmylidae, as a whole, have attracted the attention of many neuropterists, notably Hagen, McLachlan and Krüger. Many of them are large-winged insects, with well-marked pattern and densely reticulated wings. These features have led to the description of many forms, but unfortunately little attention has been paid to genital structure in either sex, and it is probable that many synonyms have been created, especially in the Osmylinae and Spilosmylinae. Krüger, in his revision of the family in 1913-1914, based his classification almost entirely on venation and placed much reliance on rather minute venational characters. In some species at least, further material has shown these characters to be variable, even differing on opposite sides of the same insect. In spite of this, Krüger's work forms a very useful basis for our classification. Nevertheless in the Osmylidae the venation, being complicated, is by no means stable, and should be used with some reserve as a basis for determination.

The recent acquisition by the British Museum of the historic collection of Neuroptera built up by McLachlan, and also the types and many of the specimens of Neuroptera from the Tillyard collection, has enabled me to make a more careful study of the members of the two subfamilies Stenosmylinae and Kalosmylinae. These subfamilies form a convenient unit for study, inasmuch as the genera (with the exception of *Isostenosmylus*) are restricted in their distribution to Australia (excluding N. Queensland), Tasmania, New Zealand and Chile. The exception is also South American, but it has a more northerly range, covering Ecuador, Southern Brazil and Peru. Further collecting in Chile and Patagonia may well extend the range of *Isostenosmylus* southward and will probably discover further species of these subfamilies. The major part of the Australian Osmylidae belongs to these two subfamilies, the exceptions being *Eidoporisimus pulchellus* Esben-Petersen, *Porismus strigatus* (Burm.), and one or two Spilosmyline species of Papuan origin which have reached North Queensland.

The structure of the male genitalia confirms the opinion that the Osmylidae are among the more primitive members of the true Neuroptera. In most Neuroptera the tenth sternite in the male has been retracted within the abdomen and has become much modified from the normal U-shaped sternite to a saddle or arch-like structure. In these subfamilies are found examples of a tenth sternite which is still external and covered with hairs (*Stenosmylus*, *Oedosmylus*), as well as intermediate forms leading to the more or less internal structure of *Isostenosmylus*. In many Osmylidae there is found in the male a pair of eversible, finger-like scent-glands, opening on the dorsum between the eighth and ninth abdominal tergites. These are present in the Kalosmylinae, but appear to be absent in the Stenosmylinae, in which the eighth and ninth tergites are fused.

The value of the male genitalia as a means of specific identification varies in different genera. In *Stenosmylus*, *Oedosmylus* and *Isostenosmylus* these structures are very helpful, particularly in the latter genus, in which the wings are rather uniform. In *Kempynus* and *Euosmylus* they are of little use; in fact, the male genitalia of *Euosmylus* are practically indistinguishable from those of some species of *Kempynus*. In the female the form of the eighth sternite and the reflexed lobe hinged to its apex offer good characters. Another female structure which is of assistance is the form of the accessory glands. In the Stenosmylinae they take the form of a pair of slender, serpentine tubes, each terminating in a small oval sac. In the Kalosmylinae this sac is more elongate, generally constricted about midway and differs in form in the various species.

To examine the genitalia properly it is necessary to remove the apex of the abdomen and to clear it by boiling in caustic potash solution. After neutralizing the alkali with acetic acid, the preparation is stained in carbol-fuchsin and mounted in canada balsam in the usual manner. Staining is necessary to reveal the shape of the basal parts of the tenth sternite. These structures gradually thin down to a very fine edge which, if unstained, becomes invisible in canada balsam. All the drawings in this paper have been made from cleared specimens in clove oil, before mounting. The various parts, shown separately, are not necessarily drawn to the same scale, as this would mean an undue reduction of some drawings.

The photographs of the wings have been made primarily with the object of showing the pattern and in some instances this has been slightly emphasized, with the result that venation in some areas is a little obscured. It was found that illuminating the wings from behind only, whilst giving an excellent rendering of the venation, tended to lose the finer shades of the pattern. Pale markings formed by areas in which the veins were whitish were lost entirely, the veins, being in silhouette, reproducing as black. Frontal illumination was therefore used, with a white background some distance behind the wings. The only disadvantage of this method is the slight tendency to reflection of the illuminant from certain areas, unless the wing be completely flattened between glasses.

STENOSMYLINAE Krüger.

Stenosmylinae Krüger, 1913, *Stettin. ent. Ztg.*, **74** : 23, 105-115, 214.

Anterior wing with one cross-vein in subcostal area, medius forked far distant from base. Posterior wing without a sinuous cross-vein from the base of the medius to the radial sector. (In some genera, *Stenosmylus*, *Oedosmylus*, there may occur a feeble or incomplete sinuous cross-vein between the medius and the stem of the radius.) Cu_2 long. In the male apparently no eversible scent-glands opening between the eighth and ninth tergites.

KEY TO GENERA.

1. Wings brownish or black, with conspicuous opaque, white, apical, patches
Euporismus Tillyard.
- Wings without such apical patches 2.
2. In anterior wing, first cross-vein to M beyond the basal corneous spot
arises from the stem of Rs; M forks near the margin of the wing 4.
- In anterior wing, first cross-vein to M beyond the basal corneous spot
arises from the first branch of Rs; M forks nearer the centre of the wing
a few cells beyond the second corneous spot 3.

- 3. In anterior wing of ♀, part of Cu_1 and Cu_2 or JA thickened; Australian, Tasmanian species *Oedosmylus* Krüger.
In anterior wing of ♀, these veins normal; S. American species *Isostenosmylus* Krüger.
- 4. A_2 in anterior wing extends to level of origin of Rs *Stenosmylus* McLachlan.
This vein extends to level of origin of first branch of Rs. *Stenolysmus* gen. nov.

STENOSMYLUS McLachlan.

(Pl. I.)

Stenosmylus McLachlan, 1867, *J. Linn. Soc. Lond. (Zool.)*, 9 : 267.
1868, Brauer, *Verh. Zool.-Bot. Ges. Wien*, 18 : 308; 1913, Krüger, *Stettin. ent. Ztg.*, 74 : 106-112.
Genotype (fixed by McLachlan, 1867) : *Osmylus tenuis* Walker, 1853.

In anterior wing, first cross-vein to the medius beyond the basal corneous spot arises from the stem of Rs; A_2 extends to level of origin of Rs. ♂. Tenth sternite largely external, hairy, varying in shape according to species. ♀. Hinged lobe of eighth sternite slender, bifid at apex; valves of ninth segment not heavily fringed.

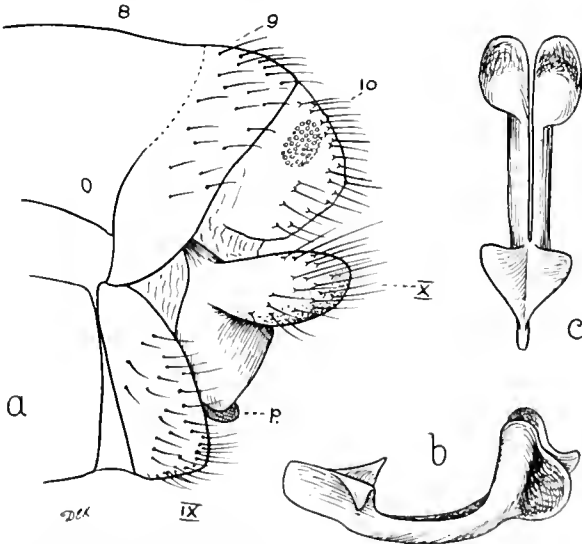
DISTRIBUTION : Australia.

Stenosmylus tenuis (Walker).

(Pl. I, fig. 2; text-figs. 1, 2.)

Osmylus tenuis Walker, 1853, *List Neur. Ins. Brit. Mus.*, 2 : 234; Hagen, 1866, *Stettin. ent. Ztg.*, 27 : 455.
Stenosmylus tenuis (Walker), McLachlan, 1867, *J. Linn. Soc. Lond. (Zool.)*, 9 : 267; Krüger, 1914, *Stettin. ent. Ztg.*, 75 : 57, 114-117.

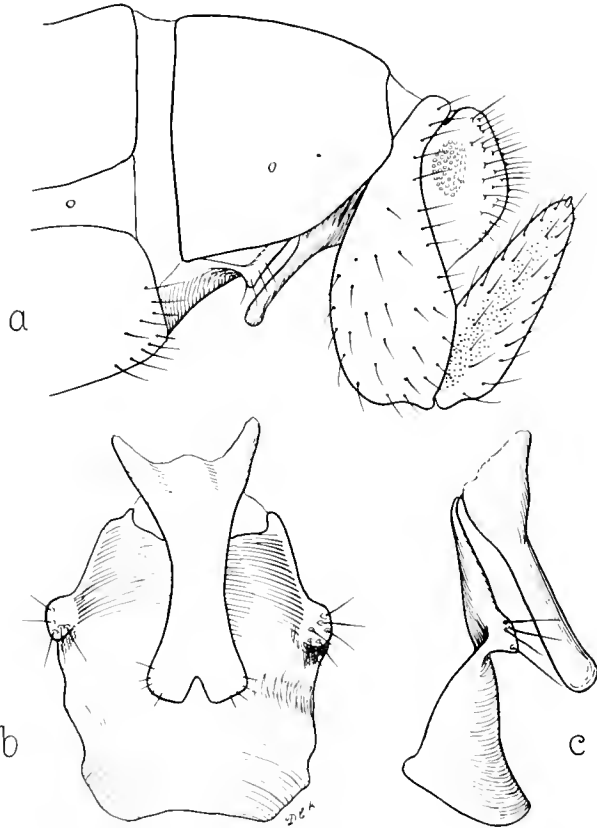
Walker's description of the general appearance is adequate, and the only amplification I propose to give is the description of the ♂ and ♀ genital appendages.
♂. Eighth and ninth tergites fused dorsally; ninth sternite short. Anal



TEXT-FIG. 1.—*Stenosmylus tenuis* (Walker), ♂ type. *a*, apex of abdomen, lateral; *b*, parameres, lateral; *c*, the same, dorsal.

plates from the side broadly rounded, with a large group of trichobothria. Tenth sternite external, triangular from above, from the side projecting in a stout hairy finger. Its lower basal margin extended downwards in a pair of thin chitinized plates. Between these plates lie the parameres, slender, curved rods, flattened and fused basally. The fused portion bears on its upper surface a pair of triangular flaps. Apices of the parameres dilated.

♀. Seventh sternite simple, apical margin not produced. Eighth tergite a little shorter than its depth; sternite broad, convex basally and concave apically.



TEXT-FIG. 2.—*Stenosmylus tenuis* (Walker), ♀ paratype. *a*, apex of abdomen, lateral; *b*, eighth sternite, ventral; *c*, the same, lateral.

About mid-way the lateral margins are each produced downwards in a short, triangular tooth, carrying a number of setae. To the apex of the sternite is hinged a slender process, rather shorter than the sternite, directed basally. This process, which has a somewhat dilated base, is from the side parallel-sided; from beneath the apex is expanded and has a small V-shaped excision at the centre of its margin. Ninth tergite short dorsally, side lobes pyriform. Valves of the ninth segment straight, lanceolate, apex with a minute style. Anal plates rounded, group of trichobothria large and ovate.

From Walker's series of three I select as type a male from Van Diemen's Land. The other specimen from this locality is a female, as also is the example

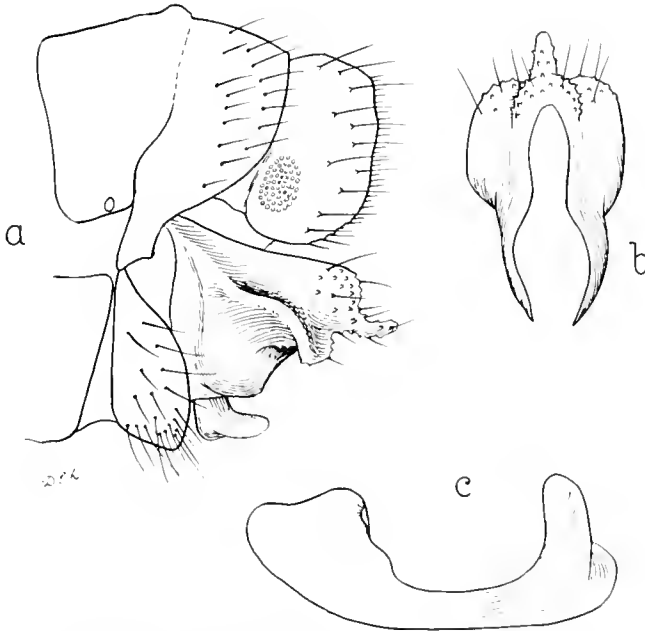
from Adelaide. In addition to these localities I have also seen examples from E. Australia and New South Wales.

***Stenosmylus stenopterus* McLachlan.**

(Pl. 1, fig. 1; text-figs. 3, 4.)

Stenosmylus stenopterus McLachlan, 1867, *J. Linn. Soc. Lond. (Zool.)*, **9**: 267; Kruger, 1914, *Stettin. ent. Ztg.*, **75**: 57, 114-117.

McLachlan's description of the female type is, as usual, very good and requires modifying only in respect of his account of the genitalia. The

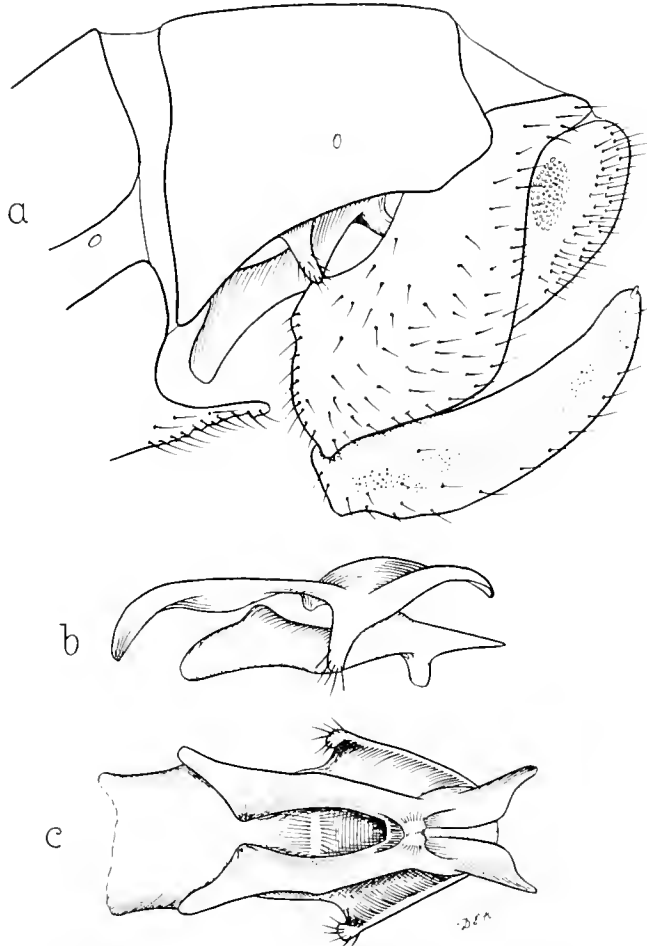


TEXT-FIG. 3.—*Stenosmylus stenopterus* McL. ♂. *a*, apex of abdomen, lateral; *b*, tenth sternite, dorsal; *c*, parameres, lateral.

"long straight spine dilated towards the apex" is at the *apex* of the seventh, not the base of the sixth, segment. The eighth sternite has a slender process arising from each lateral margin, fringed with hairs. The "deeply bifid semi-transparent valve" arises from the eighth and not the seventh sternite; it is bifid at both ends. The "sabre-shaped flattened yellow borer," the valves of the ninth segment, bear at their apices very small styles.

♂. Eighth and ninth tergites fused dorsally. Anal plates fused dorsally, quadrate from the side, angles rounded, the group of trichobothria set low, rather ovate. Tenth sternite large and broad, centre of apical margin globose, extreme apex produced in a slender curved finger. On either side of the centre and at a lower level is a rounded lobe, which from the side is seen extending basally as a sinuous ridge. Lower margins produced downwards, plate-like, apices incurved under the central process. Parameres resembling those of *S. tenuis*, apices less dilated, and no triangular expansions at the base.

Of the three examples in the type series, one is now very defective, and appears to have been repaired with an abdomen of a female *S. tenuis*. Another, with the same register number, 58-124, also lacks an abdomen, and I have therefore selected as type the female from S. Australia (Bakewell), 59-24. It is from



TEXT-FIG. 4.—*Stenosmylus stenopterus* McL., ♀ type. *a*, apex of abdomen, lateral; *b*, eighth sternite, lateral; *c*, the same, ventral.

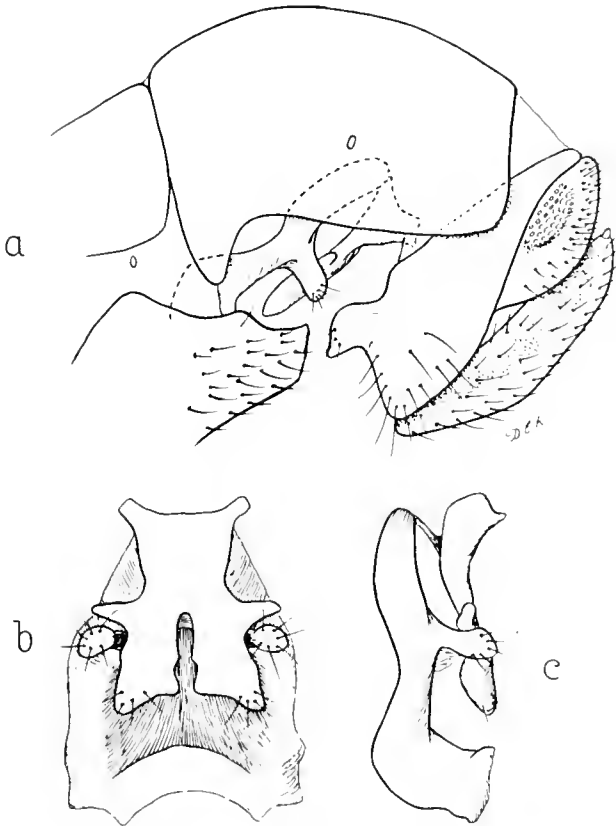
this example that the figures of female genitalia have been drawn. The distribution of the species, as exemplified by British Museum material, covers S. Australia, Victoria and N.S. Wales.

Krüger has placed this species in the synonymy of *S. tenuis*. I feel sure that he cannot have seen a true *tenuis*, for apart from the genitalic differences, *S. stenopterus* has a noticeably narrower anterior wing, its apex more acute. The pattern of the wing is variable, but I have not seen a *stenopterus* without an apical streak, nor a *tenuis* with anything approaching a definite apical streak.

***Stenosmylus turneri* sp. n.**

(Pl. I, fig. 3; text-fig. 5.)

♀. Head and palpi shining brownish, antennae dull luteous. Pronotum elongate, about as wide as the distance between the eyes, shining brownish, the margins fringed with strong setae. Many of these setae arise from strongly elevated bases, giving the lateral margins a serrate appearance. This feature is



TEXT-FIG. 5.—*Stenosmylus turneri* sp. n., ♀ type. *a*, apex of abdomen, lateral; *b*, eighth sternite, ventral; *c*, the same, lateral.

to be seen in other species of the genus. Thorax and abdomen brownish, less shining, with scattered yellowish hairs. Legs pale brownish, irregularly marked with dark brown. Wings hyaline, practically immaculate (two or three brown specks on the gradate series and one on the fork of Cu_1 in anterior wing), stigma brownish, venation mainly brownish. Wings shaped much as in *S. tenuis*, but without the prominent hair bases on the cross-veins, which are a feature of *tenuis* and *stenopterus*.

Genitalia of the pattern of *stenopterus*; seventh sternite produced at centre of its apical margin. Eighth sternite shorter and broader, the hinged, bifid appendage also much shorter, the forks not more than half the length of the

appendage. Lateral margins about mid-way with slender tooth-like projections. Base not bifid, but widely excised. Ninth tergite with a blunt process at its lower basal angle. Valves of ninth segment sabre-like, with a minute apical style. Anal plate short, deep, rounded, group of trichobothria elongate-oval.

Length of anterior wing 18 mm., posterior wing 16 mm.

Type ♀, S.E. QUEENSLAND, Tambourine Mts., 2-9.iv.35 (*R. E. Turner*), in the British Museum.

STENOLYSMUS gen. nov.

(Pl. I, fig. 4.)

Genotype: *Nymphes extraneus* Walker.

The species for which this genus has been erected had a somewhat restless time during the first few years of its entomological life. Walker placed it in *Nymphes*, which it indeed resembles in the form of its wings, but the more slender antennae and the absence of any but a marginal branch to Cu_1 bar it from the Nymphidae. Hagen, in 1866, placed it in the genus *Osmylus*, then a rather composite genus. The following year McLachlan, when revising Walker's list of Neuroptera in the British Museum, placed it doubtfully in the genus *Myiodactylus*, but at the same time pointed out that it possessed "ventral valves and a borer analogous to those described . . . under *Stenosmylus stenopterus*." I suspect that it was its more robust form and rather pallid appearance which deterred him from including it in *Stenosmylus*. Whatever his reasons, I think he was entirely justified, as both male and female genitalia show good characters to separate it from *Stenosmylus*, although it is undoubtedly allied to that genus. The chief difference in wing venation is in the length of A_2 in the anterior wing. This vein is much longer in the present genus, about half as long as A_1 , and extends to about the level of the first branch of Rs. In *Stenosmylus* A_2 is only about one-quarter as long as A_1 , reaching only to the level of the origin of Rs.

♂. Eighth and ninth tergites and anal plates partially fused, anal plates also fused together dorsally. Tenth sternite large, more modified than in *Stenosmylus*, the projecting hairy lobe smaller. Parameres shorter and stouter.

♀. Seventh sternite with its apical margin produced in a broad plate, with a slightly excised apex. Process hinged to apex of eighth sternite broad, truncate, with two apical pockets or depressions. Eighth tergite longer than deep. Group of trichobothria on anal plate small and nearly circular. Valves of ninth segment elongate, somewhat twisted along their axes; apical margin fringed with stout hooked setae; apex of valve with a small but definite style.

It is perhaps scarcely necessary to point out that the name *Stenolysmus* is an anagram of *Stenosmylus*, and does not imply any special relationship with *Lysmus* Navás.

DISTRIBUTION: Australia.

Stenolysmus extraneus (Walker).

(Pl. I, fig. 4; text-figs. 6, 7.)

Nymphes extraneus Walker, 1853, *List. Neur. Ins. Brit. Mus.*, **2**: 230.

Osmylus extraneus (Walker), Hagen, 1866, *Stettin. ent. Ztg.*, **27**: 453.

? *Myiodactylus extraneus* (Walker), McLachlan, 1867, *J. Linn. Soc. Lond. (Zool.)*, **9**: 262.

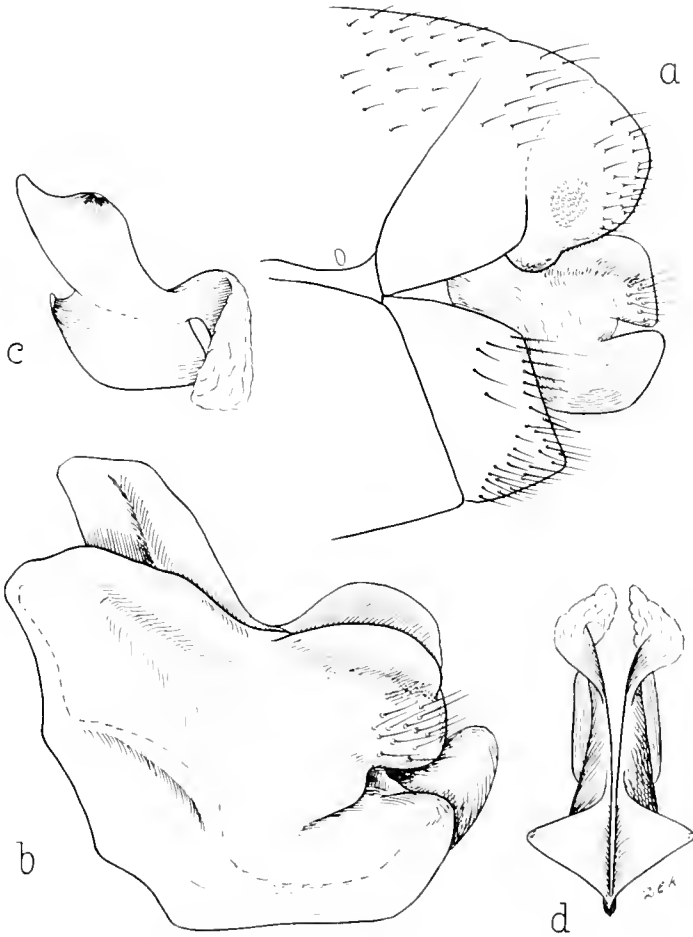
Stenosmylus extraneus (Walker), Banks, 1913, *Trans. Amer. ent. Soc.*, **39**: 215.

Stenosmylus australiensis Esben-Petersen, 1917, *Vidensk. Medd. naturh. Foren. Kbh.*, **68**: 1

(*Syn. nov.*).

Walker's type is a female without locality, but I have no doubt that a female of *S. australiensis* E.-P. from the Tillyard collection is conspecific. The description of the male genitalia is from a specimen in McLachlan's collection, determined by myself.

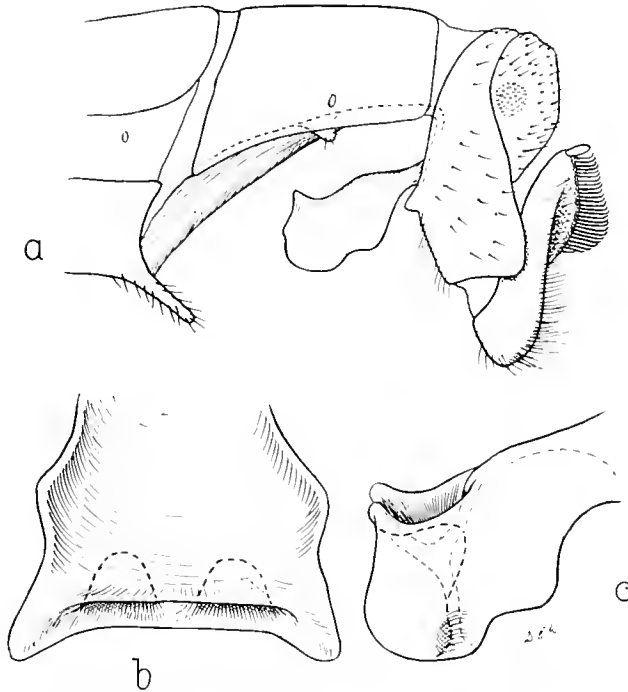
♂. Eighth and ninth tergites and anal plates fused dorsally, the anal plates forming a hood. The latter from the side are rounded, a little flattened apically,



TEXT-FIG. 6.—*Stenolysmus extraneus* (Walker), ♂. *a*, apex of abdomen, lateral; *b*, tenth sternite, lateral; *c*, parameres, lateral; *d*, the same, dorsal.

and with a small rounded lobe at the lower basal angle. Tenth sternite large, arched, partly external. Dorsal margin produced in a small setigerous lobe, rounded from above, its upper surface elevated in a pair of convergent ridges. Lower margins of tenth sternite produced tailward, curving upward towards the apical lobe in a pair of somewhat membranous, flattened lobes. Parameres short, deep, fused at their extreme bases. Lower margins with thin keel-like flanges. Apices membranous, directed downwards and inwards. Near the base on the upper surface are two horizontal, triangular wings.

♀. Seventh sternite produced in a broad plate, apical margin with a wide shallow excision. Eighth sternite long, lateral margins each with a small triangular process. To the apical margin is hinged a broad plate directed basally. There is a deep concavity on its ventral surface near the base, a smaller depression on the upper surface at the apex and two pockets in the apical surface. The apex itself is rather widely excised. Ninth tergite short, deep, lower margin not very dilated. Valves of the ninth segment elongate, somewhat twisted, outer apical margin fringed with stout, hooked, golden setae. Style small, elongate. Anal plates short, rather trapezoidal, trichobothria-group small, circular.



TEXT-FIG. 7.—*Stenolysmus extraneus* (Walker), ♀. *a*, apex of abdomen, lateral; *b*, apex of lobe of eighth sternite, ventral; *c*, the same, lateral.

Length of anterior wing: ♂ 22–26 mm., ♀ 23–28 mm.

„ posterior wing: ♂ 20–24 mm., ♀ 21–26 mm.

DISTRIBUTION: Australia. This species appears to be scarce in collections, and I have seen only five examples, of which only one has a locality more definite than Australia, namely, New South Wales, Beecroft, nr. Sydney, 19.iv.17.

OEDOSMYLUS Krüger.

(Pl. II.)

Oedosmylus Krüger, 1913, *Stettin. ent. Ztg.*, 74: 106–112.

Genotype: *Oed. tasmaniensis* Krüger.

Wings rather elongate, otherwise much as in *Isostenosmylus*. In the female anterior wing the apical part of Cu_1 and either part of Cu_2 and M_{3+4} , or else IA,

are thickened, as are also some of the associated cross-veins. Tenth sternite in male large, hairy, external.

DISTRIBUTION : Australia, Tasmania.

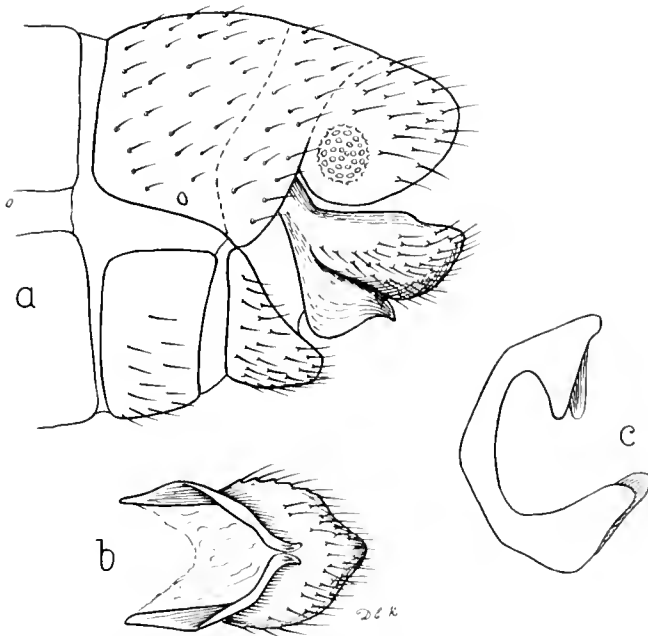
Oedosmylus pallidus (McLachlan).

(Pl. II, fig. 1 ; text-figs. 8, 9.)

Osmylus (?) *pallidus* McLachlan, 1863, *J. Ent.*, 2 : 113, pl. 6, fig. 2. Hagen, 1866, *Stettin. ent. Ztg.*, 27 : 455.

Stenosmylus pallidus (McLachlan), 1870, *Ent. mon. Mag.*, 6 : 195.

Oedosmylus pallidus (McLachlan), Krüger, 1913, *Stettin. ent. Ztg.*, 74 : 216.



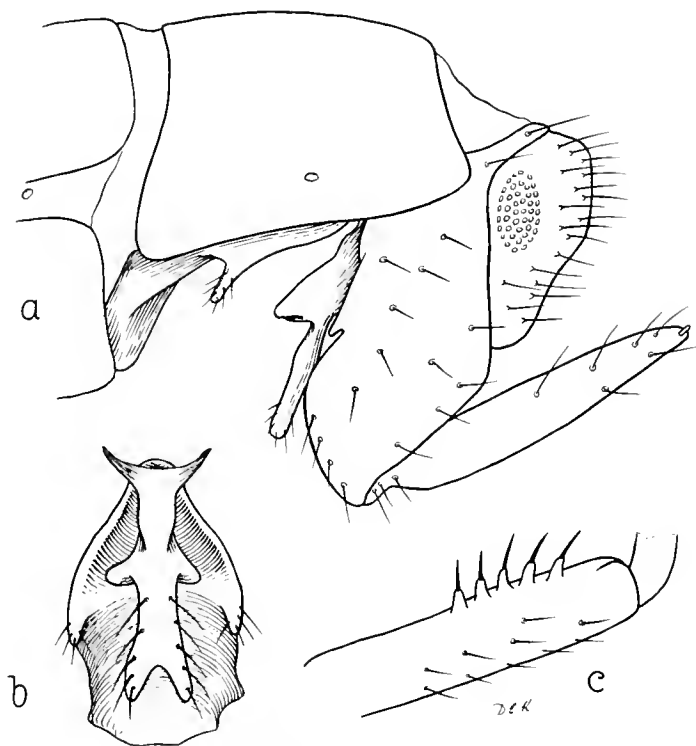
TEXT-FIG. 8.—*Oedosmylus pallidus* (McL.), ♂. *a*, apex of abdomen, lateral ; *b*, tenth sternite, ventral ; *c*, parameres, lateral.

McLachlan's type is a female, and to his description may be added that in the anterior wing, the apical halves of Cu_1 and Cu_2 , the cross-veins between these in the same area, the basal portion of M_{3+4} and some of the cross-veins between M and Cu_1 are dilated to about twice their normal width. The artist seems to have tried to portray this in pl. vi, fig. 2, but the dilatation of Cu_1 has been carried too far basally. The female genitalia follow the stenomyline pattern. Seventh sternite scarcely produced, eighth from the side with a slender, basally directed finger arising from the centre of the lateral margins. Posteriorly the sternite tapers to a rounded apex. Hinged lobe slender, apex bifurcate, from the side with a pair of triangular projections on its upper surface about midway, directed somewhat outwards. Ninth tergite very narrow dorsally, lower portion much expanded and with a narrow excision on its basal margin. Valves long and narrow, with a small apical style. Anal plates pyriform from the side, broad end uppermost.

Anterior coxa with a row of five or six finger-like teeth on its anterior surface near apex, each tooth carrying a socketed seta.

With this female I have associated three males from Hornsby and Hampton, N.S.W. They have the same pallid, almost immaculate wings, the anterior pointed and slightly falcate, hind margin lightly bordered with brownish.

♂ Genitalia: eighth and ninth tergites and anal plates fused, the latter forming a hood with slightly excised apex. Ninth sternite produced, apical margin rounded, centre flattened. Tenth sternite forming a broad hairy lobe,



TEXT-FIG. 9.—*Oedosmylus pallidus* (McL.), ♀ type. a, apex of abdomen, lateral; b, eighth sternite, ventral; c, anterior coxa, lateral.

apex rounded, sides sinuous from beneath. Lower margins of the sternite produced downwards to form plates with approximated, acute, hooked apices. Parameres slender, fused basally, bases dilated in triangular wings, apices rounded, not very dilated.

DISTRIBUTION: "Australia"; New South Wales, Hampton, i. 18, Hornsby, 12. iii. 18, R. J. Tillyard.

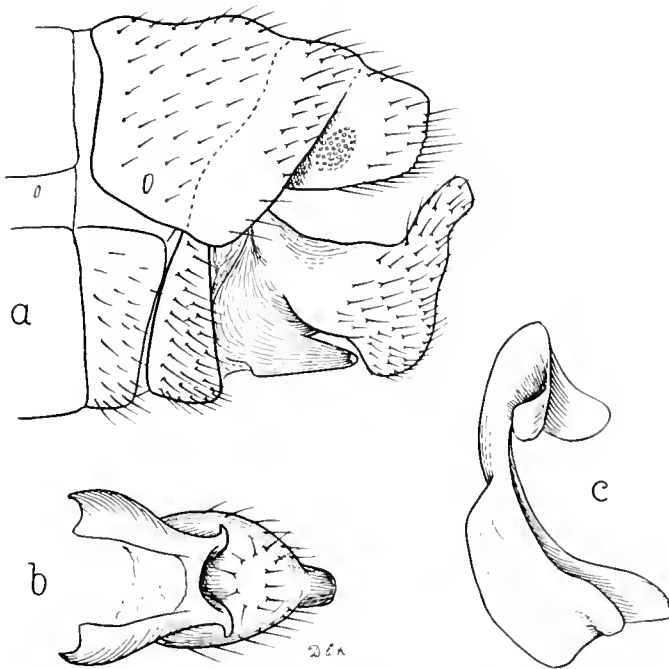
Oedosmylus tasmaniensis Krüger.

(Pl. II, fig. 2; text-figs. 10, 11.)

Oedosmylus tasmaniensis Krüger, 1913, *Stettin. ent. Ztg.*, **74**: 26, 27, 94 (not described), 106–112, 216; 1914, **75**: 117–119 (full description).
Stenosmylus tasmaniensis (Krüger), Tillyard, 1926, *Ins. Austr. N.Z.*: 320.

Anterior wings elongate, 3.3–3.4 times as long as broad, posterior margin rounded, not falcate, apex not pointed. Anterior coxa of female with numerous short, socketed setae scattered over the anterior surface, not set on a row of prominent serrations as in *O. pallidus*.

♂ Genitalia: eighth and ninth tergites completely fused, anal plates forming an excised hood, fused at its centre to the margin of ninth tergite. Ninth sternite short, only slightly produced. Tenth sternite prominent, apex hairy, from the side dilated, upper angle produced upward in a truncate horn, lower angle rounded; from beneath it is parabolic, with the horn projecting beyond the

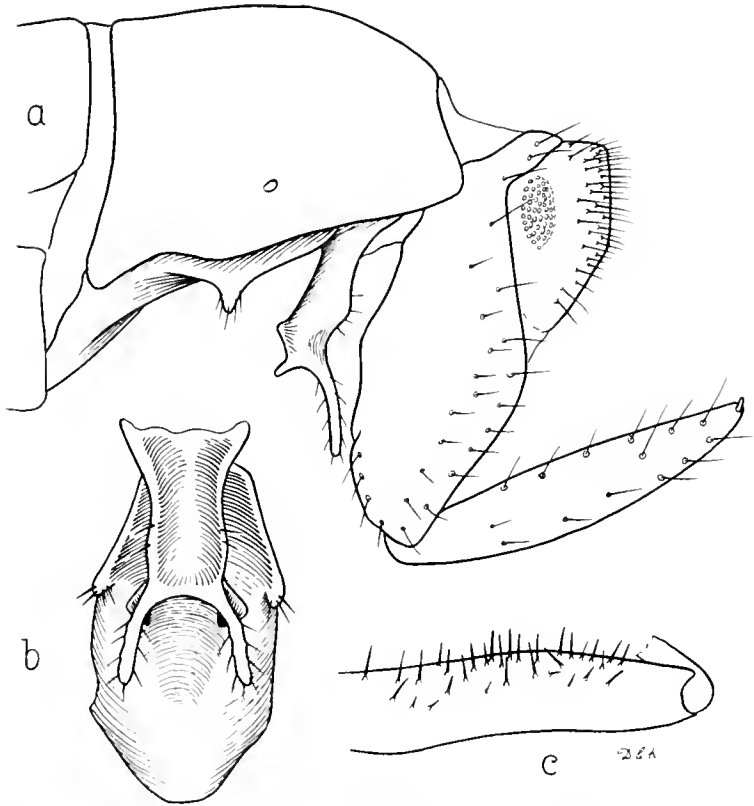


TEXT-FIG. 10.—*Oedosmylus tasmaniensis* Krüger, ♂. *a*, apex of abdomen, lateral; *b*, tenth sternite, ventral; *c*, parameres, lateral.

apex. Lower margins produced downward, forming plates with outcurved, hooked apices. Parameres slender, fused basally, less curved than in *pallidus*. Apical half with a membranous expansion on lower surface, apices rounded and divergent.

♀. Seventh sternite scarcely produced, eighth elongate, apical margin truncate, process of lateral margin short and stout. Hinged lobe stouter than in *pallidus*, lower apical margin terminating in a pair of slender fingers with a deep U-shaped excision between them. Upper apical angles short, plate-like, dilated from beneath. The stem of the lobe is concave beneath. Ninth tergite narrow dorsally, much expanded in its lower portion, no excision on its basal margin; valves narrow and elongate. Anal plates rhomboidal, upper angle truncate.

DISTRIBUTION: Tasmania: Hobart, George's Bay, 1.i.85; Windermere (? label indistinct), 23.xii.87, 22.i.88; Cygnet, 27.xii.10.



TEXT-FIG. 11.—*Oedosmylus tasmaniensis* Krüger, ♀. *a*, apex of abdomen, lateral; *b*, eighth sternite, ventral; *c*, anterior coxa, lateral.

***Oedosmylus latipennis* sp. n.**

(Pl. II, fig. 3.)

This species may best be distinguished from *tasmaniensis* by the shape of the anterior wings. In *latipennis* they are definitely broader (three times as long as broad), and the posterior margin is angled, not evenly rounded. The posterior wings are also relatively broader. The pattern is much the same, but in the female, Cu_1 and 1A are less swollen. I have been unable to discover any real difference in the male genital structure of the two species; unfortunately, both female paratypes of *latipennis* lack the abdomen. Should further material reveal no difference in this sex also, it will perhaps be necessary to reduce *latipennis* to the rank of a subspecies. For the present, bearing in mind the fact that the distribution of *latipennis* encroaches on that of *tasmaniensis*, I prefer to keep them as distinct species.

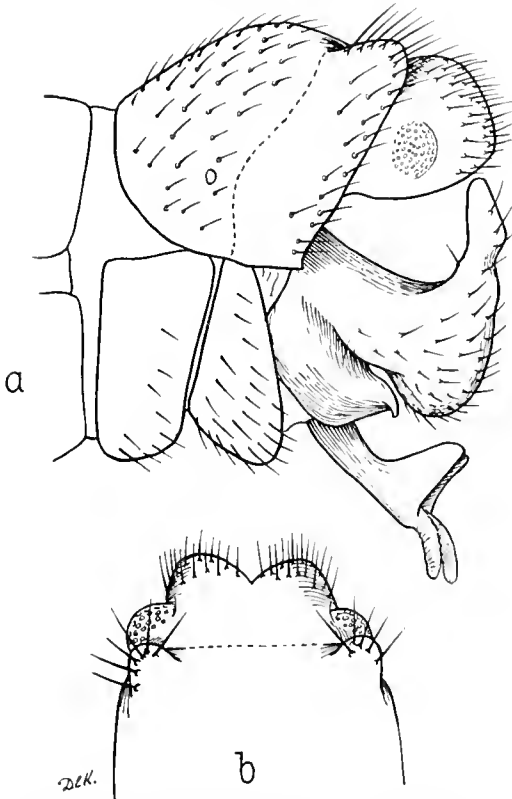
Length of anterior wing: ♂ 19–20 mm., ♀ 19 mm.

Type ♂, paratype ♀, N.S. WALES: Mt. Kosciusko, 4500 ft., 21.i.85; paratype ♂, Mt. Kosciusko, 5000 ft., 22.i.1930, *R. J. Tillyard*; paratype ♀, Mt. Wilson, 19.xi.1921, *R. J. Tillyard*; paratype ♂, TASMANIA: Triabunna, 25.xii.1915, *G. H. Hardy*, in British Museum.

Oedosmylus montanus sp. n.

(Pl. II, fig. 4; text-figs. 12, 13.)

Allied to *O. tasmaniensis* rather than *O. pallidus*, but differing in the form of the wings and the genitalia. Anterior wing more elongate than in *O. latipennis*, posterior margin angled. Dilated veins of ♀ (Cu_1 and 1A) much as in *tasmaniensis*. Anterior coxa of female as in *tasmaniensis*.



TEXT-FIG. 12.—*Oedosmylus montanus* sp. n., ♂ type. *a*, apex of abdomen, lateral; *b*, ninth tergite and anal plates, dorsal.

♂ Genitalia: eighth and ninth tergites fused, eighth more convex from side, ninth with a pair of raised hairy lobes on the apical margin, in dorsal aspect partly overlapping the trichobothria of the anal plates. Anal plates hood-like, excised, more rounded from the side than in *tasmaniensis*. Tenth sternite stouter, upper angle more slender, curving slightly basad, apices of the plate-like lower margins stouter. Parameres with eversible membranous fingers at the lower apical angles. These fingers are very delicate and may possibly occur in other members of the genus.

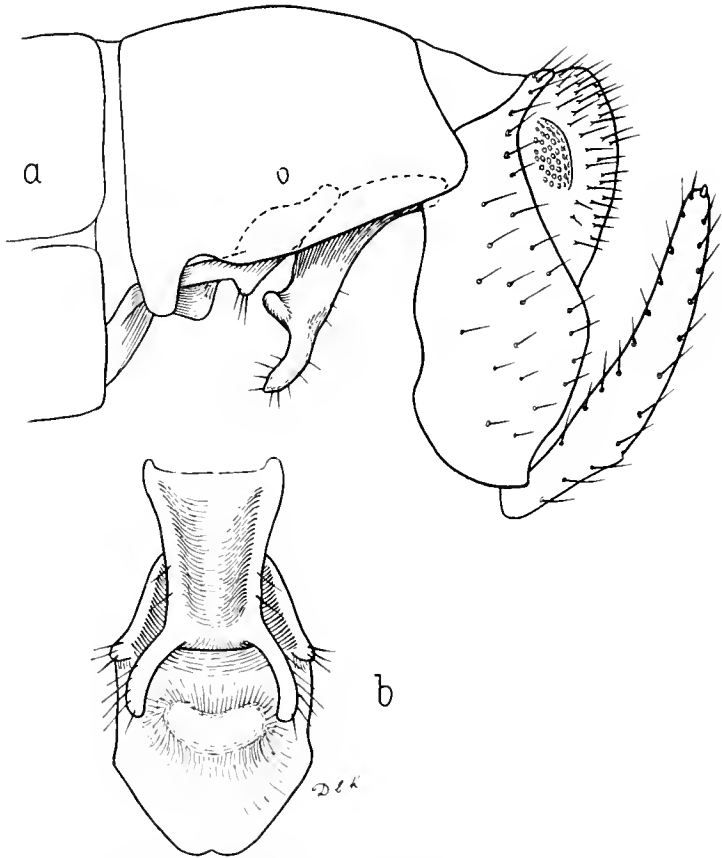
♀ Genitalia: lower margin of eighth tergite near base with a deep rounded excision. Eighth sternite with a reniform prominence in basal half, basal margin excised. Hinged lobe rather stout, apex more roundly excised, arms shorter and

stouter. Upper portion of apex forms a transverse ridge. Lower portion of ninth tergite broader, valves more slender, slightly curved.

Length of anterior wing: ♂ 20 mm., ♀ 21 mm.

QUEENSLAND: National Park, 3-4000 ft.

Type ♂, 18.xii.21, paratype ♂, 20.xii.21, paratype ♀, 21.xii.21, in British Museum.



TEXT-FIG. 13.—*Oedosmylus montanus* sp. n., ♀ paratype. *a*, apex of abdomen, lateral; *b*, eighth sternite, ventral.

ISOSTENOSMYLUS Krüger.

(Pls. III and IV.)

Isostenosmylus Krüger, 1913, *Stettin. ent. Ztg.*, **74**: 23, 216; *op. cit.*, **75**: 48, 120.

Genotype: *Osmylus pulverulentus* Gerstaecker.

= *Austrosmylus* Banks, 1913, *Trans. Amer. ent. Soc.*, **39**: 215. (**Syn. nov.**)

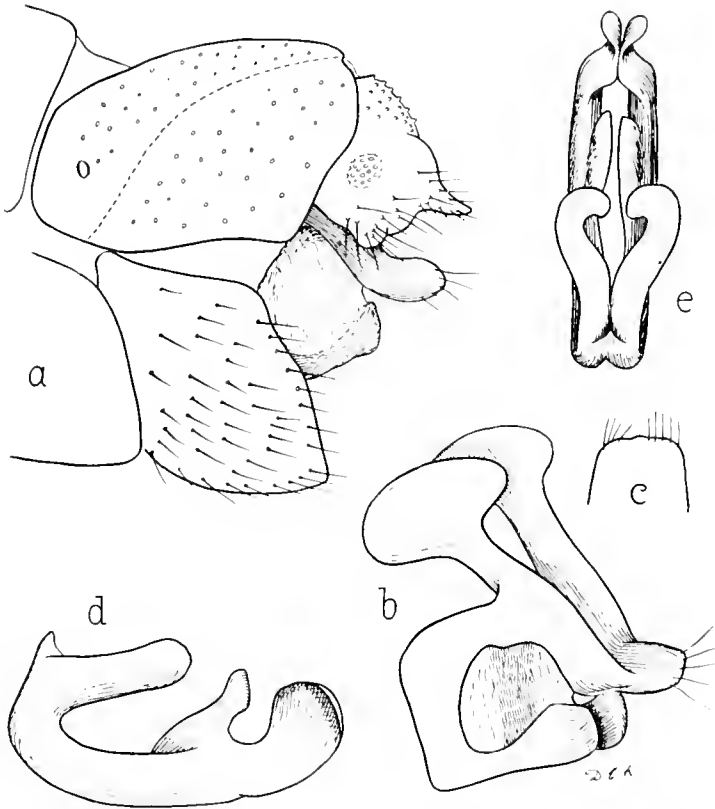
Genotype: *Osmylus pulverulentus* Gerstaecker.

In anterior wing, one cross-vein in the subcostal area. First cross-vein to M beyond the basal corneous spot arises from the first branch of Rs. No thickening of Cu₁ and Cu₂ or IA in either sex. In the hind wing, no basal radio-medial cross-vein; Cu₂ long.

♂. Eighth and ninth tergites fused, line of fusion often indistinct; dorsum

often membranous and impressed in a longitudinal trough. Anal plates fused dorsally, differing in form in the various species. Tenth sternite largely internal, U-shaped, with a branch on lower surface at base. Parameres fused basally, with a pair of basal, and sometimes also apical, branches.

DISTRIBUTION: S. America (Ecuador, Peru, S. Brazil).



TEXT-FIG. 14.—*Isostenosmylus fusciceps* sp. n., ♂ paratype. *a*, apex of abdomen, lateral; *b*, tenth sternite, lateral; *c*, apex of the same, dorsal; *d*, parameres, lateral; *e*, the same, dorsal.

Isostenosmylus fusciceps sp. n.

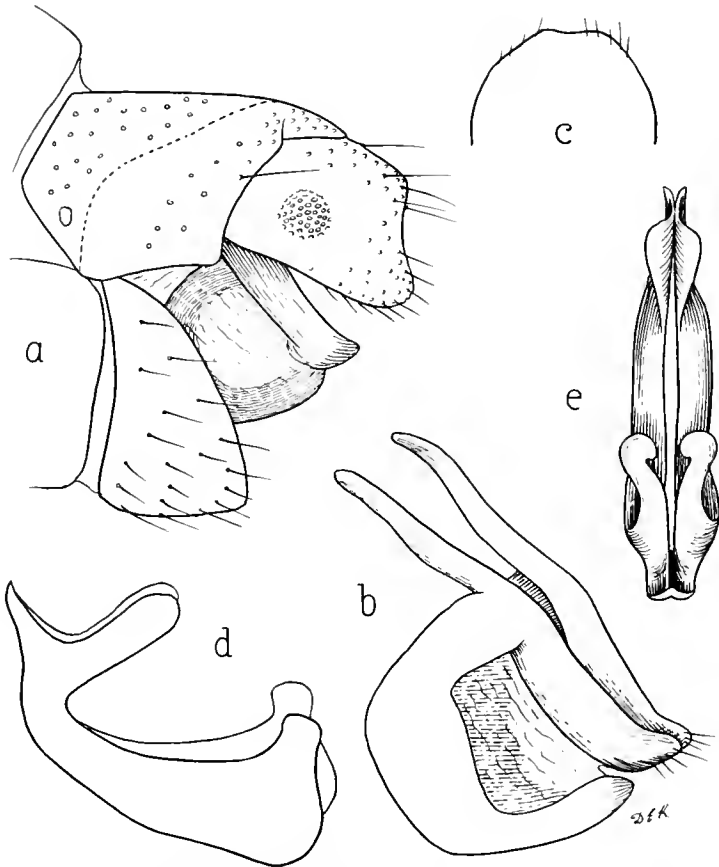
(Pl. III, fig. 1; text-fig. 14.)

5. Vertex, frons to below antennae, and genae fuscous, remainder fulvous, palpi dark fulvous. Antennae with two basal, and under surface of some succeeding segments dark, remainder light fulvous. Pronotum nearly twice as long as wide, fuscous, with golden-brown setae. Meso- and metanota fuscous with darker markings. Legs pale yellowish, tibiae finely speckled with blackish and with a narrow, external, apical band of blackish. Abdominal segments 1-7 fuscous, remainder fulvous. Wings greyish hyaline, marked with brownish as in Pl. III, fig. 1. Veins mainly brownish, with some whitish areas.

Anal plates small, apical margins produced in short, broad spatulae, slender from the side; lower angles slightly produced and rounded. Ninth sternite rather large, rhomboidal from the side. Tenth sternite largely internal, with its apex produced in a short quadrate plate, whose apical margin is fringed with fine setae. Sides of the segment slender, terminating in ovate plates. From the lower margin of each side arises a flattened branch, bent twice at right angles, so that its apex approaches the apex of the segment, the area between the branch and the segment membranous. Parameres with the basal branches (the attachment to the tenth sternite) directed apically and approaching each other; in dorsal aspect they appear somewhat lyriform. Apices of the parameres thin, somewhat dilated, from above approximating and then diverging. Shortly before its apex each paramere bears on its upper surface an upwardly directed branch.

Length of anterior wing 25 mm., of posterior wing 23 mm.

Type ♂, 1 paratype ♂, PERU: Callanga, from the McLachlan collection, now in the British Museum.



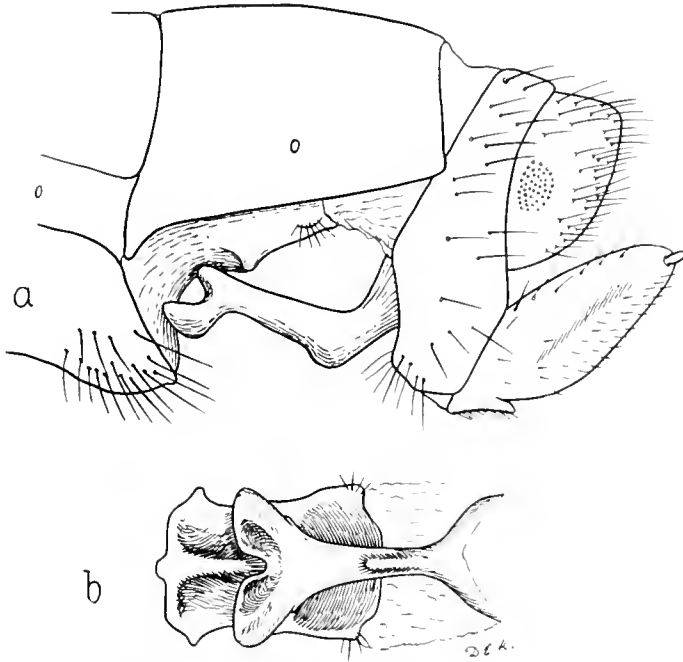
TEXT-FIG. 15.—*Isostenosmylus pulverulentus* (Gerst.), ♂. *a*, apex of abdomen, lateral; *b*, tenth sternite, lateral; *c*, apex of the same, dorsal; *d*, parameres, lateral; *e*, the same, dorsal.

***Isostenosmylus pulverulentus* (Gerstaecker).**

(Pl. III, fig. 2; text-figs. 15, 16.)

Osmylus pulverulentus Gerstaecker, 1803, *Mitt. naturw. Ver. Greifswald*, 25 : 169.*Isostenosmylus pulverulentus* (Gerst.), Krüger, 1913, *Stettin. ent. Ztg.*, 74 : 20, 112, 115, 216.*Austrosmylus pulverulentus* (Gerst.), Banks, 1913, *Trans. Amer. ent. Soc.*, 39 : 215.*Isostenosmylus pulverulentus* (Gerst.), Krüger, 1914, *Stettin. ent. Ztg.*, 75 : 120, 121.

There is little to add to the general descriptions of Gerstaecker and Krüger. I have seen a more heavily marked specimen from "Espirito Santo" in which the cubital spot at the level of the apex of A_1 is extended forward as a narrow streak to the radius.



TEXT-FIG. 10.—*Isostenosmylus pulverulentus* (Gerst.), ♀. a, apex of abdomen, lateral. b, eighth sternite, ventral.

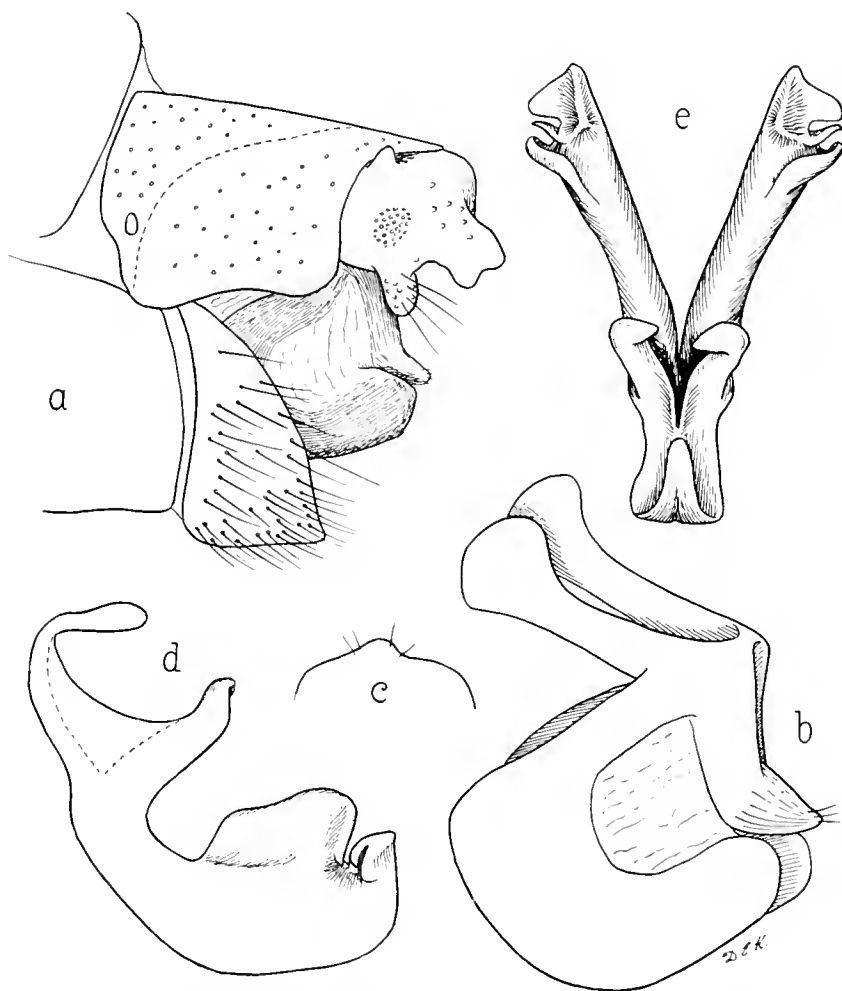
♂ Genitalia: line of fusion between eighth and ninth tergites marked by an internal thickening; ninth more chitinized than eighth, its apical margin produced in a rounded lobe, which is divided to its base by a V-shaped, membranous, apparent excision. Margin of ninth sternite, from beneath, projecting in an obtuse triangle. Anal plates obliquely truncate, lower apical angles rounded. Tenth sternite rather as in *fusciceps*, the apical margin rounded, its centre shallowly excised. Sides of the sternite slender, not dilated at the ends, lower branches broader. Parameres without an upper branch near apex, which is much deeper. Basal branches less apically directed, fused basal portion of parameres longer and more acute.

♀. Apical margin of seventh sternite produced in an elliptical, somewhat truncated lobe. Eighth sternite about two-thirds of the length of tergite, with

a longitudinal ridge; basal margin curved down at right angles to meet the produced apex of seventh sternite. There is a transverse ridge about mid-length of the sternite and the anterior angles are slightly raised and hairy. Attached anteriorly by membrane is a slender lobe with a dilated and excised apex, directed basally. From the side this lobe is angled near its base and the apex is divided into an upper and lower portion by a rounded excision. Ninth tergite short and deep, valves rather broad, lanceolate, each with a small apical style and a small pointed process on the lower margin near the base.

Length of anterior wing 21-25 mm.

The above descriptions are based on a pair from Rio Grande do Sul. In view of the general resemblance in wing pattern between the various species, I suspect that Gerstaecker's example from "Hoch-Peru" may prove to be not conspecific with those from Southern Brazil.



TEXT-FIG. 17.—*Isostenosmylus fasciatus* sp. n., ♂ type. *a*, apex of abdomen, lateral; *b*, tenth sternite, lateral; *c*, apex of the same, dorsal; *d*, parameres, lateral; *e*, the same, dorsal.

***Isostenosmylus fasciatus* sp. n.**

(Pl. IV, fig. 1; text-fig. 17.)

♂. Head light fulvous, marked with brownish on the genae, centre of clypeus, below antennae and on vertex. Palpi and two basal segments of antennae brownish. Pronotum nearly twice as long as broad, dark brown, with a broad, yellowish, median fascia. Meso- and metanota dark brown, with yellowish markings. Legs as in *fusciceps*. Abdominal tergites 1-7 brownish, with a narrow, median, yellowish line. Sternites and apex of abdomen yellowish. Wings greyish hyaline, marked with brownish as in Pl. IV, fig. 1. Venation brownish, with pale areas forming four indefinite streaks across the anterior wing. Area between first and second branches of Rs rather broader than in preceding species.

Apical margin of ninth tergite produced, sternite from beneath moderately produced, margin forming a flattened cusp. Anal plates small, basal margin elevated in a small triangular projection. Apical angles produced, the lower rounded and hairy, the upper broad, its apex from above rounded, from the side with a shallow excision. Tenth sternite with rounded apical margin, its centre more produced. Sides slender, apices moderately dilated, forming clavate plates.

Parameres more developed than in preceding species. The fused base angled upwards, basal branches directed upward. Apices larger and with a complex system of folds on their upper outer surfaces.

Length of anterior wing 23 mm., of posterior wing 21 mm.

Type ♂, PERU: Callanga; paratype ♂, BOLIVIA: "Chaico", in the British Museum, both from the McLachlan collection.

***Isostenosmylus nigrifrons* sp. n.**

(Pl. IV, fig. 2; text-fig. 18.)

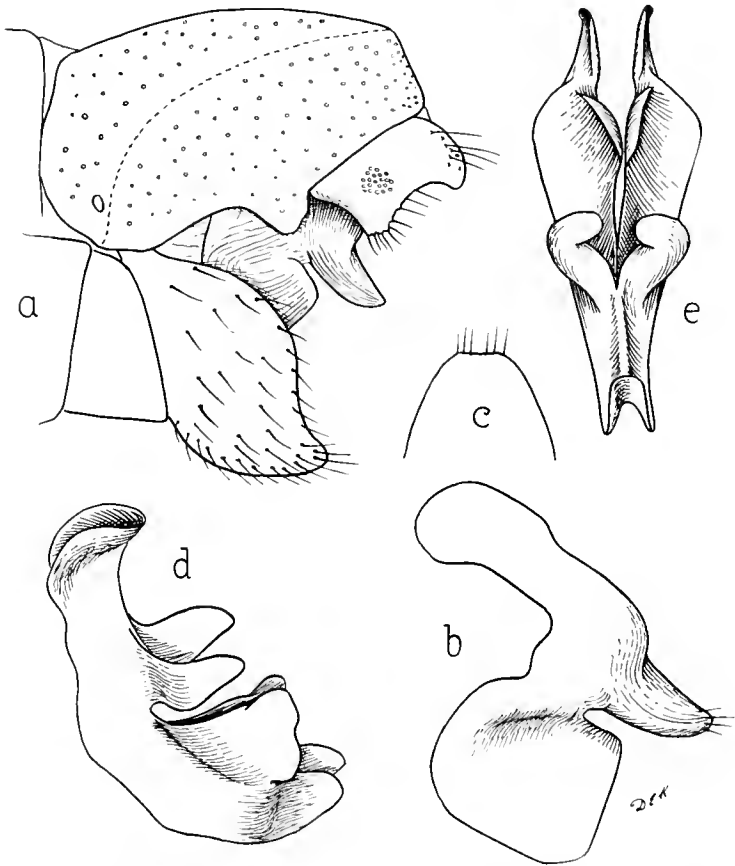
♂. Head fulvous, frons below and between antennae, with a black transverse band from eye to eye. In the centre this band extends downward in a tongue, and on either side of it, between the eye and the tentorial pit, is a round black spot. Genae and palpi shining black. Antennae (incomplete) yellowish, two basal segments brownish. Prothorax a little more than twice as long as broad, blackish, with a yellowish median fascia. Meso- and metanota yellowish, with black markings. Legs as in other species of the genus. Abdomen (discoloured) brownish above, fulvous beneath. Wings similar to *fasciatus*, more lightly marked, but with the posterior margin of hind wing distinctly clouded with brownish.

From the side the dorsal outline of the eighth and ninth tergites is distinctly angled at the point of fusion. Apical margin of ninth sternite produced at its centre in a short finger. Anal plates with the upper and lower apical angles produced, the latter only slightly, rounded, and hairy on its inner surface; the upper is larger and hooked downwards. Excision between upper processes in dorsal aspect with sinuous sides. Tenth sternite from above with its apical margin parabolic, its apex flattened or slightly excised. Bases of the arch dilated only on their lower sides; lower branches in form of quadrate plates attached by short, thick stems. Fused bases of the parameres with a V-shaped

excision in dorsal aspect; basal branches shorter than in *fasciatus*, directed upward and incurved apically. Apex of paramere broad, plate-like, apical branch also plate-like and separated from apex by an excision.

Length of anterior wing 22 mm., of posterior wing 20 mm.

Type ♂, ECUADOR: Intaj, from the McLachlan collection, now in the British Museum.



TEXT-FIG. 18.—*Isostenosmylus nigrifrons* sp. n., ♂ type. *a*, apex of abdomen, lateral; *b*, tenth sternite, lateral; *c*, apex of the same, dorsal; *d*, parameres, lateral; *e*, the same, dorsal.

Isostenosmylus morenoi (Navás).

Oedosmylus morenoi Navás, 1928, *Bol. Soc. ent. Esp.*, 17: 91.

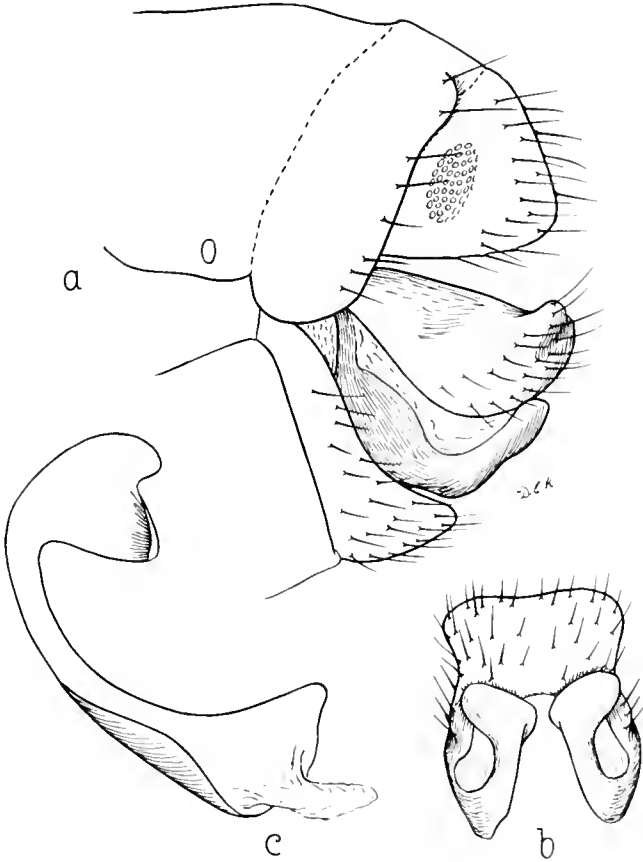
Navás has described, under the name *Oedosmylus morenoi*, an *Isostenosmylus* from Ecuador. He says that it resembles *I. pulverulentus* Gerst., and his figure certainly is very like the variety of that species which I have mentioned from Espirito Santo. The type lacks most of its abdomen and it will probably prove difficult to decide whether any of the foregoing species are conspecific with it.

EUPORISMUS Tillyard.

(Pl. V, fig. 1; text-fig. 19.)

Euporismus Tillyard, 1916, *Proc. Linn. Soc. N.S.W.*, **41**: 43.Genotype: *E. albatrox* Tillyard.

Wings with large, opaque, white patches at apices, remainder of anterior and apical half of posterior dark brown, mottled with white. In anterior wing, first cross-vein to the medius beyond the basal corneous point arises from the first



TEXT-FIG. 19.—*Euporismus albatrox* Tillyard, ♂ type. *a*, apex of abdomen, lateral; *b*, tenth sternite, lateral; *c*, parameres, lateral.

branch of the radial sector. Medius forks several cells beyond the second corneous point. Cu_2 in posterior wing long. Gradate veins form a very even line; outer branches of radial sector very numerous.

Tillyard placed this genus between *Oedosmylus* and *Porismus*, considering it to be allied to *Porismus*. At the time of publication (1916) Tillyard was probably unacquainted with Krüger's revision of the Osmylidae. His description unfortunately omits all reference to the chief character separating *Porismus* from the other subfamilies, namely, the presence of numerous cross-veins in the subcostal area. The type of *Euporismus* has only one cross-vein in this area (the figure

accompanying his description is inaccurate in this respect), and this, coupled with the absence of a basal cross-vein connecting the medius with the radial sector in the posterior wing, and the distant furcation of the medius in the anterior wing places this genus in the *Stenosmylinae*. Tillyard is undoubtedly correct in comparing it with *Oedosmylus*, but until the female is known one cannot say whether certain veins are swollen, as in *Oedosmylus*. Its striking wing pattern will readily distinguish *Euporismus* from other members of the subfamily.

***Euporismus albatrox* Tillyard.**

(Pl. V, fig. 1; text-fig. 19.)

Euporismus albatrox Tillyard, 1916, *Proc. Linn. Soc. N.S.W.*, **41**: 44, pl. 1, fig. 1; 1926, *Ins. Austr. N.Z.*: 320, pl. 24, fig. 2.

The type, a male, is now in the British Museum. To Tillyard's description the following notes on the genitalia may be added:

No apparent eversible scent-glands between the eighth and ninth tergites, which are fused; ninth fused dorsally to anal plates, free margin produced in a small rounded lobe on each side of the fused part. Ninth sternite short, triangularly produced from the side. Anal plates fused together dorsally at base, apically separated by a deep incision; from the side triangular, apex rounded. Tenth sternite large, projecting slightly beyond anal plates, hairy, apex truncate, angles gently upcurved. From beneath, lateral margins are broadly emarginate. Basal angles of sternite produced in curved branches, shorter than sternite, apices from beneath clavate and outspread. Parameres slender, fused basally, apices dilated, lower apical margin extended downwards and outwards, supporting the usual membranous eversible finger.

Length of anterior wing 30 mm., posterior wing 28 mm.

QUEENSLAND: Killarney, head of Condamine R., i. 1914 (*E. J. Dumigan*). Of the three paratypes mentioned by Tillyard (sex not stated) one is in Dr. Esben-Petersen's collection, one in Mr. Banks's collection, and the third is presumably in the Australian Museum, Sydney, or in the Entomological Dept., Council for Scientific and Industrial Research, Canberra.

KALOSMYLINAE Krüger.

Kalosmylinae Krüger, 1913, *Stettin. ent. Ztg.*, **74**: 40, 104-113.

In anterior wing, one cross-vein in subcostal area; medius forking near its base, but beyond the origin of the first branch of Rs. In posterior wing a basal cross-vein between the medius and the radial sector, not very sinuous; Cu_2 long. In the male a pair of eversible scent-glands between the eighth and ninth tergites.

KEY TO GENERA.

1. In posterior wing, branches of medius widely separated, cells between them long and sinuous; New Zealand, Australia, Chile *Kempynus* Navás.
In posterior wing, branches of medius not widely separated, cells between them short, quadrate 2.
2. In posterior wing, M_3 separates from M_4 at about the level of the apex of Cu_1 ; small species, New Zealand *Euosmylus* Krüger.
 M_3 separates from M_4 two or three cells before apex of Cu_1 ; larger species, Australia *Australysmus* gen. n.

KEMPYNUS Navás,

(Pls. VI and VII.)

- Kempynus* Navás, 1912, *Mem. R. Acad. Barcelona*, **10** (9) : 59.
 Genotype: *Osmylus excisus* Navás (= *Osmylus incisus* McL.).
- Banks, 1913, *Trans. Amer. ent. Soc.*, **39** : 214.
 Genotype: *Stenosmylus incisus* McLachlan.
- = *Kalosmylus* Krüger, 1913, *Stettin. ent. Ztg.*, **74** : 23, 96-102.
 Genotype: *Osmylus incisus* McLachlan. (**Syn. nov.**)
- = *Osmylinus* Banks, 1913, *Trans. Amer. ent. Soc.*, **39** : 214.
 Genotype: *Osmylus longipennis* Walker. (**Syn. nov.**)

Krüger proposed the suppression of Navás' name *Kempynus* on the grounds that (a) the name was incorrectly spelt, being derived from Kempny, and should have been *Kempnyus*; (b) the genus was based on a non-existent species (*excisus* McLachlan).

The first is no reason for rejection, nor is there even a case for emendation of the name, as it is perfectly clear that Navás intended this spelling, for he used it no less than six times in his publication. As regards the second, this is due to a *lapsus calami* by Mr. W. F. Kirby in labelling McLachlan's type of *O. incisus*, which was copied without verification by Navás. Even so, *Kempynus excisus* is not a non-existent species, as a very full description was given by Navás when erecting the genus *Kempynus*. I therefore consider *Kempynus* to be a valid genus with as genotype *Kempynus excisus* Navás, = *Osmylus incisus* McL.

Wings falcate or entire. Anterior with one cross-vein in subcostal area; medius forking near base, but beyond origin of first branch of radial sector. Posterior wing: basal radio-medial cross-vein present, M_{1+2} and M_{3+4} widely separated, cells between them long, narrow and sinuous; M_3 separates from M_4 several cells before apex of Cu_1 ; often a basal cross-vein from fork of medius to cubitus; Cu_2 long. Relatively large species, expanse 42-55 mm.

DISTRIBUTION: New Zealand, Australia, Chile.

Kempynus incisus (McLachlan).

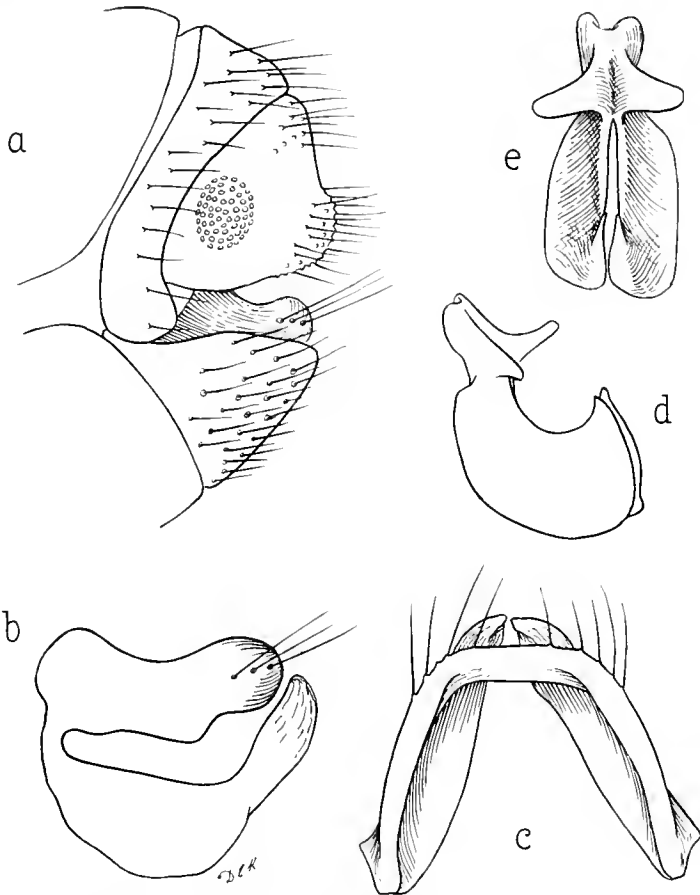
(Pl. VI, fig. 1; text-figs. 20, 21.)

- Osmylus* (?) *incisus* McLachlan, 1863, *J. Ent.*, **2** : 112; Hagen, 1866, *Stettin. ent. Ztg.*, **27** : 455.
- Stenosmylus incisus* (McLachlan), 1870, *Ent. mon. Mag.*, **6** : 195; 1873, *Ann. Mag. nat. Hist.*, (4), **12** : 38; 1894, *Ent. mon. Mag.*, **30** : 241-242. Hudson, 1904, *N. Z. New* : 50.
- Kalosmylus incisus* (McL.), Krüger, 1913, *Stettin. ent. Ztg.*, **74** : 29, 96-102, 212-213, 1914, *op. cit.*, **75** : 104-106.
- Kempynus incisus* (McL.), Banks, 1913, *Trans. Amer. ent. Soc.*, **39** : 215. Tillyard, 1926, *Ins. Austr. N.Z.* : 320.
- Kempynus excisus* Navás, 1912, *Mem. R. Acad. Barcelona*, **10** (9) : 59.

This species varies somewhat in the intensity of the markings. One form has the smaller mottlings of the anterior wing merged into the ground-colour, only the large markings along the posterior margin distinct.

♂ Genitalia: ninth tergite short and deep, sternite triangular from side, apical margin rounded, with a small, shallow excision at its centre. Anal plates fused, hood-like, apical margin broadly excised; from side triangular, upper and apical angles with rounded hairy warts, apical the larger. Tenth sternite largely withdrawn, arched, apex from above truncate, from side rounded. From basal

angles arise large curved branches, whose apices converge, and project a little beyond apex of sternite. Parameres short, fused basally; on the dorsal surface near the base are a pair of outspread, slender wings. Beyond, the parameres are curved upward, plate-like, lower margins produced downward and outward, probably covered with membrane and each with an eversible finger, as occurs in *citrinus*.



TEXT-FIG. 20.—*Kempynus incisus* (McL.), ♂ type. *a*, apex of abdomen, lateral; *b*, tenth sternite, lateral; *c*, the same, dorsal; *d*, parameres, lateral; *e*, parameres, dorsal.

♀. Seventh sternite slightly produced, and bearing on its apical margin a pair of small, slender processes, separated by about twice their length. Eighth tergite large and deep, sternite short, from beneath broad and sinuous, concave at its centre, raised sides with a few radiating setae. Hinged lobe set at some distance from sternite, connected to it by membrane, in side view arising between the sides of ninth tergite. From beneath, it is bifurcate, the two branches separated by a wide rounded excision, apices dilated, obliquely truncate and turned abruptly downward. Ninth tergite narrow, not much dilated at its lower angles; valves

rather broad, of medium length, a short, stout style just before the apex. Anal plates short, deep, fused dorsally to form a hood, bearing two transverse bands of stout setae, one at apex and other towards base. Accessory glands with long ducts, each terminating in an elongate sac, constricted midway, the apical part being the larger.

From three examples marked "Type" by McLachlan, I have selected as



TEXT-FIG. 21. —*K. incisus* (McL.), ♀. *a*, apex of abdomen, lateral; *b*, eighth sternite, ventral; *c*, accessory glands.

holotype a male in the British Museum, labelled "Auckland, N. Zeal." and "excisus M'L. type" in W. F. Kirby's handwriting. There is another paratype (without abdomen) from the same locality, labelled "Kempynus excisus McLach." by Navás, and two male paratypes "Otago, Oxley," from McLachlan's collection.

In the British Museum are additional specimens from the following localities: Wellington; Wainuiomata; Wilton's Bush; Waitara; Kaitoke, all collected and presented by Mr. G. V. Hudson.

Kempynus citrinus (McLachlan).

(Pl. VI, figs. 2, 3; text-figs. 22, 23.)

Stenosmylus citrinus McLachlan, 1873, *Ann. Mag. nat. Hist.*, (4), **12** : 38; *id.*, 1894, *Ent. mon. Mag.*, **30** : 242; Hudson, 1904, *N. Z. Neur.* : 51.
Kalosmylus citrinus (McL.), Krüger, 1913, *Stettin. ent. Ztg.*, **74** : 26, 96-102, 213; *id.*, 1914, *op. cit.*, **75** : 106-108.
Kempynus citrinus (McL.), Banks, 1913, *Trans. Amer. ent. Soc.*, **39** : 215; Tillyard, 1926, *Ins. Austr. N.Z.* : 320.

This appears to be a more variable species than *K. incisus*, the extreme form that I have seen being very prettily mottled on both wings, the membrane being greyish rather than yellowish. Another variety has a brownish streak between the branches of the cubitus in the anterior wing.

♂. Genitalia scarcely distinguishable from *incisus*. Apical margin of tenth sternite less truncate, basal branch larger. Parameres with an eversible finger at lower apical angle, arising from membrane covering paramere. This membrane is very delicate and liable to damage during clearing in caustic potash, and probably occurs in other species also.

♀. Similar to *incisus*. Apex of seventh sternite slightly produced, rounded, margin with a pair of very small teeth, sometimes absent. Eighth sternite roughly triangular from beneath, concave at its centre, with a deep apical incision, which is narrower than in *incisus*. Apices of hinged lobe less dilated, incurved and not turned down. Ninth tergite narrow, slightly dilated at lower angles, valves a little broader than in *incisus*. Anal plates nearly as long as deep, hood-like, setae arranged in two groups. Accessory gland more constricted, terminal sac set at right angles to stem.

The type is a female, labelled "New Zealand." Other specimens in the British Museum from the following localities: Wellington; Waitara; Wainuiomata; Wilton's Bush (collected by *G. V. Hudson*) and from Ohakune (*T. R. Harris*).

Kempynus latiusculus (McLachlan).

(Pl. VII, fig. 1; text-fig. 24.)

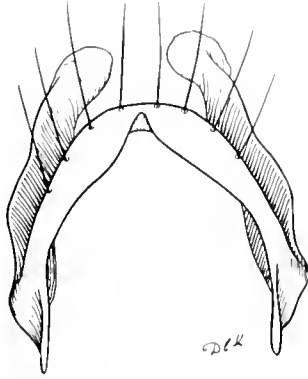
Stenosmylus latiusculus McLachlan, 1894, *Ent. mon. Mag.*, **30** : 241; Hudson, 1904, *N. Z. Neur.* : 54; Tillyard, 1926, *Ins. Austr. N.Z.* : 320, pl. 24, fig. 1.
Kalosmylus latiusculus (McL.) Krüger, 1913, *Stettin. ent. Ztg.*, **74** : 26, 99-102, 213; *id.*, 1914, *op. cit.*, **75** : 108-109.

This species appears to vary little, most examples before me being less mottled (tessellated) than the type.

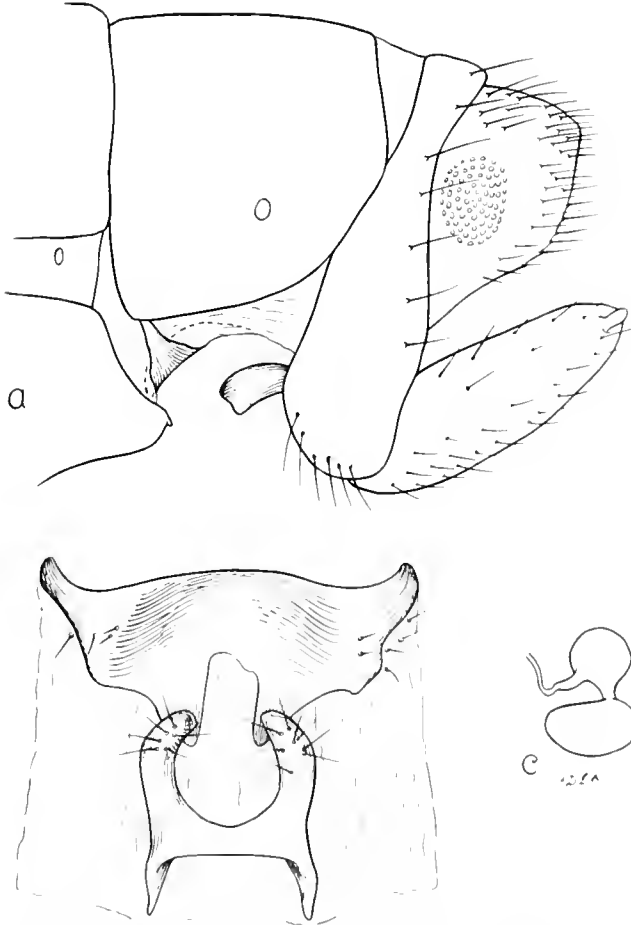
♂. Apex of anal plates slightly truncate from side. Tenth sternite more robust, apical margin more hairy, from above broader and more rounded than in *incisus* and *citrinus*.

♀. Differing only in a few details from *incisus* and *citrinus*. Seventh sternite with a pair of small triangular processes on its apical margin. Eighth sternite very lightly chitinized, hinged lobe from side with apex dilated, lower angle right-angled, upper rounded. The apex is not abruptly bent down as in *incisus*. From beneath the arms of the lobe are less widely separated, excision between them oval, not circular. Terminal sac of accessory gland pyriform.

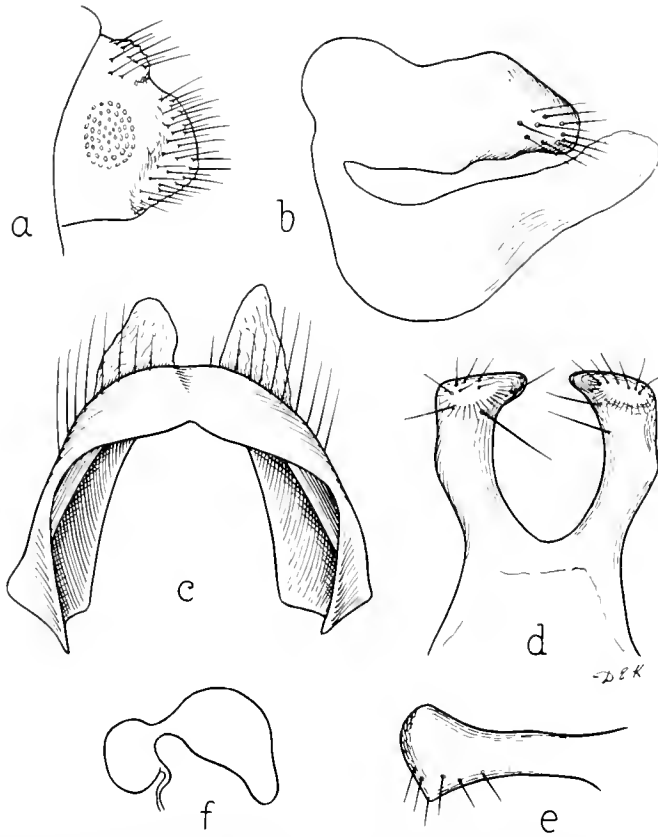
Type is a female, labelled "Otira Gorge, on window at light." Subsequent specimens from the following localities: Wellington, Hutt Forks (*Stella Hudson*) and Wellington, Mangaterua R. (*G. V. Hudson*).



TEXT-FIG. 22.—*K. citrinus* (McL.), ♂. Tenth sternite, dorsal.



TEXT-FIG. 23 — *K. citrinus* (McL.), ♀. *a.* apex of abdomen, lateral; *b.* eighth sternite, ventral; *c.* apex of accessory gland.



TEXT-FIG. 24.—*K. latiusculus* (McL.), *a-c*, ♂; *d-f*, ♀. *a*, anal plate, lateral; *b*, tenth sternite, lateral; *c*, the same, dorsal; *d*, lobe of eighth sternite, ventral; *e*, apex of same, lateral; *f*, apex of accessory gland.

***Kempynus longipennis* (Walker).**

(Pl. VII, fig. 2.)

Osmylus longipennis Walker, 1853, *List. Neur. Ins. Brit. Mus.*, **2** : 235; Hagen, 1866, *Stettin. ent. Ztg.*, **27** : 455.

? *Stenosmylus longipennis* (Walk.), McLachlan, 1868, *J. Linn. Soc. Lond. (Zool.)*, **9** : 268; *id.*, 1870, *Ent. mon. Mag.* **8** : 195.

Kalosmylus longipennis (Walk.), Krüger, 1913, *Stettin. ent. Ztg.*, **74** : 26, 96-102, 213-214; *id.*, 1914, *op. cit.*, **75** : 109-110.

Osmylinus longipennis (Walk.), Banks, 1913, *Trans. Amer. ent. Soc.*, **39** : 214.

This species is still represented in the British Museum only by the type. This now lacks part of the abdomen, all but two segments of an antenna, one anterior leg and four tarsal segments of the other; the margins, particularly of the anterior wing, are damaged. I quote Walker's description, enclosing any additional notes of my own within square brackets:

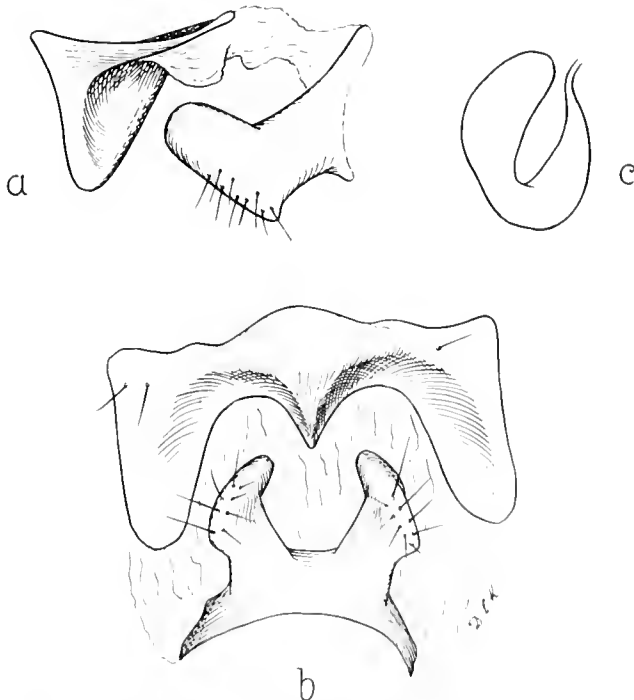
"OSMYLUS LONGIPENNIS.

"*Piceus*; *prothorax linearis*; *pedes testacei, fasciis tarsisque piceis*; *alae cinerascens, longissimae, anticae fusco guttatae*.

" [Head testaceous, marked with brownish on face below antennae, dark brown above antennal bases and two impressed dark brown areas on vertex.] Subcostal veinlets much more numerous than in *O. chrysops*, and more contiguous towards the base; veinlets of the sector of the second radius [branches of the radial sector] also much more numerous; gradate veinlets forming many more series; veins more oblique towards the tips; marginal veinlets much more numerous; arcolets in the disk much more numerous, more alike and regular in form, generally almost square. Pitchy: prothorax linear [2.4:1.9], longer than that of *O. chrysops*, and not narrower in front as is the latter [anterior angles rounded]: legs testaceous, with pitchy bands [three on each tibia, apical, median, basal, one large median and small apical on each femur]: tarsi pitchy: wings grayish, very long; fore wings very thickly covered with [diffuse] brown dots, many of which are confluent [general appearance is of a brownish wing, with darker markings along radius and cubitus, margins with small white dots]; veins brown [with pale interruptions along radius and cubitus, marginal gradate series pale]. Length of body 5 lines; [expanse] of the wings 30 lines.

"*a.* New Holland."

The type (sex doubtful) now carries a printed label "Australia" and a manuscript label "*O. longipennis* Australia" not in Walker's handwriting. It resembles a large and very darkly marked example of *K. latiusculus* (McL.). One pair of wings has been removed from the type and placed between glass slides for figuring and as a measure of protection against further deterioration.



TEXT-FIG. 25.—*K. falcatus* Navás, ♀ type. *a*, eighth sternite, lateral; *b*, the same, ventral; *c*, apex of accessory gland.

Kempynus falcatus Navás.

(Pl. VII, fig. 3; text-fig. 25.)

Kempynus falcatus Navás, 1912, *Mem. R. Acad. Barcelona*, **10**, (4) : 60; *id.*, 1930, *Rev. Chil. Hist. nat.*, **40** : 180.? *Kalosmylus falcatus* (Nav.) Krüger, 1913, *Stettin. ent. Ztg.*, **74** : 214, 221; *id.*, 1914, *op. cit.*, **75** : 110-111.*Stenosmylus* sp. McLachlan, 1894, *Ent. mon. Mag.*, **30** : 241.

Navás' description of general appearance and figure of wing pattern are reasonably good. His type is a female and is from Mulchen, not Meelchen as given by Navás. The specimen mentioned by McLachlan is paler, but is undoubtedly conspecific.

♀ Genitalia : seventh sternite scarcely produced, eighth short, broad, apical margin with two deep rounded excisions, separated by a triangular, elevated promontory; from the side this appears as a deep triangular keel. Lobe short, bifurcate, apices incurved from beneath, angled upward from side. Ninth tergite narrow, slightly dilated at lower angles; valves broad, apices bluntly rounded. Anal plates short, deep, angles rounded. Terminal sac of accessory gland slightly constricted and folded back upon itself, duct not very long.

Type ♀, CHILE : Mulchen, i. 1902, *H. J. Elwes*.

1 ♀, "Araucania", ii. 1888, from McLachlan collection.

EUOSMYLUS Krüger.

(Pl. VIII.)

Euosmylus Krüger, *Stettin. ent. Ztg.*, **74** : 23, 102-105.Genotype : *Stenosmylus stellae* McLachlan.

Wings falcate, venation much as in *Kempynus*, but branches of medius in posterior wing less separated, cells between them broader, quadrate, not sinuous; M_3 separates from M_4 about the apex of Cu_1 ; often a basal cross-vein from fork of medius to cubitus. Small species, expanse 25-32 mm. Genitalia very similar to *Kempynus*.

DISTRIBUTION : New Zealand.

Euosmylus stellae (McLachlan).

(Pl. VIII, text-fig. 26.)

Stenosmylus stellae McLachlan, 1899, *Ent. mon. Mag.*, **35** : 259-260; Hudson, 1904, *N. Z. New.* : 52-54.*Euosmylus stellae* (McL.) Krüger, 1913, *Stettin. ent. Ztg.*, **74** : 26, 102-105, 214; *id.*, 1914, *op. cit.*, **75** : 111-113.*Kempynus stellae* (McL.) Banks, 1913, *Trans. Amer. ent. Soc.*, **39** : 215.var. *connexus* McL., 1899, *Ent. mon. Mag.*, **35** : 259.var. *obliteratus* McL., 1899, *ibid.*, **35** : 260.

This species varies considerably in size, markings and breadth of wings.

♂ genitalia are scarcely distinguishable from *incisus*. The ninth tergite is a little broader at its lower angles, and the apex of the anal plate a little more prominent.

♀. Seventh sternite slightly produced, margin with a pair of small, obtuse, triangular projections. Eighth sternite short, convex, about half as long as tergite, apex excised; lobe short, from beneath with short, stout arms, separated by a U-shaped excision. Apices obliquely truncate, somewhat excavate, inner

angles the longer. From side, the lobe is slightly downcurved, arms gradually dilating to apices, a small triangular process on upper surface at base. Ninth tergite slightly more dilated at lower angles than *incisus*, valves short and broad. Anal plates not as long as deep, angles rounded. Accessory gland hour-glass-shaped, terminal sac the larger; duct much shorter than in *Kempynus*.



TEXT-FIG. 20.—*Euosmylus stellae* (McL.), ♀ paratype. *a*, apex of abdomen, lateral; *b*, lobe of eighth sternite, ventral; *c*, accessory gland.

Type female, 2 ♂ 1 ♀ paratypes from Wainuiomata, near Wellington, also other specimens from the same locality.

Var. *connexus* McL.

Type ♂, 1 ♂ paratype from Wainuiomata; other specimens from the same locality and from Nelson.

Var. *obliteratus* McL.

Type ♂, 3 ♂♂ paratypes from Wainuiomata; other specimens from the same locality.

AUSTRALYSMUS gen. nov.

(Pl. V, fig. 2.)

Wings not falcate. Anterior with one cross-vein in subcostal area; medius forking near base but beyond origin of first radial sector. In posterior wing, basal radio-medial cross-vein present; branches of medius not very widely separated, cells quadrate, not sinuous; M_3 separates from M_1 two or three cells

before apex of Cu_1 ; no basal cross-vein from fork of medius to cubitus. Cu_2 long. Species large, 40–44 mm. expanse.

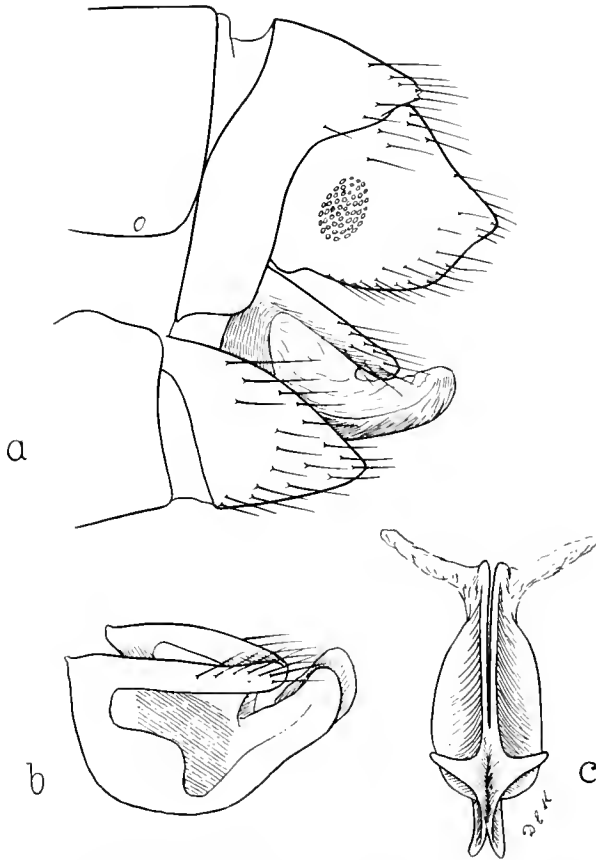
Genotype: *Australysmus lacustris* sp. n.

DISTRIBUTION: Australia (New South Wales).

***Australysmus lacustris* sp. n.**

(Pl. V, fig. 2; text-figs. 27, 28.)

Head luteous, obscured with brown, particularly on the vertex (which carries two piceous spots), below the antennae and on the margins of labrum and clypeus.

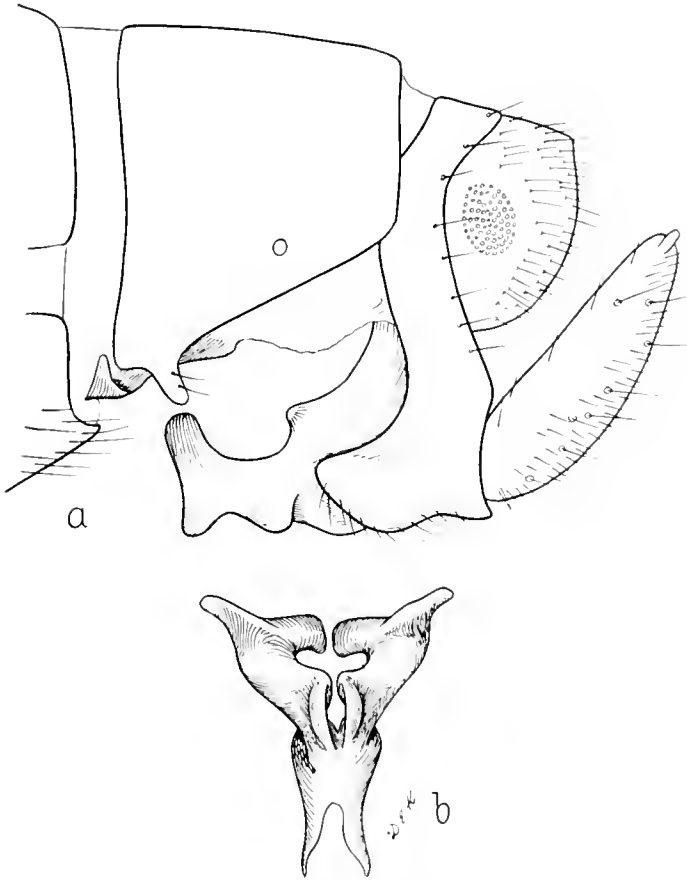


TEXT-FIG. 27.—*Australysmus lacustris* sp. n., ♂ type. *a*, apex of abdomen, lateral; *b*, tenth sternite, lateral; *c*, parameres, dorsal.

Antennae brown, joints faintly annulated with yellowish; palpi brownish. Pronotum about three-quarters as long as broad, anterior angles rounded; luteous, with five brown spots, one median, elongate, and a pair on each side, like exclamation marks; basal margin brown. Meso- and metanota brownish, with obscure yellowish markings. Legs luteous, tibia with piceous spots exteriorly at base, mid-way and apex, posterior femora brownish above, terminal segment of tarsus piceous. Anterior coxae of female not modified. Abdomen brownish.

Wings elongate, apices rounded, not falcate, membrane hyaline, pale yellowish in subcostal area. Anterior wing much speckled with brownish, venation mainly brown. Posterior wing not speckled, venation mainly brown, except for some pale areas in apical half of wing.

♂. Eversible scent-glands between eighth and ninth tergites, apparently shorter than in *Kempynus*. Ninth tergite produced, on either side of the centre



TEXT-FIG. 28.—*A. lacustris* sp. n., ♀ paratype. *a*, apex of abdomen, lateral, *b*, lobe of eighth sternite, ventral.

still further produced in two small, hairy, rounded lobes. Ninth sternite triangularly produced, apex with a broad, shallow notch. Anal plates large, hood-like, apex obtusely triangular from above, from side upper angle slightly produced and rounded. Tenth sternite slender, rib-like, hairy, from above arched, apex truncate, basal branch projecting beyond apex; parameres short, deep, lower margins produced outwards, apices with eversible membranous fingers.

♀. Seventh sternite produced at centre in rounded lobe. Eighth sternite short, quadrate, concave ventrally; apical margin with two deep excisions, separated by a slender acute tongue. Lobe large, bifurcate; from the side, deep, upper margin with a semicircular excision before apex, lower with a shallower

excision separating a rounded lobe from the apex. The latter is dilated and hammer-like, upper angle longer than lower. From beneath, this upper angle is truncate, directed inward, lower more slender and directed outward. A slightly curved ridge on the inner lower margin at the base of each fork of the lobe. Eighth tergite with a downwardly directed finger on the lower margin at base. Ninth tergite from the side slender, sinuous, lower basal angle strongly produced basally in a rounded lobe, projecting on either side of lobe of eighth sternite. Valves of medium length, with small apical styles, lower margin more curved than upper. Anal plates short, upper apical angle obtuse, lower rounded. Accessory glands each with a single short ovate sac at apex.

Length of anterior wing : ♂ 20–22 mm., ♀ 23 mm.

„ posterior wing : ♂ 18–20 mm., ♀ 21 mm.

NEW SOUTH WALES: Mt. Kosciusko, Blue Lake and Club Lake, i.ii.30, R. J. Tillyard.

Type ♂, paratype ♀ from Blue Lake, paratype ♂ from Club Lake, in British Museum.

This species bears a superficial resemblance to *Eidoporisimus pulchellus* E.-P. The latter may be readily distinguished by the distant origin of the first branch of the radial sector and the position of the fork of the medius in the anterior wing, far beyond the middle.

(MSS. recd. Jan. 3, 1940.)

PLATE I.

Anterior wings of *Stenosmylus* and *Stenolysmus*.

1. *Stenosmylus stenopterus* McL.
2. *S. tenuis* (Walk.).
3. *S. turneri* sp. n., ♀ Type.
4. *Stenolysmus extraneus* (Walk.).

PLATE II.

Anterior wings of *Oedosmylus* spp. ♀.

1. *O. pallidus* (McL.), Type.
2. *O. tasmaniensis* Krüger.
3. *O. latipennis* sp. n., paratype.
4. *O. montanus* sp. n., paratype.

PLATE III.

Wings of *Isostenosmylus* spp. ♂.

1. *I. fusciceps* sp. n., Type.
2. *I. pulcherrimus* (Gerst.).

PLATE IV.

Wings of *Isostenosmylus* spp. ♂.

1. *I. fasciatus* sp. n., Type.
2. *I. nigrifrons* sp. n., Type.

PLATE V.

Wings of *Euporismus* and *Australysmus*.

1. *Euporismus albatrox* Tillyard, ♂ Type.
2. *Australysmus lacustris* sp. n., ♀ Paratype.

PLATE VI.

Wings of *Kempynus* spp.

1. *K. incisus* (McL.) ♀.
2. *K. citrinus* (McL.) ♂.
3. *K. citrinus* (McL.) ♂ var.

PLATE VII.

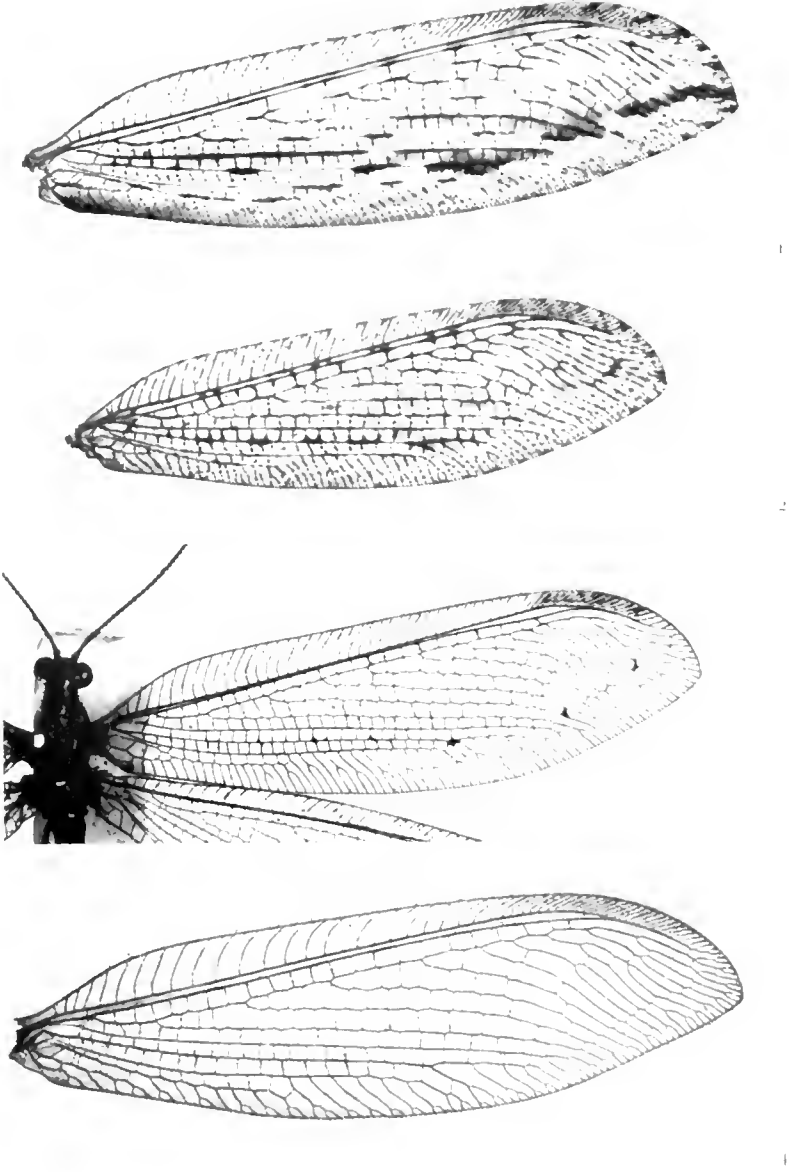
Wings of *Kempynus* spp.

1. *K. latiusculus* (McL.) ♀.
2. *K. longipennis* (Walk.) Type.
3. *K. falcatus* Navás ♀.

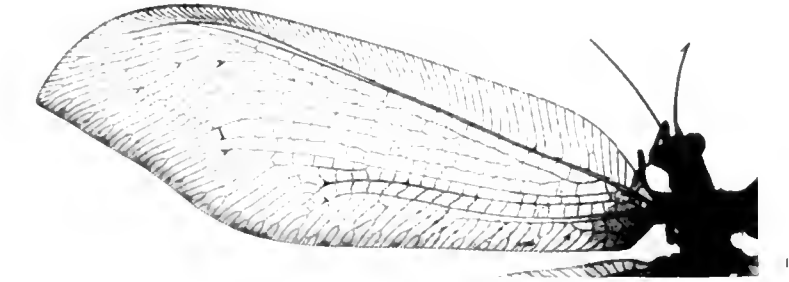
PLATE VIII.

Wings of *Euosmylus stellae* (McL.) and varieties.

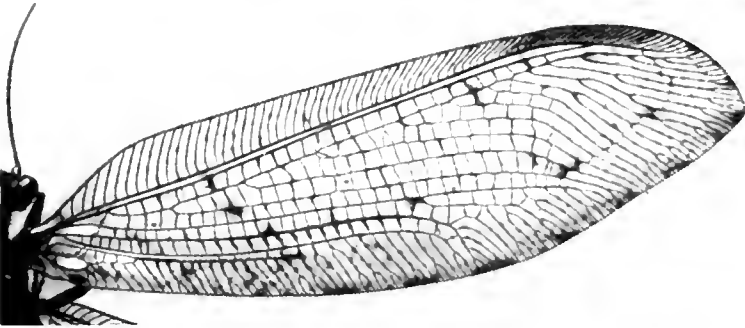
1. *E. stellae* (McL.).
2. *E. stellae*, var. *connexus* (McL.).
3. *E. stellae*, var. *obliteratus* (McL.).



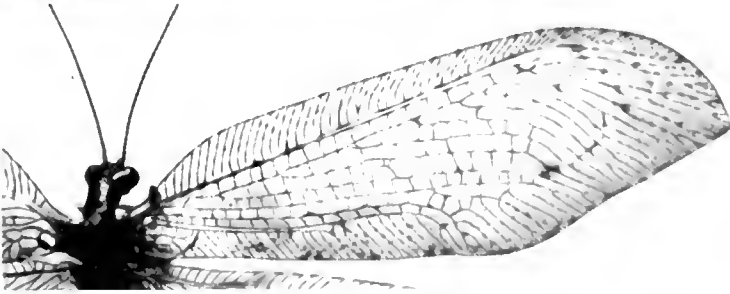
Anterior wings of *Stenosmylus* and *Stenotysmus*



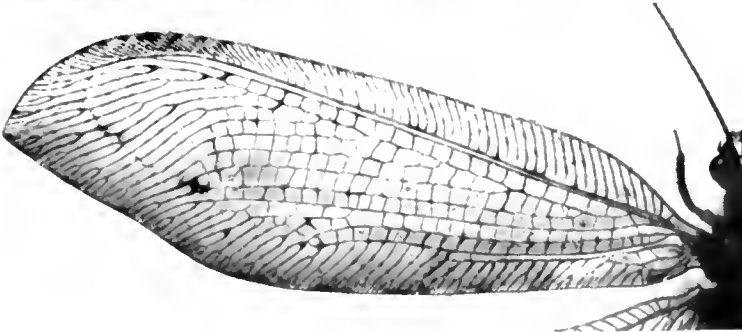
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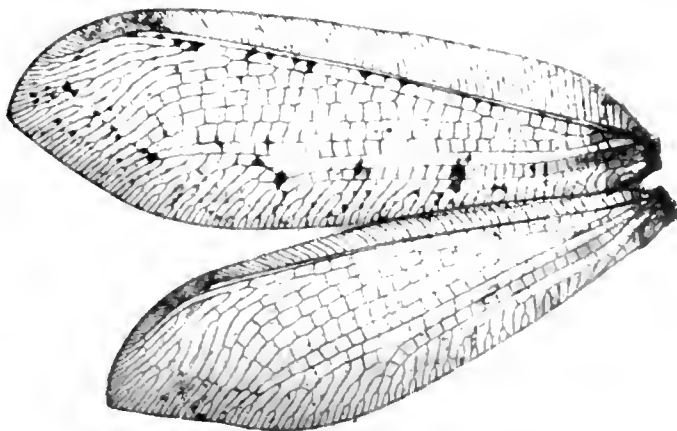
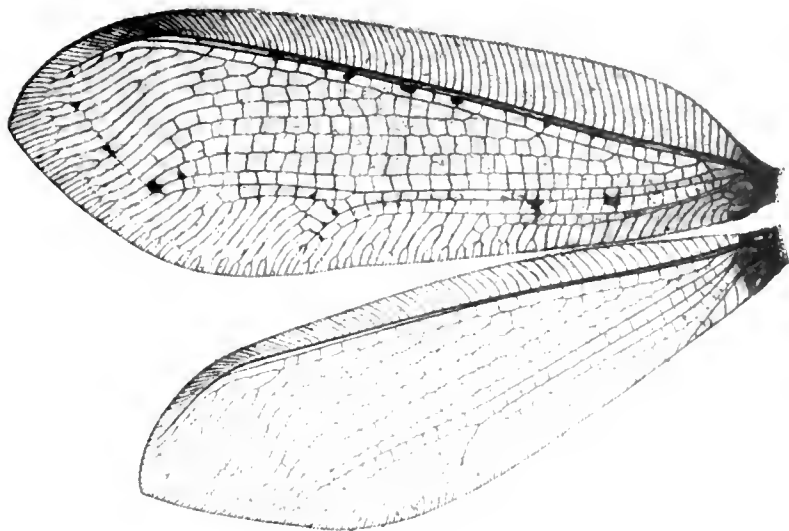


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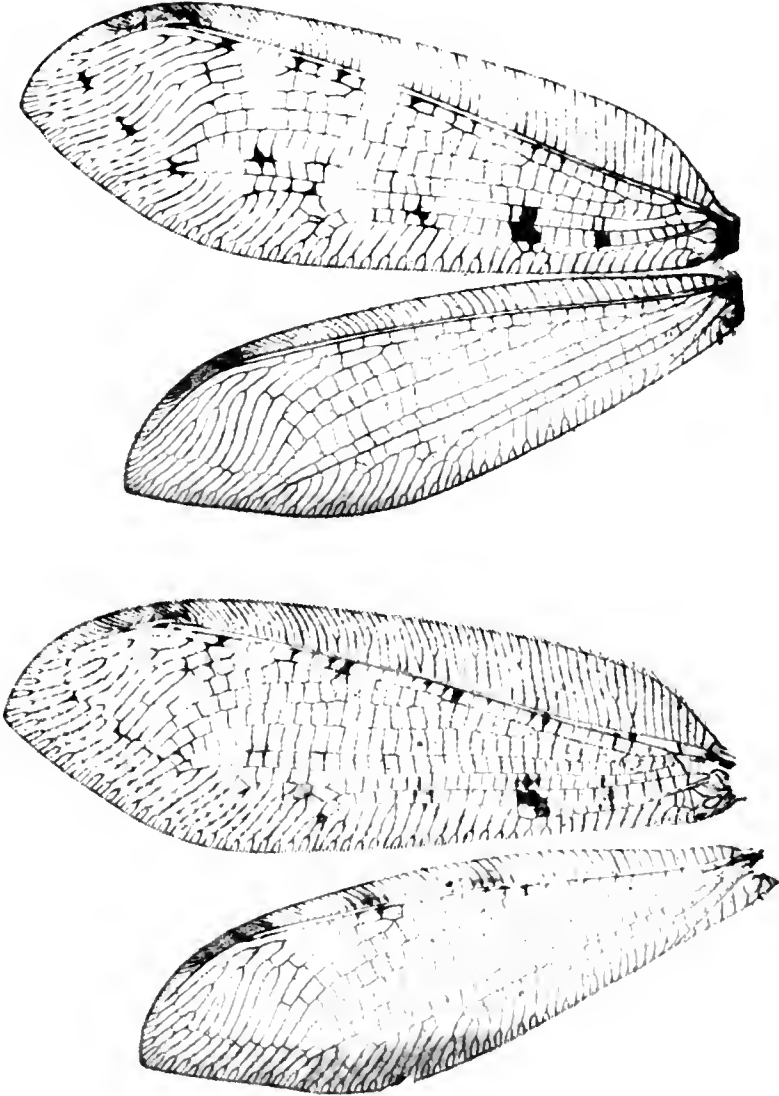


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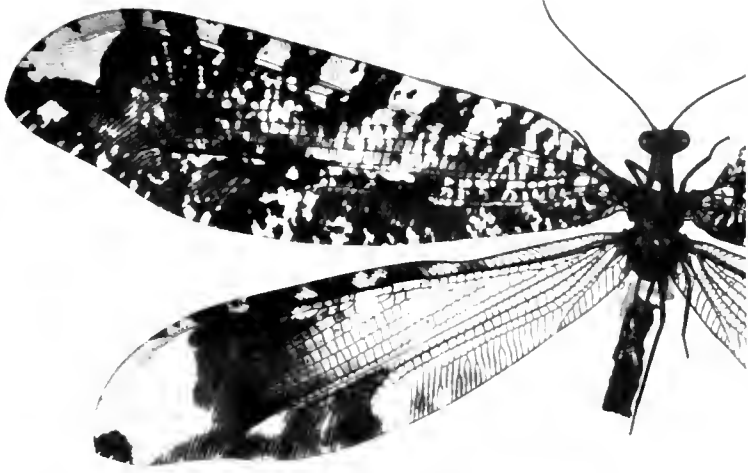
Anterior wings of female *Oedosmylus*.



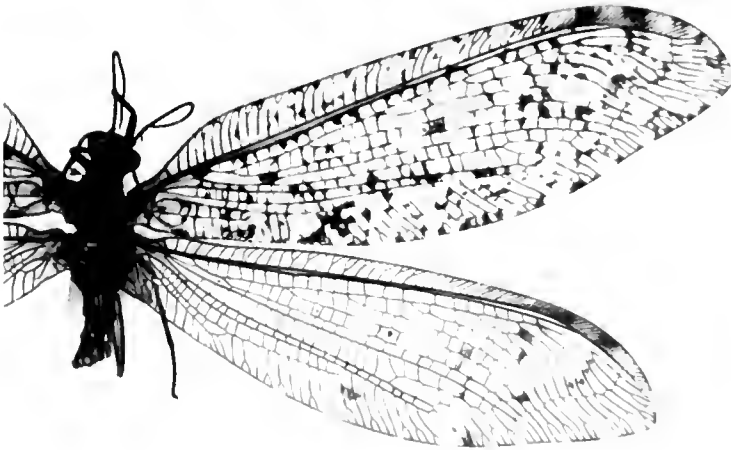
Wings of male *Isostenosmylus*.



Wings of male *Isostenosmylus*.

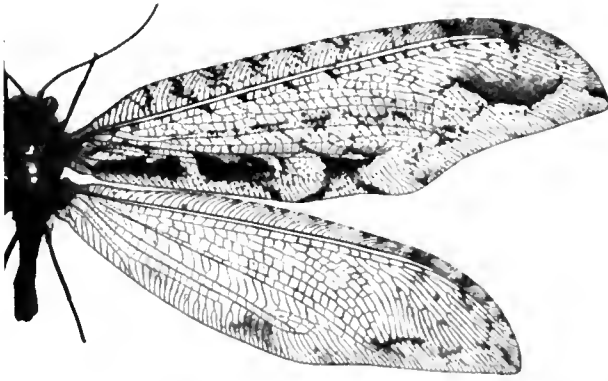


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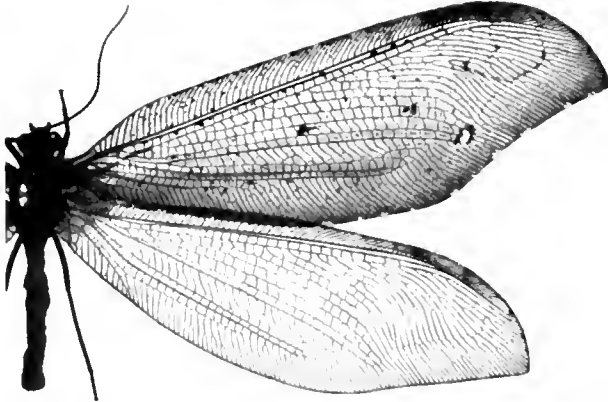


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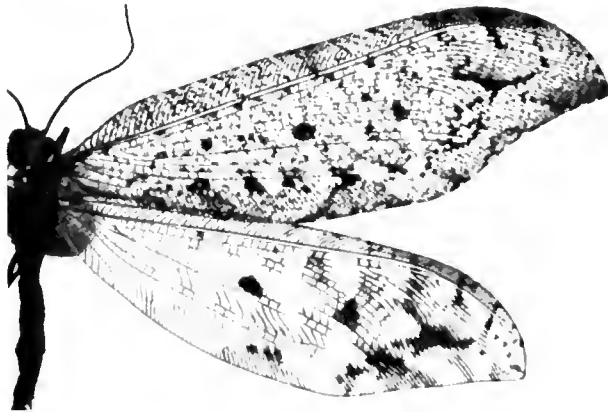
Wings of *Euporismus* and *Australysmus*.



1

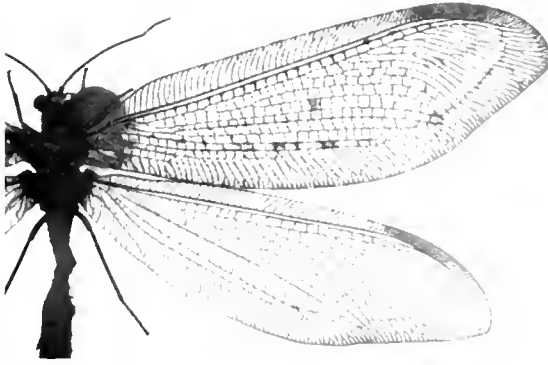


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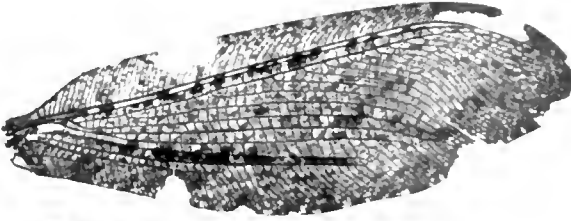


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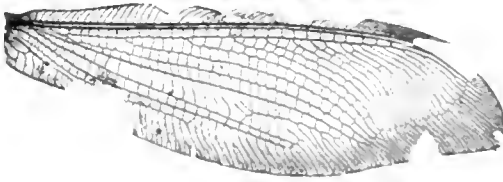
Wings of *Kempynus*.



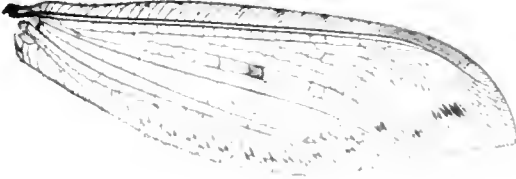
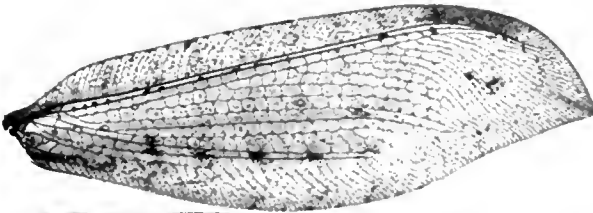
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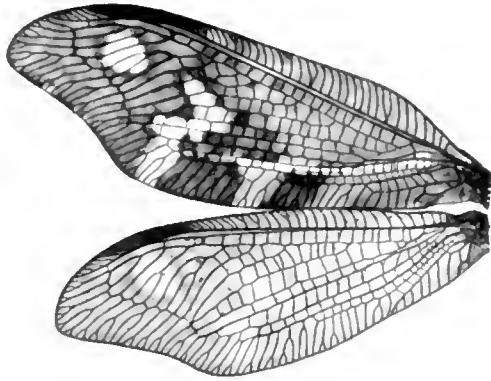
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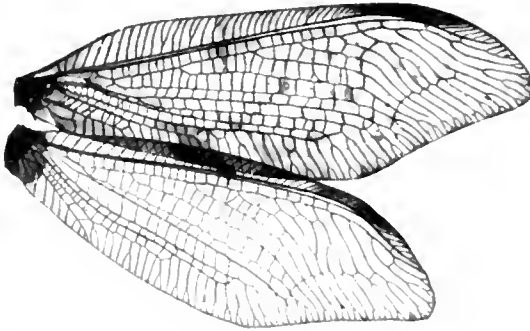
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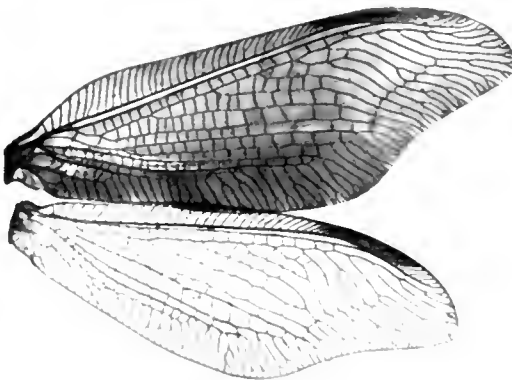
Wings of *Kempynus*.



1



2



3

Wings of *Euosmylus stellae* (McL.) and varieties

ON AUSTRALIAN PAMBORINI, OZAENINI AND SCARITINI
(COLEOPTERA, CARABIDAE)

By M. BÄNNINGER.

T. G. SLOANE was greatly hindered in his numerous studies on Australian Carabidae by being unable to consult many of Castelnau's and Blackburn's types. The former are mainly in the Genoa Civic Museum and the latter in the British Museum. Through the courtesy of Mr. Gilbert J. Arrow and Prof. O. de Beaux I have been able to examine these, for which I express my sincere thanks. The study of the types has enabled me to give new keys to the genera *Scaraphites*, *Euryscaphus* and *Philoscaphus*, and to add remarks on some hitherto doubtful names or supposed synonymy. Descriptions are also given of two new forms of *Pamborus* and *Mystropomus*, which were among the Carabinae sent me by Mr. P. J. Darlington, jun., for naming. They had been collected by himself during his visit to Australia a few years ago.

Abbreviations: B = Coll. Bänninger; BM = British Museum (Natural History); G = Genoa Civic Museum; ZM = Zoological Museum, Berlin.

(!) signifies that the identity has been established by examination of the type. For references to Sloane's papers the year of publication is given.

Tribe PAMBORINI.

I give below a key to those species of *Pamborus* which are known to me. Geographical distribution is given only as far as it is definitely known; uncertain localities are omitted.

1. Elytra, in anterior half at least, with 6-8 broad and strong intervals (including the sutural one) on each, of which the 7th and 8th are some times less marked and more or less disintegrated into small tubercles. Last ventral segment of ♂ truncate 2.
- Elytra each with about 13-15 narrow carinate intervals at least in anterior half, more or less disintegrated into tubercles at sides and behind. Prothorax with lateral basal impression uniting in a concavity with marginal channel. Neck constriction behind the eyes deep in middle of head. At least the last ventral segment more or less roughly rugose or punctate 6.
2. Prothorax with lateral basal impression uniting with marginal channel in a broad concavity, the convex space between them widely separated from posterior margin or reaching it but incompletely and flattened (sometimes in *opacus*) 3.
- Prothorax with lateral basal impression uniting with the marginal channel at the very narrow basal margination; the space separating them very convex close to posterior margin. Last ventral segment in anterior half not roughly rugose or punctate 5.
3. Aedeagus dentate on inner side not far from apex. Neck constriction behind eyes more or less deep in middle of head. Elytra with 7th

interval catenulate by a varying number of interruptions, the 8th generally a little shorter but strong and entire. Surface more or less greenish generally, especially on prothorax, partly bluish, sometimes the elytra of a bronze-copper colour; such specimens of (? individually) smaller size and posteriorly more narrowed prothorax are probably *morbillosus* Boisduval). Length, 24-34 mm. Victoria to Brisbane

alternans Latreille.¹

- Aedeagus not dentate at inner side near apex. Neck constriction of head less deep or obliterated at middle 4.
4. Elytra with 7th and 8th intervals very strong, the 7th not catenulate, the 8th not or scarcely crenulate. Surface more or less greenish. Length, 25-33 mm. Southern Queensland to Canoblas Mts. and Coonabarabran, N.S.W. (Sloane, 1905) *viridis* Gory.
Elytra with external intervals much narrower and less elevated than the inner ones, the 7th catenulate by several interruptions, the 8th more or less crenulate or disintegrated into short tubercles (but in a single ♀ from Millaa Millaa near Cairns, Mus. Comp. Zool., as in *viridis*). Elytra generally more opaque and less convex. Neck constriction more or less obliterated in middle. Length, 27-32 (-35) mm. Cairns district, N. Queensland *opacus* Géhin² (Sloane 1905).
5. Elytra with 3rd interval catenulate at least in posterior half, the 5th and 7th more or less catenulate also in anterior half; no line (or only a vestigial one) of elevated small tubercles in the striae. Length, 21-25 mm. Clarence River, Macpherson Range *macleayi* Castelnau (! G).
Elytra with 3rd, 5th and 7th intervals entire, sometimes partly interrupted in posterior half; the striae with a line of elevated small tubercles. Length, 21-24 mm. Brisbane *brisbanensis* Castelnau (! G).
6. Elytra with reflexed border bearing a few widely placed raised serrations. Hind angles of the rather broad prothorax short and broadly advanced. Last segment of ♂ truncate. Length, 15-19 mm. Sydney to Brisbane *guerini* Gory.³
Elytra with edge of reflexed border smooth 7.
7. Last ventral segment of ♂ truncate. Prothorax broader, with short and broadly advanced hind angles. Elytra more convex, the 4th and 8th intervals not catenulate. Length, 24-25 mm. Herberton district, N. Queensland; 1 ♂ Mac Ivor River (B) *elegans* Sloane.
Last ventral segment of ♂ rounded as in the ♀. Hind angles of the longer prothorax narrower and strongly lobate. Elytra less convex 8.
8. Elytra with 4th, 8th and 12th intervals more or less catenulate, the 14th disintegrated into small longitudinal tubercles. Larger, broader. Length, 23-26 mm.; breadth, 8.5-10 mm. Dorrigo Plateau, west of Coff's Harbour *pradierei* Chaudoir.

¹ The examples from the Macpherson Range and Upper Richmond River have the side margin of the prothorax broader, more grooved and not so sharply upturned as in those from the other localities, which I consider as typical.

² My interpretation is evidently identical with Sloane's, who also named specimens from the same region *opacus* Géhin from the description. But Géhin's specimen was said to come from the Murray River in N.S.W., which is probably wrong. I do not know any *alternans* to which the description applies, whilst it agrees very well with the species in question.

³ The colour varies very much: deep black, or elytra with golden margin, or the whole elytra with a coppery or brassy lustre. The var. *chaudoiri* Castelnau mentioned in Csiki's *Catalogue* has not been described, and the name does not occur in Castelnau's collection in Genoa.

Elytra with intervals much more entire and more regular, the 4th not at all or only once interrupted in anterior half, the 14th entire in anterior half. Smaller and rather narrower. Length, 20-23 mm.; breadth, 7.5-8.5 mm. Barrington Tops, N.S.W. (S. of Dorrigo Plateau)
 subsp. n. *darlingtoni* Bänninger.

***Pamborus pradierei darlingtoni* subsp. n.**

Chaudoir gives the length of his *pradierei* as 23 mm., and says expressly that the 4th, 8th and 12th intervals are catenulate and the 14th disintegrated into small longitudinal tubercles. The exact locality was unknown. These characters agree exactly with those of six specimens before me from Dorrigo Plateau, West of Coff's Harbour, N.S.W. (Mus. Comp. Zool., Cambridge, Mass., and my coll.). Sloane knew the species from the nearby Bellinger River and I have a specimen named by him from Comboyne, N.S.W. The catenulation of the 4th interval varies somewhat; in one example it is missing in the anterior half. All intervals are disintegrated at least from the anterior margin of the 4th segment. Upper side with a coppery or greenish lustre, more pronounced at margin of elytra. Length, 23-26 mm.; breadth of elytra, 8.5-10 mm.

Further south, on the Barrington Tops Plateau, 5000 ft., Mr. P. J. Darlington found in great number (about 60 specimens, of which 55 are before me) a very interesting subspecies which is named after its discoverer *darlingtoni* subsp. n. It is smaller and rather narrower. The intervals are much more entire, more regular and reach nearer the apex before being disintegrated into tubercles. The 4th is not catenulate, but in five examples there is a pit on one side or on both sides in the anterior half. The 14th is more or less entire at least in the anterior half. Lustre of elytra more greenish except near margin.

Length, 20-23 mm.; breadth, 7.5-8.5 mm. Type and cotypes in the Museum of Comparative Zoology, Cambridge, Mass., and, through the courtesy of Mr. P. J. Darlington, in my own collection. Cotypes will also be sent to the Queensland Museum.

Tribe OZAENINI.

***Mystropomus regularis* sp. n.**

In the two species hitherto described, viz. *subcostatus* and *chaudoiri*, each elytron bears, including the sutural one, four shining ribs on the very dull ground. In *chaudoiri* traces of an additional interval are present between each two ribs; it is indicated by close shining granules, which are often dispersed also over the other parts of the elytra. In the new species, *regularis*, the alternate intervals are not obliterated nor different. Each elytron shows seven scarcely elevated stripes, produced by a stronger lustre and the denser shining granules. It is impossible to call them ribs. The 7th interval is scarcely distinguishable as a rule, whereas there are sometimes traces of the 8th interval, especially behind. The length of 13-16 mm. agrees with that of big specimens of *subcostatus*.

♂, ♀, Millaa Millaa, Atherton Table, 2500 ft., and ♂, ♀, Lake Barrine, Atherton Table, 2800 ft., N. Queensland, collected by Mr. P. J. Darlington, jun., of the Museum of Comparative Zoology, Cambridge, Mass. Type in that Museum; the cotype will be sent to the Queensland Museum; for the gift of the specimen from Lake Barrine I am very much indebted to Mr. Darlington.

The pronotum is wider in front in *regularis* and more narrowed behind than in average specimens of *subcostatus*, but judging by the greater material of the

latter at hand the shape of the pronotum is liable to considerable variation. The distinctness of *subcostatus* and *chaudoiri* is somewhat uncertain. I have seen the type of the latter (G). Identical specimens (B) are before me from Parramatta, Richmond River and Killarney Plateau in the extreme south of Queensland (both Mus. Comp. Zool. Cambridge, Mass.). In addition to the described formation of the intervals the small size of 9-11.5 mm. and the long basal part of the pronotum, the sides of which diverge rather strongly behind, are characteristic. Amongst 16 specimens of *subcostatus* at hand from Salisbury, N.S.W. (near Barrington), as well as in 3 specimens from Gosford, near Sydney, definite approximations in all these respects occur, whereas there are hardly any in 12 specimens from the Dorrigo, west of Coff's Harbour.

Tribe SCARITINI.

Genus SCARAPHITES Westwood.

Scaraphites Westwood, 1842, *Arcana Ent.*, 1: 157.

Palpi filiform, last joint not triangular nor securiform. Triangular projection of clypeus at each side of labrum wanting or scarcely marked. Suborbital grooves to receive the antennae single, not divided. Paragenae not separated from submentum by a sharp oblique groove beginning at hind angle of mentum. Base of elytra without ocellate punctures. Elytra without a costa at sides, lateral border visible from above in its whole length. Upperside of front tibiae apically with three strong teeth, without additional denticulations above the upper tooth. The bifurcation of the two lower teeth, seen from behind, of variable position with regard to the insertion of the tarsi. Entirely black, without metallic lustre.

GENOTYPE: *Scarites silenus* Westwood 1842.

KEY TO SPECIES.

1. Elytra without widely separated strong punctures on lateral declivity, within the umbilicate series, and on apical declivity. Border at shoulder not dentate and not folded over. Prothorax very feebly sinuate on each side posteriorly, without setigerous puncture in the angle; base more or less imperfectly margined, especially at each side of peduncle. Genae strongly conically projecting below the eyes. Bifurcation of the two lower teeth of front tibiae (seen from behind) at level of insertion of tarsi; the excavate posterior surface in the vicinity of the two upper teeth coarsely rugose. Intermediate tibiae apically with a strong acute tooth. The episterna are narrower than the epipleurae at the same level in a transverse line starting from the inner anterior angle of the metepisterna 2.
- Elytra with some widely separated strong punctures on lateral¹ and apical declivities, in *lucidus* and *humeralis* on apical half only. At the level mentioned above the episterna are of about the same width as the epipleurae (*silenus* more or less excepted) 3.
2. Smaller, narrower. Umbilicate series behind the shoulder only a little farther from outer margin than in the apical third. Length, 34-40 mm. North Australia; Ord River in N.W. Australia (Sloane 1898)
laticollis Macleay 1866.²

¹ The series corresponds to the 7th stria.

² *S. gigas* is hardly more than a subspecies. Two specimens with the doubtful locality Swan River (B) of 34 and 37 mm. in length are evidently less typical *laticollis* than the ♂ I have from Darwin, N. Territory.

Larger, relatively shorter and broader. Elytra with the border more explanate, especially near the shoulder, where the umbilicate series is much more distant from it than in apical third. Prothorax more deeply emarginate in front, especially near angles, the sides more converging to base, more rounded towards the hind angles and the latter scarcely marked. Length, 37-51 mm. West Australia: Murchison District to King Sound . . . subsp. *gigas* Castelnau 1867 (! G).¹

3. Elytra with border wide at humeral angles, not folded over inwards, but with edge interrupted just behind shoulder to form a humeral prominence, projecting outwards. Prothorax shortly and strongly sinuate on each side posteriorly, angles sharply marked, subrectangular, with a setigerous puncture, basal margin more or less entire. Bifurcation of the two lower teeth of the front tibia not beyond the insertion of the tarsus; the excavate posterior surface in the vicinity of the two upper teeth very smooth. Intermediate tibiae with external apical tooth acute. Hind tibiae a little dilated at apex 4.

Elytra with border thickened and folded over inwards at humeral angles and forming a tooth (sometimes much less so in *hirtipes*). Genae somewhat projecting conically beneath eyes. Prothorax not, or very feebly, sinuate on each side posteriorly, basal angles rounded or very little marked. Bifurcation of the two lower teeth of the front tibia markedly beyond the insertion of the tarsus; the excavate posterior surface of the two upper teeth and vicinity, with rare individual exceptions (? worn), more or less rugose 5.

Elytra with border continuous at humeral angles, not or only a little thickened, not folded over and not dentate (see also *hirtipes*). The excavate posterior surface of the front tibia very smooth in the vicinity of the two upper teeth 6.

4. Border of the elytra very sparsely granulate near umbilicate series, the declivity opaque but not granulate behind. Border of prothorax very narrow and sharply reflexed, the sinuation near base generally strong and very short. Length: 22-31 mm. South West Australia (Chaudoir's locality, Melbourne, is certainly wrong)

lucidus Chaudoir 1863 (Sloane 1905).

The entire border of the elytra (as far as the row of strong punctures) and the apical declivity densely granulate and opaque. Border of prothorax broader, especially behind, and the sinuation at base generally a little longer. Front tibia with apical tooth on posterior side, at base of insertion of tarsus, longer than in *lucidus*. Length, 30-41 mm. "West Australia," Rottneest Is *humeralis* Castelnau 1867 (! G).

5. Intermediate tibia with upper apical tooth acute. The undulate striae of the head ± confined to the frontal furrows. Border of the prothorax not or feebly crenulate. Elytra ± regularly oval, not strongly narrowed to base. Length, 22-36 mm. New South Wales (Sydney), Eastern Victoria, King Is., Tasmania. Synonyms: *maclayi* Westw. 1842 (Cast. 1867, Sl. 1905); *intermedius* Macl. 1865 (! Sloane 1905); *insulanus* Sloane 1888 (! Sloane 1905) *rotundipennis* Dejean 1825.

Intermediate tibiae with upper apical tooth dilated and obtuse. The

¹ In one from Roebuck Bay (BM) the rugosity of the elytra is extremely rough and deep, and the striae very distinct.

- undulate striae of the head much more extended. Border of prothorax \pm crenulate. Elytra very strongly narrowed to base, greatest width much behind middle. Length, 23-34 mm. Western Victoria, South Australia. Synonyms: *crenaticollis* MacL. 1864 (! Sloane 1893); *assimilis* Sloane 1893 (! Sl. 1905) *hirtipes* Macleay 1864¹ (! Sloane 1893).
6. Front tibia with the bifurcation of the two lower teeth not or very little beyond the insertion of the tarsus. Intermediate tibia with upper apical tooth almost regularly narrowed, acute or somewhat rounded at the apex. Genae when seen from above not or only a little higher than the eyes, very sharply projecting below eyes seen from the front. Base of prothorax rounded or widely and feebly truncate, hind angles not dentate, sometimes a little marked, margin entire at base. Elytra of ♂ extremely short, little longer than broad, sides very strongly rounded, of the ♀ a little longer and the sides a little less rounded. Length, 28-43 mm. Southern West Australia. Synonyms: ♂ *bacchus* Westw. 1842; ♂ *heros* Castelnau 1867 (! G); ♀ *mastersi* Macleay 1869 (! Sloane 1905)² *silenus* Westwood 1842 (♀). Front tibia with the bifurcation of the two lower teeth much beyond the insertion of the tarsus. Intermediate tibia with the external apical tooth flattened and very broad to the rounded, straightly or obliquely truncate apex. Genae, seen from above, projecting conically beyond the eyes 7.
7. Hind tibia with apex strongly produced and prominent externally. Elytra with lateral border narrow at humeral angles. Sides of prothorax not, or only faintly, sinuate behind, hind angles not (or faintly) marked, posterior margin more or less obliterated. Length, 25-35 mm. South West Australia: Eucla (Sloane), Swan River (B). South Australia: Yorktown (ZM). subsp. *pacificus* Sloane 1888. Hind tibia less dentate at apex. Elytra with lateral border wide at humeral angles, striae faint, 8th interstice not convex. Prothorax with sides rather strongly sinuate behind and basal angles rather strongly dentate, front margin emarginate, especially near the broad angles, which are distinctly prominent. Length, 31-36 mm. "Australia" (B) *lenaeus* Westwood 1842. Differing from *lenaeus* by less sinuate sides of prothorax and not (or scarcely) dentate angles; front margin hardly emarginate and angles not produced. Elytral striae rather distinct, 8th interstice distinctly convex at middle. Length, 27-36 mm. South West Australia: King George Sound (Macleay, BM), "King River, south West Australia" (BM) subsp. *latipennis* Macleay 1863.³

According to Sloane's *Checklist* (1905) four species remained unknown to him: *bacchus* Westwood, *heros* Castelnau, *humeralis* Castelnau and *martini* Castelnau. There is a fifth, *confusus* Westwood, which is not mentioned in any

¹ The form of the shoulder of *hirtipes* is sometimes intermediate between that of *retundipennis* and of *pacificus*. In accordance with Sloane's decision and the rules of nomenclature (Article 28), but contrary to Csiki's *Catalogue*, I give *hirtipes* priority over *crenaticollis*, though the latter is described a page before.

² As Sloane suggested, having the type before him, there seems scarcely any doubt that *mastersi* Macleay from Mt. Barker is described from a ♀ of *silenus*. A ♀ specimen from the adjacent Albany is in the British Museum.

³ *S. pacificus*, *lenaeus* and *latipennis* are very closely allied and probably at most subspecies or perhaps individual aberrations of one species.

of his papers. The study of Castelnau's types at Genoa enabled me to elucidate two of the above names: *humeralis* is closely allied to *lucidus*, and *heros* is a synonym of *silenus*. On the remaining three I make the following remarks:

The types of *S. bacchus* and *silenus* Westwood are missing from the Hope Department of Entomology, University Museum, Oxford. The description says that in *bacchus* the genae are produced into an angle beyond the eyes, while this is not so in *silenus*. But in strong males they often also project considerably beyond the eyes. Both are described from the same locality, Swan River, and comparing the two figures and descriptions, there seems to me no doubt that *bacchus* is the broader ♂ and *silenus* the more parallel ♀ of the same species, which, according to the rules of nomenclature, has to take the latter name, as Sloane chose it in his revisions. There are specimens of both sexes from Swan River named *bacchus* in Castelnau's collection, which supports the above conclusion, and I have seen a specimen from Perth (BM) labelled by Sloane as "*silenus* Westwood which is a small form of *bacchus* Westwood."

The type of *S. lenaeus* Westwood is also missing from Oxford, but there is a specimen with the label in Westwood's handwriting "*lenaeus* West., ? small male." I have examined it, through the courtesy of Prof. G. D. H. Carpenter. It is *hirtipes*, the teeth of the intermediate tibiae disagreeing with figure and description. I quite agree with Sloane's interpretation of *lenaeus*, having in my collection a previously unnamed ♀ with the very old label "N. Holl." *S. latipennis* Macleay is evidently very close to it and hardly more than a subspecies. There is a ♂ of the latter from the type locality, King George Sound, in the British Museum.

The type of *S. martini* Castelnau is not at Genoa. According to the author, the entire body is smoother than in *rotundipennis* and the punctures on the declivity are larger. This agrees very well with the example I consider to be *lenaeus*, which synonymy Sloane conjectured in 1907. But Castelnau's description does not say anything about the very different shoulders and posterior angles of the prothorax. It seems to me better to leave the decision to the future.

The description of *S. confusus* Westwood is very poor and gives no locality. It is impossible to say what it may be.

Genus EURYSCAPHUS Macleay.

Euryscaphus Macleay, 1865, *Trans. ent. Soc. N.S.W.*, 1: 187.

Palpi with the last joint triangular or securiform. Lower edge of genae prominent and usually projecting in front below the eyes. The suborbital grooves to receive the antennae are single, not divided. Paragenae with a sharp oblique, often almost transverse groove, beginning at the hind angle of the mentum and separating the paragenae from the submentum and gula. Clypeus on each side of the labrum with a more or less triangular projection. Pronotum with the base sharply bordered above peduncle. Elytra without a keel on sides, lateral border visible from above in its whole length, base with some ocellate punctures. Epipleurae very broad anteriorly, twice as wide as the metepisterna, or more. Upperside of front tibia with two strong teeth, their bifurcation, when viewed from behind, much above the insertion of the tarsus; a variable number of much smaller denticulations above the upper tooth. Mesotibia with the apical tooth acute, often rather small. Elytra very broad and short, in the ♂ generally nearly circular, more elongate in the ♀. Entirely black, without metallic lustre.

The affinities of some *Euryscaphus* with the genus *Carenum* are very great. I have from the Boileau collection two very large ♀ specimens (length, 34–35 mm.; breadth of elytra, 13 mm.) from "N.W. Australia" which were named *E. hopei*, and for some time I also considered them to be a *Euryscaphus* near *politus*, in spite of their shape, which is too oblong for the genus. But the paragenae are not defined behind by the deep oblique groove which is so characteristic of *Euryscaphus*; the genae do not project below the eyes and the front tibiae are strongly tridentate. In Sloane's classification of *Carenum* (1900) into groups one comes near the *macleayi* and *transversicollis* groups, but my specimens do not agree with any of the species in question. In the *anthracinum* group of *Carenum* and the groups with the penultimate joint of the labial palpi short and swollen, grooves like those in *Euryscaphus* separate the paragenae from the submentum and the gula.

GENOTYPE: *Euryscaphus angulatus* Macleay 1865.

KEY TO SPECIES.

1. Posterior angles of pronotum rounded, the base more or less rounded between them or more or less lobate above peduncle 2.
 Posterior angles of pronotum upturned and more or less rectangular.
 Elytra without a discoidal puncture on apical third 6.
2. Elytra with a discoidal puncture about one third from apex 3.
 Elytra without a discoidal puncture on apical third 4.
3. Lateral border of elytra very narrow, except near shoulder, feebly rounded to the shoulder-tooth which is very distant from the peduncle. Pronotum with lateral and basal borders rather narrow, basal border normal on each side of peduncle, epipleurae not (or hardly) visible from above, base not (or scarcely) lobate, the wide longitudinal impression at a considerable distance from lateral border wanting or very shallow. Length, 31–43 mm. South Australia, Western New South Wales, Victoria. Synonyms: ♂ *bipunctatus* Macleay 1865 (Sloane 1893); ♂ *howitti* Castelnau 1867 (! Sloane 1893); ♀ *tatei* Blackburn 1887 (! BM); *ferox* Sloane 1888 (! 1890), ♂ *chaudoiri* Blackburn 1892 (! BM)
obesus Macleay 1863 (! Sloane 1893) ♀.
 To be separated from *obesus* by the very broad lateral border of the pronotum and the stronger wide impression at a considerable distance from lateral border. Length, 32 mm.; breadth, 13 mm. South Australia (Lake Eyre) subsp. *sulcicollis* Blackburn 1892 (! BM).
 Elytra with lateral border broad to apex, anteriorly shortly and strongly rounded to the shoulder-tooth (sometimes more or less obliterated), which is much nearer to the peduncle than in *obesus* and *sulcicollis*. Lateral border of pronotum very broad, base generally strongly lobate, the border very narrow on each side of peduncle and the epipleurae visible from above, generally with the same wide shallow impression at a considerable distance from lateral border as in *sulcicollis*. Genae more projecting below eyes than in the two preceding forms. Length, 31–44 mm. South-West Australia. subsp. *ebeninus* Sloane 1890.¹
4. Reflexed border of elytra ending at humeral angle and forming a very thick upturned humeral projection, less so in the ♀. Pronotum with base rounded and strongly produced backwards above peduncle, lateral

¹ There can hardly be any doubt that the three forms are subspecies of a single species.

margin more or less crenulate, epipleurae more or less broadly visible from above on each side of peduncle. Very large species, ♀ more elongate than ♂, which has almost round elytra. Length, 35-51 mm.; breadth, 15-24 mm. Central and North Australia, West Australia (Lake Darlott). Synonym: ♀ *titanus* Sloane 1889 (! Sloane 1893)

waterhousei Macleay 1864.

"Size moderate, elytra narrow and narrowly rounded behind." "Probably founded on a small form of *waterhousei*." Length, 31-33 mm.; breadth, 12-13 mm. Bourketown District, N. Queensland. Ex Sloane 1893, 1897 *atratus* Sloane 1893.

Reflexed border of elytra extending more or less beyond humeral angle, not forming a thickened upturned projection. Lateral border of pronotum not crenulate, epipleurae not or very narrowly visible from above on each side of peduncle 5.

5. Elytra rounded, not distinctly angular, at shoulder. (Base of pronotum rounded and more or less lobate above peduncle.) Length, 22-33 mm.; breadth, 10-14.5 mm. S. Queensland, New South Wales, Victoria, ? Eastern South Australia, "Central Australia." Synonyms: *minor* Macleay 1865 (! Sloane 1905); *affinis* Castelnau 1867 (! Sloane 1893 = *minor* Macleay); ♀ *hopei* Castelnau 1867 (! G); *arenarius* Sloane 1888 (! Sloane 1890 = *minor* Macleay)

dilatatus Macleay 1865 (! Sloane 1905).

Elytra very distinctly angular at shoulder. (Base of pronotum more truncate, not or less lobate above peduncle.) Length, 25-34 mm.; breadth 11-15.5 mm. S. Queensland, South, Central, and West Australia, as far North as Murchison River. Synonyms: ♀ *politus* Sloane 1893; ♂♀ *concolor* Sloane 1893; ♂ *terrenus* Sloane 1894

carbonarius Castelnau 1867.

6. Supraorbital pore present. (Frontal sulci less deep behind than in *subsulcatus*, and fading out in the generally somewhat depressed neck.) Central carina of mentum reaching the end of the tooth; its sides normally bordered. Marginal border of pronotum, including posterior angles, much more widely upturned, with an anterior marginal puncture and a broad flat depression inside anterior angles. Shoulders much more rounded off than in *subsulcatus*. Length, 33-36 (-42) mm. "Queensland" (Sloane, *Check List* 1905); Peak Downs (ZM); 1 ♀ without locality (B) *angulatus* Macleay 1865.

Supraorbital pore wanting. (Frontal sulci sharp and deep behind, no neck constriction.) Central carina of mentum reaching the strongly upturned sides of the tooth. Lateral border of pronotum strongly but not very broadly upturned, without setigerous punctures, transverse impression behind front margin hardly perceptible even near anterior angles. Shoulders square, strongly marked. Length, 22-29 mm. South Australia (Ouldea) . . . *subsulcatus* Blackburn 1887 (! BM).

E. carbonarius Castelnau and **dilatatus** Macleay.

It is almost impossible to name specimens belonging to group 5 from the keys and descriptions hitherto published. A specimen from Queensland (BM) named *dilatatus* Macleay by Sloane gave a hint. Another specimen which I recently saw in the British Museum collection simplifies the question considerably. It

is from Norseman, W.A., and was obtained from Sloane himself in 1923, thus many years after his latest publication on the genus. Perhaps he had again examined Castlenau's type in the Howitt collection (*see* Sloane 1905, 1907). It bears the label "*E. carbonarius* Cast." with *politus* Sloane, *concolor* Sloane and *terrenus* Sloane as synonyms. According to the descriptions and the material at hand the differences of the pronotum are evidently subject to some variation, which greatly complicates interpretation of the descriptions. The shape of the shoulder affords a better character and it agrees very well with the geographical distribution. There is, however, some doubt, as the type of *carbonarius* is said to come from Cooper's Creek, which would be the extreme eastern point of distribution, and *E. affinis* Castelnau is from the same locality and was identified from the types by Sloane as *minor* Macleay = *dilatatus* Macleay. It seems to be somewhat doubtful whether the synonymy of the nine names is quite correct.

Genus **PHILOSCAPHUS** Macleay.

Philoscaphus Macleay, 1871, *Trans. ent. Soc. N.S.W.*, 2: 96.

Palpi with the last joint triangular or securiform. Lower edge of genae not dentate nor projecting over the eyes. Suborbital grooves to receive antennae, single, not divided. Paragenae not separated from mentum and submentum by an oblique groove (sometimes a little marked in *barnardi*). Clypeus on each side of labrum with a triangular projection. Elytra with one or two sharp costae on each side, which disappear near apex. Base with some ocellate punctures, often more or less disappearing in the rough sculpture. Shoulder dentate. Epipleurae broad. Upper side of front tibia more or less tridentate, with or without further denticulations above the upper tooth. The bifurcation of the two lower teeth, seen from behind, above the insertion of tarsus. Colour variable.

GENOTYPE: *Carenum tuberculatum* Macleay 1863.

KEY TO SPECIES.

1. Disc of the elytra perfectly flat and quite smooth and opaque on inner side of costa. Lateral margin and base of thorax and lateral margin of elytra, as well as an irregular patch inside shoulder, of a bright green or red-golden colour; ventral surface cyaneous. Costa following the curvature of the elytra widely separated from the margin, which is visible from above in its whole length. Length, 14-16.5 mm. South Queensland *barnardi* Macleay 1887.
- Disc of elytra with a very rough sculpture on inner side of costa (tubercles, elevations). Upperside black 2.
2. Disc of elytra flat on inner side of costa, with a few longitudinal impressions like striae and a number of transverse and irregular ones, giving a very uneven appearance. Costa seen from above very distant from the lateral margin, towards which it slopes almost vertically; lateral margin broadly visible from above in its whole length.¹ Length, 16.5-18.5 mm. S.E. New South Wales. (Macleay 1873, 3: 324)
carinatus Macleay 1864.

¹ The shape of elytra and position of the costa are, except for the rough sculpture extending to the lateral margin and black colour, much as in *barnardi*.

- Lateral margin of elytra very narrowly visible from above in anterior half or somewhat hidden by the costa. Disc more or less convex on inner side of costa, with longitudinal rows of broad elevations and scattered tubercles in the intervening space. Epipleurae very broad. Head smooth or only with traces of rugae between the eyes and the furrows. Thorax strongly lobate above peduncle, disc generally more or less smooth or with moderately deep transverse rugae 3.
- Lateral margin of elytra completely hidden in its whole length, except just behind shoulder and for a certain distance at apex, by the strongly overhanging costa; the large elevations generally less numerous, the sculpture more disintegrated into more numerous smaller tubercles. Epipleurae considerably narrower. Thorax strongly lobate above peduncle, disc with very strong transverse rugae 4.
3. Elytra with a single costa at side (generally with marked bifurcation at level of 2nd or 3rd segment). Length, 21-32 mm. New South Wales, Queensland (Kuranda, B), Eastern South Australia
tuberculatus Macleay 1863.
- Elytra with two costae at side, at least for some extent, corresponding to the 7th and 8th interstices, the 8th more or less obliterated anteriorly or fused with the 7th, and both (especially the 7th) often more or less interrupted posteriorly. Length, 23-33 mm. West and South Australia. Synonyms: *lateralis* Macleay 1873 (! Sloane 1905); *crassus* Blackburn 1887 (Sloane 1905); *tepperi* Blackburn 1887¹
costalis Macleay 1873 (! Sloane 1905).
4. Disc of elytra with one or two rows, among the irregular tubercles, of stronger or more or less distinct tubercles which correspond to the 3rd and 5th interstices, the latter beginning at about middle of upper visible part of basal carina. Length, 22-30 mm. S.E. Queensland to Kuranda. Synonym: *duboulayi* Blackburn 1892 (! BM)
mastersi Macleay 1871.
- Disc of elytra with a semi-interrupted costa of two-thirds of their length, beginning at middle of upper part of basal carina. Elytra narrower, with base decidedly narrow. Sculpture of lateral declivity more tuberculate above lateral channel, with a row of narrow elevations, forming the line of a broken costa. The prosternum has the intercoxal part lightly channelled, not deeply excavate at the base. Length, 22.5 mm.; breadth, 8.3 mm. North Queensland. Ex Sloane
bicostatus Sloane 1905.

¹ Sloane (1905: 114), from description, placed *P. tepperi* Blackburn (Angebeckma) in the synonymy of *tuberculatus*, though the description speaks of two costae at middle of each elytron for an extent of 2 mm. I cannot find any other difference between *tuberculatus* and *costalis* except the presence of one or two costae. *P. tepperi* seems to be founded on an example connecting them. There is a specimen (BM) from Callabonna identified as *tepperi* Blackburn by A. M. Lea which, as well as the localities, supports that suggestion.



CERCARIA IMBRICATA LOOSS 1896, *nec* 1893—A NOTE
ON NOMENCLATURE

By MIRIAM ROTHSCHILD.

IN 1938 a paper dealing with Notocotylid cercariae was published in which it was proposed to divide these larvae into three main groups according to the structure of the excretory vesicle (Rothschild 1938). "*Cercaria imbricata* Looss, 1896" was selected as the "type" of the second group, characterized by the anterior portion of the vesicle looping between the lateral eye-spots and passing anteriorly to the median eye-spot. It is felt that attention should be drawn to a slight error in nomenclature, the larva in question being more correctly designated as "*Cercaria imbricata* Looss 1896, *nec* 1893." The reasons for the correction are given below.

In 1893 Looss published a paper where in a footnote (p. 20) he records a Monostome cercaria from *Paludina impura* from Leipzig (Germany). To this larva he gave the provisional name ("provisorischen Namen") *Cercaria imbricata*. He considered this form might eventually develop into *Monostomum attenuatum* Rud. Where cercariae are concerned the term "monostome," together with the indication of the host, is insufficient to constitute a description and the name must be regarded as a *nomen nudum*.

In 1896 Looss found a monostome cercaria in "*Melania tuberculata* Bourg." in Egypt which he thought was the same species as that provisionally named *C. imbricata* by him in 1893. On this occasion he gives a good description, and the name *imbricata* becomes valid for this species. He puts forward the view, based on circumstantial evidence, that the adult form is *Monostomum verrucosum* Froel., not *Monostomum attenuatum*.

In 1935 U. Szidat¹ found a cercaria in *Bythinia tentaculata* (= *Paludina impura*) which she identified as *Cercaria imbricata* Looss. Cysts of this larva were fed to ducklings, and an undescribed *Notocotylus* was recovered from the birds. This she named *N. imbricatus*. The description of this cercaria is inadequate, but the figures clearly reveal that it is not the species found by Looss in Egypt. The anterior portion of the excretory vesicle passes posteriorly to the median eye-spot, thus placing the cercaria in the Monostomi group.

It seems very probable that Looss' original surmise was correct, and that the cercaria he discovered in *Paludina impura* was the larval form of a *Notocotylus* identical with, or very closely related to, *N. attenuatus*, whereas the species from *Melania tuberculata* was the larval form of *Catatropis verrucosa*. These two types of excretory vesicle may well prove to be characteristic of the genera *Notocotylus* and *Catatropis* respectively.

¹ The Szidats have frequently shown a curious, even reckless disregard for the laws of nomenclature when naming cercariae and linking larval with adult forms. Thus in 1933 they identified a cercaria from *Planorbis cornutus* as *C. ephemera* Nitzsch, but on rearing the adult form, described it under the name "*Notocotylus thuenemanni* n.sp.!" Several equally glaring examples could be cited.

Pending further research into the morphology of both cercariae and adult forms of the Notocotyliidae, it is perhaps unwise to attempt to correct the unfortunate number of nomenclatural errors which characterize much of the literature on this group. It will, however, save further confusion if Looss' species is clearly referred to as *Cercaria imbricata* Looss 1896, *nec* 1893.

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(MSS. recd. Jan. 20, 1940.)

22 JUN 1940
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NOVITATES ZOOLOGICAE

A JOURNAL OF ZOOLOGY

Founded by

LIONEL WALTER, LORD ROTHSCHILD

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THE TRUSTEES OF THE BRITISH MUSEUM

6 NOV 1940
PRESENTED

VOL. 42

PART 2, pp. 217-396

25 October, 1940

LONDON :

PRINTED BY ORDER OF THE TRUSTEES
BRITISH MUSEUM (NATURAL HISTORY)

CROMWELL ROAD, LONDON, S.W. 7

1940

Price Fifteen Shillings

NOVITATES ZOOLOGICAE

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6 NOV 1940
PRESENTED

NOVITATES ZOOLOGICAE

Vol. 42

OCTOBER, 1940

No. 2

A MONOGRAPHIC REVISION OF THE MEXICAN WATER BEETLES OF THE FAMILY ELMIDAE

By H. E. HINTON, Ph.D.,

Department of Entomology, British Museum (Natural History).

(With 401 text-figures.)

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INTRODUCTION.

THIS monograph owes its origin to an attempt to determine the Elmidae collected on an expedition undertaken by Dr. R. L. Usinger and the writer to Central Mexico in the summer of 1933. At the time great difficulty was experienced in assigning names to the various forms, the existing descriptions being too brief, and in most instances unaccompanied by illustrations of essential characters such as the male genitalia. It was also found impossible to determine the small amount of material available of the immature stages. In the summer of 1934 an opportunity was taken to collect again in Mexico, and on this expedition particular attention was paid to the immature stages. As a result it has been possible in nearly all instances to assign those stages to genera if not to species.

In this paper all available stages of each species are described and figured. Such parts of the internal anatomy as the alimentary canal, male and female reproductive organs and central nervous system are described and illustrated for all genera except one. It is believed that this is the first time that these characters of the

internal anatomy have been used in conjunction with those of the external anatomy for defining genera in any family of the Arthropoda.

Altogether 36 species and one subspecies belonging to eleven genera are described. Of these, nine species, one subspecies and two genera are described as new.

GENERAL REMARKS.

The Use of Quantitative Methods in Taxonomy.

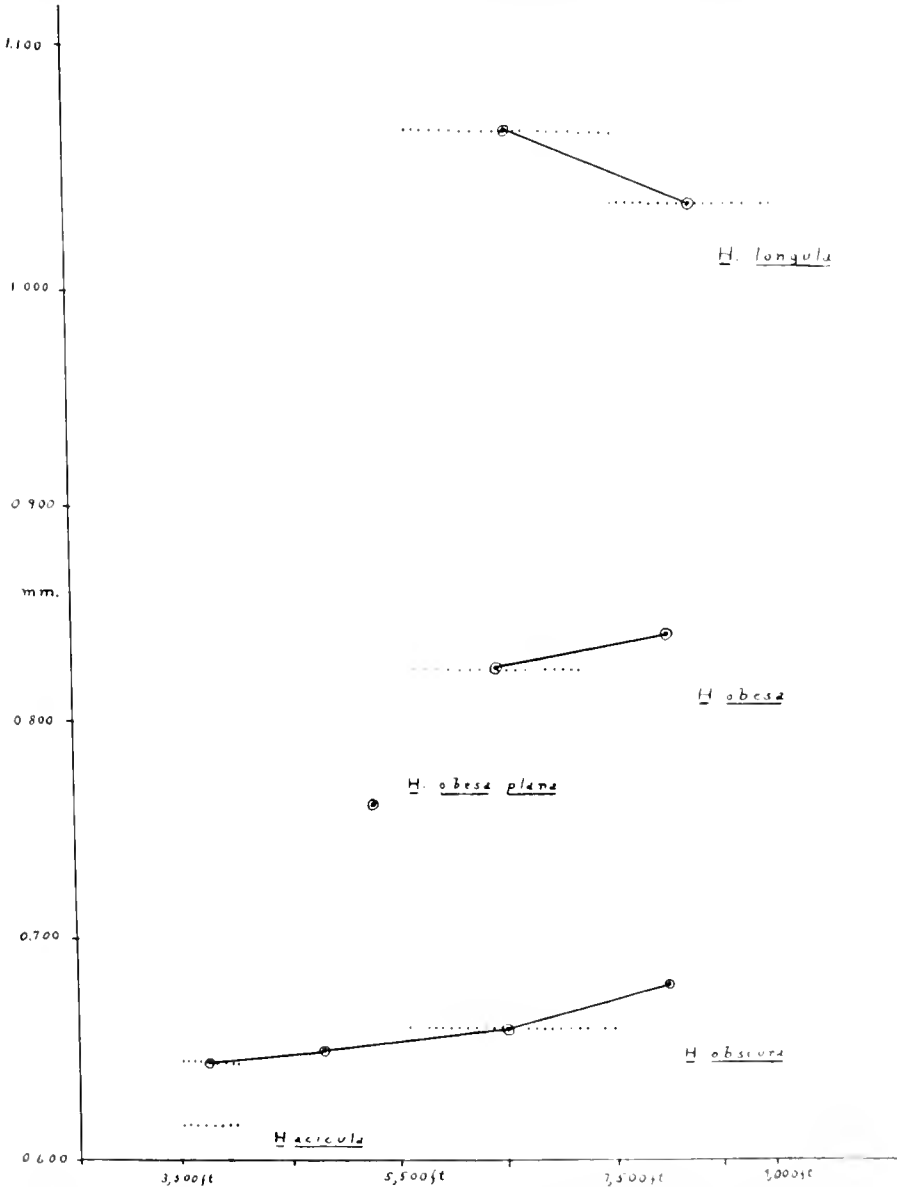
The application of quantitative methods to taxonomy has been much neglected. The usual taxonomic procedure has been, with few exceptions, entirely qualitative, and for the most part only those characters which are conspicuously discontinuous have been dealt with. The recent progress in the application of quantitative methods has been reviewed by Richards (1938). Only the influence of the environment on linear measurements will be discussed here.

It has been pointed out by Heincke (*vide* Richards, 1938), Zarapkin (1934) and Richards (1938) that most of the structures of two species differ significantly in the means of their measurements. This has always been found to occur among those species measured by the writer. From this fact it might be concluded that significant differences between the means of linear measurements of the structures of two populations are good specific characters. The writer has had experience with a group of insects living in a relatively stable environment, and therefore unusually suitable for such studies, and has found that in these quite a small difference in environment (in altitude and presumably in temperature) has resulted in significant differences between the means of most of the linear measurements of two populations belonging to the same species. Such significant differences are even apparent among populations of the same species from the same stream, associated with altitude differences of less than 1000 ft. (in Mexico at about 19° N.).

It is possible that in terrestrial insects the means of those living, for example, on the north side of a hill would differ significantly owing to a difference in temperature from those living on the south side of the same hill. It is also possible that for the same reason there would be a significant difference between the means of the same species living on opposite sides of a tree trunk. Apart from differences in absolute size that can be attributed to temperature, the mean size of populations is influenced by the type and quantity of food available in a particular locality, etc.

Although significant differences between the means of two populations are not in themselves always specific characters, it might be claimed that while small differences are not, very large differences are, and that in a particular genus or family it is only necessary to determine the degree of variation for each category in the taxonomic hierarchy. If this were true it could be said that two populations whose means differed by, say, 0.06 mm. belonged to different species, while differences of less than 0.06 mm. were of subspecific importance. It is true that, on the whole, interspecific differences in size are greater than intraspecific, but even in the writer's very limited experience cases have been found in which the means of different populations of the same species differ as widely as those of different species. For example, the difference between the means of the length of the prothorax of *Heterelmis obscura* taken at 8000 ft. and at 3500-4000 ft. is 0.034 mm., while the difference between the mean of *H. obscura* taken at 3500-4000 ft. and that of *H. acicula* taken in the same locality is only 0.022 mm. When a test of homogeneity is applied to these, it is found that the difference between *obscura* and *acicula* is significant to the same degree as that between the two populations of

H. obscura, i.e. $P < 10^{-3}$. Furthermore, if the general decrease in size with a decrease in altitude which has already been observed in *obscura* (text-fig. A) is



TEXT-FIG. A.—The mean length of the prothorax of five species of *Heterelmis* is plotted against the altitude at which the population occurred. The means were taken from populations of 14 to 75 individuals.

continued below the 3500 ft. level, at some point below this level the mean of the prothorax length will be equal to that of *acicula* at 3500-4000 ft

If all aspects of the environment were identical for two populations and

significant differences could be found between the means of their linear measurements, such differences would be genetical. If these differences were not positively correlated with characters of known value, it would be left to the judgment of the observer to decide whether they were of specific or only of subspecific importance.

For ordinary taxonomic purposes quantitative work of the type dealt with above has a very limited application. Even in those cases where the specific means are very different, it should be noted that there is frequently an overlap in the measurements (*vide* text-figs. 366-368). This means that the species must be first segregated on qualitative characters before quantitative work can begin; and at that point, unfortunately, taxonomic work usually ends.

The genus *Heterelmis* (text-fig. A) has been studied more extensively than any other in this paper, and reveals the following general points: considering one species at a time, the mean length of the prothorax increases progressively with increase of altitude for *obscura* and *obesa obesa* (this is also true for *Microcylloepus inaequalis* and *Neoelmis longula*, p. 313 and p. 326); while for *longula* (occurring only at the highest altitudes) an increase of altitude is accompanied by a decrease of prothorax length. It is not known how far this effect of altitude is due to modification and how far to selection. It is quite possible that within *obscura*, for instance, certain genotypes are larger than others (in this genus length of prothorax is positively and highly correlated with absolute size, p. 379), and that the former flourish better at higher altitudes. It is probable, however, that a considerable part of this effect is due to the influence exerted during ontogeny, by the environment at different altitudes, on essentially the same genotypes. There is no information as to which factor in the environment at different altitudes is responsible for modifying size, but temperature may be suggested as the most likely possibility. As regards *longula*, it may be suggested that above certain altitudes—in this genus probably above 8000 ft. in lat. 19° N.—such factors of the environment as very low temperatures have a dwarfing effect.

Considering the relationship between the different species of *Heterelmis*, with regard to altitude and prothorax length, it appears from text-fig. A that the greater the mean altitude of the species the greater is the length of the prothorax (and therefore the greater the absolute size). The scanty data obtained for *obesa plana* and *acicula* are in general accord with this statement if it is remembered that *obesa plana* does not belong to the same section of the genus as *acicula* and *obscura*. Furthermore, when two species, e.g. *obscura* and *obesa obesa*, are compared in the same environment, at 5600-7500 ft. for instance, it is found that *obscura* is still much smaller—the difference in size being genetical. So it may be concluded that *the greater the size, as determined by genetical factors, the greater will be the altitude of the habitat to which the species will tend to be segregated*. Unpublished data on a number of genera in this and other families support this general principle.

The Use of the Internal Anatomy in Classification.

The use of internal characters in dealing with groups of family or superfamily rank in the taxonomic hierarchy has been dealt with already.¹ It is only necessary here to point out that without the use of such characters it is much more difficult, and in many instances impossible, to build a system of

¹ 1939, *Trans. R. Ent. Soc. Lond.*, 89: 133-184, 1 pl., 105 figs.

classification which gives even an approximate picture of the phylogeny of the groups involved.

In the classification of the categories of lower rank, such as genera and species, the internal anatomy has very seldom been used in the Arthropoda. Practically without exception, genera are based entirely on the characters of the external morphology. In the writer's experience there appear to be almost as many characters of the internal anatomy which can be considered to be of generic importance. The present study of the internal anatomy of a number of genera has in some cases modified the conception of generic limits.

If the species of Elmidae of which the characters of the internal anatomy are known be divided into genera solely on these characters, the resulting genera frequently correspond exactly to genera which taxonomists have previously founded on external structures alone. However, in some groups, e.g. *Elsianus*, where the application of generic criteria used in the past, such as the presence or absence of sublateral carinae on the pronotum, would have resulted in two and possibly three genera, the similarity of the internal anatomy has caused a more careful search for characters of the external anatomy which could be considered to be of generic importance. This has led to the discovery of the generic importance of such characters as the venation of the hind wings and the distribution of the tomentose areas on the body—characters almost entirely neglected in previous descriptions of genera. In the particular case of *Elsianus*, it might be mentioned that the extent of the genus first suspected from a study of the internal anatomy is supported by a study of the larvae.

Until now the genus *Cylloepus* seemed to consist of a fairly homogeneous assembly of species, but an examination of the internal anatomy shows that the species fall into two very distinct groups. These groups differ from each other in the number of egg tubes to each ovary, the place of entry of the spermathecal duct into the bursa copulatrix, the form of the lateral accessory glands of the male, the number of caeca on the anterior margin of the midgut, and the number of Malpighian tubules. Experience of the family gained elsewhere shows that all these characters are of generic importance, and from this it is concluded that the two groups are really very different genera. The only character of the external anatomy which has been found to be correlated with these differences in the internal anatomy is the absence or presence of a transverse belt of tomentum on the hypomera. The species having a transverse belt of tomentum on the hypomera have been placed in a new genus, *Hexacylloepus*. Among the described species of *Hexacylloepus* a considerable amount of variation in the extent of the tomentose belt is already evident; and it is possible that when more species are known, some will be found in which the tomentose belt is not developed. If this were to occur, it would be necessary to study the soft parts of the internal anatomy before these species could be placed in their proper genus. It is believed that sooner or later, among some groups of genera in the family, dissection of the soft parts of the internal anatomy will be necessary before the species can be referred to their respective genera.

No one to-day would claim that all genera should be distinguished solely on characters of the antennae. Almost everyone would agree that all characters of the external anatomy of the adults should be used in defining genera and in attempting to build natural systems of classification; and many would insist that the external anatomy of other stages be considered also. However, in practice, if not in theory, most systematists still draw a very sharp line between characters of the external and internal anatomy.

Specific differences in the internal anatomy certainly occur, and are often more conspicuous than external differences. In the writer's very limited experience specific differences are not as numerous in the gross structure of the soft parts of the internal anatomy as they are in the structure of the external anatomy. No instance has yet been observed of two species differing only in the structure of the soft parts of the internal anatomy. There is no theoretical reason why species differing in a few genes should not have the effect of these genes confined to these parts.

METHOD.

While describing the species the problem arose as to how far the descriptions should be complete. To describe and illustrate in detail every structure on the body of each species is for all practical purposes a generally recognized impossibility. Any modification of this procedure rests upon the judgment of the individual worker. Some solve this problem by describing only those characters which will enable one to separate the species from those already described in the same genus. In practice this means that each time a new species, which differs in structural details from those previously described, is added to a genus it becomes necessary to re-examine and redescribe all the species; and if such a standard is accepted, whenever species are added to a genus, all other specific descriptions in that genus must be revised. Fortunately a slightly higher standard generally prevails to-day. The systematist selects from the characters that he sees those which by comparison with other species of the genus, or by analogy with the species of related genera, appear to him to be important; and to these he adds a few characters which he thinks are likely to prove useful when more species are known, but makes no attempt at anything approaching a complete description.

It has already been pointed out that a really complete description is a practical impossibility, and that anything short of this must, at least where those genera to which many species will be added are concerned, involve a certain amount of redescription. The amount of redescription necessary is governed largely by the number of species later added to the genus and the accuracy and completeness of the existing specific descriptions. Although all redescription cannot be avoided, an attempt is made here to describe and figure each species in such detail that redescription will be reduced to a minimum, or, in those genera of which few species remain to be discovered, will not be necessary at all. However, if other criteria are in the future needed to distinguish satisfactorily the species of Elmidæ, *e.g.* the number of branches of the recurrent nerve or the biochemical properties of some tissue, the descriptions given here will have to be rewritten.

Previous workers have seldom given precise measurements of the various structures, and statements such as "prothorax longer than broad" are the rule. It has been found that this degree of accuracy is not usually sufficient, and in the descriptions given here the exact measurements have been made with the aid of an eyepiece micrometer. It has also been found necessary to describe more accurately than has been the custom the distribution of punctures and tubercles. Statements such as "punctures coarse," "tubercles moderately dense," etc., have been found to be too subjective and have been avoided by giving the exact diameters of the punctures, or else comparing them with structures already measured or found to be specifically stable, *e.g.* the facets of the

eyes. The density of the tubercles and punctures has been expressed in terms of their own diameters.

The 13 illustrations of the adult beetles were done by Miss O. F. Tassart. All other illustrations were done by the writer with the aid of a camera lucida. Lines next to figures refer to a length of 0.20 mm. unless otherwise indicated.

MATERIAL.

The descriptions of the internal anatomy are drawn from species collected by the writer in Bolivia, Brazil, French Guiana, Trinidad (B.W.I.), and England.

The material which forms the basis of this monograph was collected by Dr. R. L. Usinger and the writer in central Mexico during the summer of 1933, and by the writer in the same region in the summer of 1934. The entire collections of Elmidae in the British Museum (Natural History) have been available, as have also the Mexican and Central American Elmidae in the collections of the U.S. National Museum, the Museum of Comparative Zoology at Harvard College, the Deutsches Entomologisches Institut at Berlin-Dahlem, and the Muséum National d'Histoire Naturelle of Paris. Collections of Elmidae have also been sent by a number of individuals.

The following is a list of all the specimens of the species known to occur in Mexico examined by the writer:

1. <i>Hexanchorus gracilipes</i> Sharp.		<i>A. sulcicollis</i> (Sharp).	
Adults . . . Panama . . .	2.	Adults . . . Panama . . .	6
" . . . Costa Rica . . .	2.	" . . . Mexico . . .	9.
" . . . Mexico . . .	1176.	<i>Xenelmis bufo</i> (Sharp).	
Pupa . . . " . . .	1.	Adults . . . Panama . . .	2
Larvae . . . " . . .	26.	" . . . Mexico . . .	15
<i>Phanocerus clavicornis</i> Sharp.		<i>Muröcyllopus angustus</i> , sp. n.	
Adults . . . Guatemala . . .	7.	Adults . . . Mexico . . .	18
" . . . Mexico . . .	4.	" . . . " . . .	
" . . . Brazil . . .	82.	<i>M. trilus</i> , sp. n.	
Larvae . . . Guatemala . . .	7.	Adults . . . " . . .	1299
<i>Tobrobis ungulatus</i> (Hinton).		<i>M. inaequalis</i> (Sharp).	
Adults . . . Mexico . . .	951.	Adults . . . Guatemala . . .	34
Larvae . . . " . . .	20.	" . . . Mexico . . .	2026
<i>Elsianus grandis</i> Hinton.		Larvae . . . " . . .	22.
Adults . . . " . . .	11.	<i>M. obesus</i> , sp. n.	
<i>E. graniger</i> Sharp.		Adults . . . Guatemala . . .	4
Adults . . . Costa Rica . . .	1.	<i>Noelmis apicalis</i> (Sharp).	
" . . . Mexico . . .	82.	Adults . . . " . . .	4
Pupae . . . " . . .	18.	" . . . Mexico . . .	271
Larvae . . . " . . .	75.	<i>N. aspera</i> , sp. n.	
<i>E. sandersoni</i> Hinton.		Adults . . . " . . .	10
Adults . . . " . . .	6.	<i>N. azteca</i> , sp. n.	
<i>E. scutellaris</i> Hinton.		Adults . . . " . . .	2.
Adults . . . " . . .	14.	<i>N. longula</i> Hinton . . .	
<i>E. stratioides</i> Hinton.		Adults . . . " . . .	148.
Adults . . . " . . .	6.	<i>Hexacyllopus abditus</i> Hinton.	
<i>E. striatus</i> Sharp.		Adults . . . Mexico . . .	57.
Adults . . . Guatemala . . .	1.	<i>H. apicalis</i> , sp. n.	
" . . . Mexico . . .	228.	Adults . . . " . . .	177.
Larvae . . . " . . .	119.	<i>H. horni</i> Hinton.	
<i>Elsianus</i> sp. ?.		Adults . . . " . . .	3.
Larvae . . . " . . .	1.	<i>H. scabrosus</i> , sp. n.	
<i>Elsianus</i> ? sp. ?.		Adults . . . " . . .	4
Larvae . . . " . . .	3.	<i>Cyllopus blairi</i> Hinton.	
<i>Austrolimnius formosus</i> (Sharp).		Adults . . . " . . .	27.
Adults . . . Guatemala . . .	2	<i>C. heterocerus</i> (Sharp)	
" . . . Mexico . . .	40.	Adults . . . Guatemala . . .	7.
		" . . . Mexico . . .	4

<i>C. proximus</i> Hinton.		<i>H. obesa obesa</i> Sharp.	
Adults . . . Mexico	1.	Adults . . . Guatemala	9.
<i>C. puncticollis</i> (Hinton).		" . . . Mexico	5003.
Adults . . . "	130.	<i>H. obesa plana</i> , subsp. n.	
<i>C. sculptipennis</i> (Sharp).		Adults . . . "	1194.
Adults . . . Guatemala	1.	<i>H. obscura</i> Sharp.	
" . . . Mexico	11.	Adults . . . Guatemala	38.
<i>C. sexualis</i> Hinton.		" . . . Costa Rica	2.
Adults . . . "	98.	" . . . Mexico	1607.
<i>C. spinipes</i> Hinton.		" . . . Texas	1.
Adults . . . "	94.	<i>H. tarsalis</i> , sp. n.	
<i>Cylloepus</i> sp. ?		Adults . . . Mexico	1.
Larvae . . . "	2.	<i>Heterelmis</i> .	
<i>Heterelmis acicula</i> , sp. n.		Larvae of several	154.
Adults . . . "	32.	spp.	
<i>H. longula</i> Sharp.		Total specimens	16,500.
Adults . . . "	167.		

ACKNOWLEDGMENTS.

My best thanks are due to Dr. A. D. Imms, F.R.S., for his advice and encouragement during the course of this work. To Dr. G. Salt and Dr. W. H. Thorpe I am indebted for many helpful suggestions. Dr. K. G. Blair and Dr. M. L. R. Pettersson have also given useful advice on special points.

For the gift or loan of material my best thanks are due to Mr. H. S. Barber, Dr. H. Bollow, Dr. P. J. Darlington, Dr. Fritz van Emden, Dr. W. Horn, Dr. R. Jeannel, Dr. F. Plaumann, Dr. P. N. Musgrave, Dr. M. W. Sanderson, Dr. H. Scott and Mr. F. X. Williams.

I am grateful to the Managers of the Balfour Fund (University of Cambridge) for a grant of £200 and to those of the Worts Fund for a grant of £40 which enabled me to work on the biology of some of the South American Elmidae, and to collect properly preserved material for my studies on the internal anatomy.

A KEY TO THE TRIBES OF THE ELMIDAE.

- i. Adults terrestrial, rarely entering the water. Body never with tracts of tomentum. Front coxae usually strongly transverse and with the trochantin exposed. Abdomen frequently with six visible ventral segments LARINI.
- Adults aquatic, seldom or never leaving the water. Body with tracts of tomentum. Front coxae usually round and with the trochantin concealed. Abdomen never with more than five visible ventral segments ELMINI.

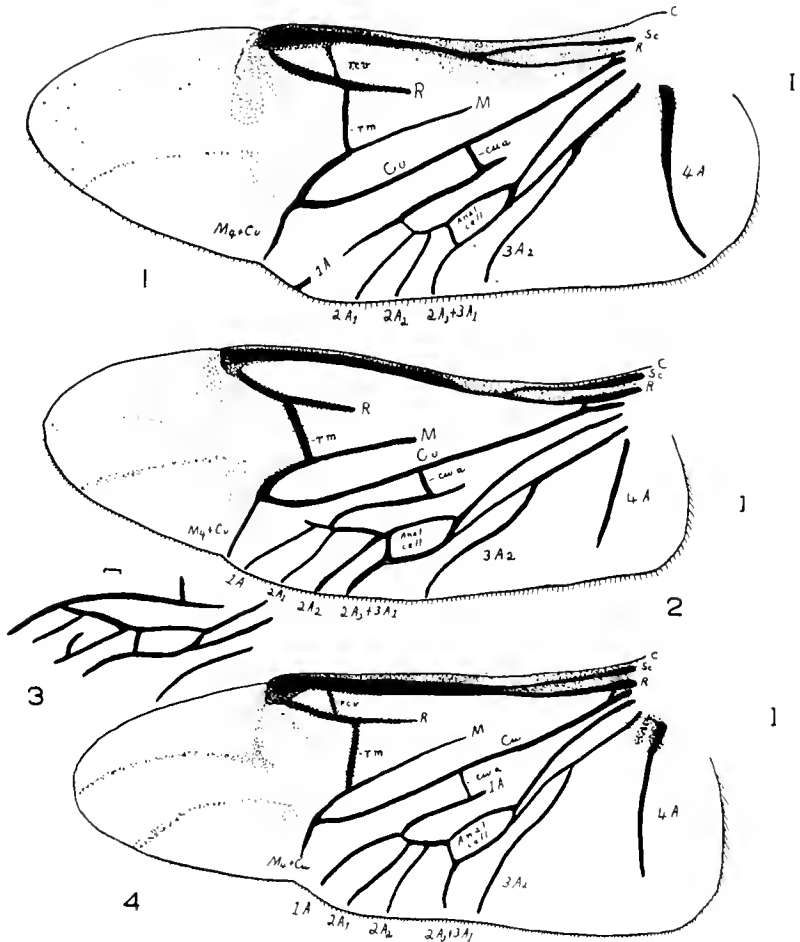
The tribe Ancyronychini (1904, Ganglbauer, *Die Käfer von Mitteleuropa*, 4 (1): 108) should be relegated to synonymy with the tribe Elmini. According to Ganglbauer the Ancyronychini are to be separated from the Elmini by the very short prosternum in front of the anterior coxae with a consequent exposure of the ventral surface of the head. The length of the prosternum in front of the anterior coxae is not always even a good generic character. Among the species of *Stenelmis* may be found many which have the prosternum in front of the anterior coxae extremely long and the head fully retractile, while many, e.g. *S. pallidipes* (Cart.), etc., have the prosternum very short and the ventral surface of the head even more exposed than in *Ancyronyx* Er.

A detailed study of the relationships of the Larini to the Elmini has been made before, and it is only necessary to repeat here that it was found that there was only one character by means of which these two tribes could be infallibly separated, *i.e.* the presence of tomentose tracts in all Elmini and their absence among the Larini. It has been shown that this division into two tribes is not a very natural one, as it is supported neither by the structure of the larvae nor by that of the pupae, and furthermore one genus, *Phanocerooides* Hinton, is referred to the Elmini, but is really much more closely related to some of the Larini than to any known members of the Elmini.

A KEY TO THE WORLD GENERA OF LARINI.

1. Prosternum broadly truncate posteriorly or at most feebly rounded ; mesosternum without a depression for the reception of the prosternal process. Elytra with two accessory basal striae on each elytron between sutural and second stria. AFRICA, MADAGASCAR
Potamodytes Grouv. (1896).
 Prosternum acute posteriorly ; mesosternum with a depression for the reception of the prosternal process. Elytra with one accessory stria or none on each elytron between sutural and second stria 2
2. Elytra with one accessory stria on each elytron 3.
 Elytra without accessory striae 8.
3. Pronotum on each side with a longitudinal carina or sulcus on basal two-fifths. NEW ZEALAND, AUSTRALIA *Hydora* Broun (1882).
 Pronotum without basal carinae or sulci 4
4. Pronotum evenly convex. AFRICA, MADAGASCAR *Hydrethus* Fairm. (1889).
 Pronotum with an apical transverse impression which at middle is on anterior third and at sides on anterior fifth or sixth. This impression is but little developed in some genera, *e.g.* *Potamophilus* 5.
5. Hind wing with a radial cross vein (text-fig. 1). WESTERN NORTH AMERICA *Lara* Lec. (1852).
 Hind wing without a radial cross vein 6
6. Second anal with either branch one or branch two absent ; between first anal and third branch of second anal (plus first branch of third anal) with only one vein. EAST INDIES, AFRICA
Potamophilinus Grouv. (1896).
 Second anal with first and second branches present so that between first anal and third branch of second anal plus first branch of third anal there are two veins 7.
7. First branch of third anal joined to second anal before the latter has given rise to any branches, the point at which these two become united being a distance greater than the diameter of the anal cell proximal to the anal cell. AUSTRALIA *Stetholus* C. & Z. (1929).
 First branch of third anal joined to third branch of second anal (*i.e.* joined to second anal after the latter has given rise to branches, text-fig. 2). EUROPE, EAST INDIES (?) *Potamophilus* Germ. (1811).
8. Pronotum on each side with a longitudinal carina or sulcus on basal two-fifths 9.
 Pronotum without a carina or sulcus on each side 10.
9. Pronotum without transverse impressions ; prosternum very broad between coxae. JAPAN *Dryopomorphus* Hinton (1936).

- Pronotum with a transverse impression on each side at apical third, this impression extending mesally and posteriorly to join the impression formed by the longitudinal sulcus. NORTH and SOUTH AMERICA, WEST INDIES *Phanocerus* Sharp (1882).
10. Pronotum with a strong transverse impression on apical third at middle and at apical fifth or sixth at sides. CENTRAL and SOUTH AMERICA *Hexanchorus* Sharp (1882).
- Pronotum without a transverse impression. CENTRAL and SOUTH AMERICA *Disersus* Sharp (1882).



TEXT-FIGS. 1-4.—(1) *Larva avara amplipennis* Darl. (2) *Potamophilus acuminatus* (F.). (3) Wing of other side of same specimen drawn from ventral side to facilitate a comparison with the normal type of venation. (4) *Potamodytes tuberosus* Hinton. Venation after Forbes.

Potamophilops Grouvelle (1896) would run to *Hexanchorus* in this key. The type has been examined in the Paris Museum and appears to be identical with *Hexanchorus*. However, at that time the wing venation was not examined,

and it is just possible that *Potamophilops* is a valid genus. *Betelmis* Matsumura (1916) was referred by its author to the Larini. As nearly as I am able to judge from the description and figure, this genus belongs in the family Psephenidae, where it is possibly synonymous with *Mataeopsephenus* Waterhouse.

The hind wings of the Coleoptera have seldom been used for separating genera. Apart from the fact that other characters are usually more readily accessible, in most groups of beetles the hind wings are frequently atrophied; and it is this tendency towards reduction which is the most serious objection to their use as generic characters. In those groups in which reduction of the wings is known to occur, the genera should never be distinguished solely by some wing character, e.g. venation, which is known to be affected by reduction, for this would often result in the difficult position of having some species represented only by individuals with reduced wings, and these individuals could not be assigned to their proper genera. But even in those groups in which reduction of the size of the wings with consequent reduction of the venation is known to occur, it is possible, and often even necessary, to use the venation as a supplementary generic criterion. In the tribe Elmini, as will be shown in my study of the Mexican genera, reduction of the wing venation is a frequent occurrence, and yet a consideration of the venation of those individuals which have fully developed wings is an aid to a fuller understanding of important generic relationships.

The Larini are a group which is not truly aquatic but is riparian. The adults are among the most agile of flying beetles, and after studying their habits it is difficult to imagine atrophy of the wings occurring except at very infrequent intervals. No individual that has been examined—individuals of most of the described species have been examined—has shown the slightest tendency towards reduction of the wings. Other families of beetles possessing strictly riparian tribes or groups of genera resemble the Larini in that the wings are seldom if ever reduced. Darlington (1936), who has studied the hind wings of the Carabidae, says (p. 157), “. . . almost without exception species which live closely associated with water have strongly developed flying wings” (italics are his).

A KEY TO THE GENERA OF MEXICAN ELMINI.¹

- 1. Maxillary palp 3-segmented. Mid-gut with prominent regenerative crypts; anterior margin without caeca. EUROPE *Elmis* Latr. (1798).
 Maxillary palp 4-segmented. Mid-gut smooth, without regenerative crypts projecting from the outer surface; anterior margin with or without caeca 2.
- 2. Base of pronotum feebly rounded in front of scutellum. Claws toothed. MEXICO *Tolriolus*, gen. n.
 Base of pronotum arcuately emarginate in front of scutellum. Claws without teeth 3.
- 3. Each elytron with a short accessory stria at base between first and second striae. Each testis composed of three sperm tubes. NORTH and SOUTH AMERICA *Elsianus* Sharp (1882).
 Elytra without accessory striae. Each testis composed of one or two sperm tubes 4.

¹ In this key I have included two genera not found in Mexico, *Lumnius* and *Elmis*, since in the past a number of Mexican species have been referred to one or another of these

4. Epipleura with a longitudinal line of granules which on anterior two-fifths is half way between dorsal and ventral margins, while on posterior three-fifths it is close and parallel to ventral margin. Hind wing with a well-developed anal lobe. Alimentary canal with five caeca on the anterior margin of the mid-gut. Each testis composed of only one sperm tube. Each ovary with only two egg tubes. Central nervous system with only the second and third abdominal ganglia discrete. AUSTRALIA, CENTRAL and SOUTH AMERICA
Austrolimnius C. & Z. (1929).
- Epipleura without a longitudinal line of granules. Hind wing without a well-developed anal lobe. Alimentary canal never with five caeca on anterior margin of mid-gut. Each testis composed of two sperm tubes. Each ovary with more than two egg tubes. Central nervous system with a different combination of discrete abdominal ganglia 5.
5. Mentum twice as long as and broader than submentum. Each elytron with three carinae or longitudinal rows of granules. Alimentary canal with four caeca on the anterior margin of the mid-gut. EUROPE, NORTH AMERICA *Limnius* Er. (1847).
- Mentum never distinctly broader and always shorter than submentum. Each elytron with at most two sublateral carinae. Alimentary canal never with four caeca on the anterior margin of the mid-gut 6.
6. Pronotum entirely tomentose. Hypomera entirely tomentose. Pronotum without sublateral carinae. Hind wing without a cubito-anal cross vein. Alimentary canal without caeca on the anterior margin of the mid-gut. Central nervous system with only the second abdominal ganglion discrete. CENTRAL and SOUTH AMERICA
Xenelmis Hinton (1936).
- Pronotum not tomentose. Hypomera never completely tomentose. Pronotum with a sublateral carina on each side. Hind wing with a cubito-anal cross vein which may be complete or incomplete. Alimentary canal always with caeca on the anterior margin of the mid-gut. Central nervous system with at least three discrete abdominal ganglia 7.
7. Hypomera never tomentose. Pronotum on apical two-fifths always with at least a moderately deep transverse impression which may be complete or confined to sides. Alimentary canal with two, three, or no caeca on anterior margin of mid-gut. Each ovary with six or less than six egg tubes 8.
- Hypomera usually at least partly tomentose. Pronotum occasionally with transverse impressions but these are never on apical two-fifths. Alimentary canal with more than three caeca on anterior margin of mid-gut. Each ovary with more than six egg tubes 9.
8. Pronotum with a moderately deep, occasionally incomplete, transverse impression, with a median longitudinal discal impression; on basal half on each side with an oblique impression. Each elytron with two sublateral carinae, only very rarely with one. Epipleura only rarely tomentose. Hind wing without a trace of an anal lobe; third anal joining second anal. Alimentary canal with two caeca on the anterior margin of the mid-gut; hind gut with six Malpighian tubules. Each ovary with six egg tubes. Central nervous system with the first three abdominal ganglia discrete. NORTH and SOUTH AMERICA
Microcylloepus Hinton (1935).

Pronotum always with a very deep and complete transverse impression ; never with a median longitudinal impression on disk nor with an oblique impression on basal half. Each elytron always with only one sublateral carina. Epipleura always tomentose. Hind wing with a feebly developed anal lobe ; third anal not joining second anal. Alimentary canal with three, two, or no caeca on the anterior margin of the mid-gut. Hind gut with only four Malpighian tubules. Each ovary with four egg tubes. Central nervous system with the first six abdominal ganglia discrete. NORTH and SOUTH AMERICA, WEST INDIES *Neelmis* Musgr. (1935).

9. Hypomera with a complete transverse belt of tomentum. Hind gut with only four Malpighian tubules. Male reproductive system with the lateral accessory glands not lobed. Each ovary with seven egg tubes. NORTH and SOUTH AMERICA *Hexacylloepus*, gen. n.

Hypomera without a complete transverse belt of tomentum. Hind gut with six Malpighian tubules. Male reproductive system with the lateral accessory glands lobed. Each ovary with more than seven egg tubes 10.

10. Body subparallel. Hypomera usually without tomentum but occasionally with a very narrow belt on anterior three-fifths adjacent to sterno-notal suture. Hind wing with the second branch of the third anal present. Prosternal process moderately narrow. Alimentary canal with eight caeca on the anterior margin of the mid-gut. Each ovary with about 18 egg tubes. Spermathecal duct opening into base of bursa copulatrix. Central nervous system with abdominal ganglia two to five discrete. NORTH and SOUTH AMERICA, WEST INDIES *Cylloepus* Er. (1847).

Body usually obovate. Hypomera always with a ventral belt of tomentum which at broadest point is two-fifths as broad as hypomera. Hind wing with the second branch of the third anal absent. Prosternal process broad. Alimentary canal with six caeca on the anterior margin of the mid-gut. Each ovary with 11 egg tubes. Spermathecal duct opening into the apex of the bursa copulatrix. Central nervous system with abdominal ganglia one to six discrete. NORTH and SOUTH AMERICA *Heterelmis* Sharp (1882).

A KEY TO THE LARVAE OF THE GENERA OF ELMIDAE.

1. Body flattened and usually at least feebly onisciform 2.
 Body cylindrical or subcylindrical 5.
2. Posterior margin of pronotum with a double row of tubercles. EUROPE *Dupophilus* Muls. (1872).
 Posterior margin of pronotum with a single row of tubercles 3.
3. Propleura not divided into an anterior and a posterior part ; meso- and metapleura divided into three parts on each side. BRAZIL *Phanoceroides* Hinton (1938).
 Propleura divided into an anterior and a posterior part on each side ; meso- and metapleura divided into two parts on each side 4.
4. Eighth abdominal segment with the pleura bounded by tergo- and sterno-pleural sutures. NORTH and SOUTH AMERICA, WEST INDIES *Phanocerus* Sharp (1882).

- Seventh and eighth abdominal segments without discrete pleura and both segments forming complete sclerotized rings. EUROPE
Elmis Latr. (1798).
5. Propleura divided on each side into three parts 6.
Propleura not divided, or if divided then only into two parts on each side 10.
6. Pleura bounded by sutures present on eighth abdominal segment.
WESTERN NORTH AMERICA *Lara* Lec. (1852).
Eighth abdominal segment forming a complete sclerotized ring 7.
7. Pleura bounded by sutures present on seventh abdominal segment 8.
Seventh abdominal segment forming a complete sclerotized ring 9.
8. Head with one ocellus on each side. Dorsal surface evenly convex.
EUROPE, NORTH AMERICA *Limnius* Er. (1847).
Head with five ocelli on each side. Dorsal surface with numerous large gibbosities. EUROPE *Potamophilus* Germ. (1811).
9. Pleura bounded by sutures present on sixth abdominal segment.
CENTRAL and SOUTH AMERICA *Hexanchorus* Sharp (1882).
Sixth abdominal segment forming a complete sclerotized ring; fifth with pleura bounded by sutures. BOLIVIA *Disersus* Sharp (?) (1882).
10. Propleura not divided, meeting on middle line of body so that sternum is suppressed. Meso- and metapleura with only the sterno-pleural suture present. NORTH and SOUTH AMERICA, WEST INDIES
Cylloepus Er. (1847).
Propleura divided into an anterior and a posterior part, and only with the anterior part meeting on the middle line of the body. Meso- and metapleura bounded by tergo- and sterno-pleural sutures 11.
11. Meso- and metapleura divided on each side into two parts 12.
Meso- and metapleura divided on each side into three parts. NORTH and SOUTH AMERICA *Heterelmis* Sharp (1882).
12. Pleura bounded by sutures present only on the first two abdominal segments 13.
Pleura bounded by sutures present on more than the first two abdominal segments 14.
13. Dorsal surface of body evenly convex. EUROPE *Latelmis* Reitt. (1883).
All abdominal segments except ninth with the posterior part transversely and strongly gibbous. EUROPE *Riolus* Muls. (1872).
14. Pleura bounded by sutures present on the first six abdominal segments.
EUROPE *Esolus* Muls. (1872).
Pleura bounded by sutures present on the first seven abdominal segments 15.
15. Dorsal surface with numerous strong gibbosities. MEXICO
Tolriolus, gen. n.
Dorsal surface except for ninth abdominal segment evenly convex 16.
16. Tubercles of terga of first eight abdominal segments arranged in parallel rows. NORTH and SOUTH AMERICA *Microcylloepus* Hinton (1935).
Tubercles of terga of first eight abdominal segments not arranged in parallel rows 17.
17. Anterior margin of head on each side with a large and conspicuous tooth. NORTH and SOUTH AMERICA *Elsianus* Sharp (1882).
Anterior margin of head on each side without a distinct tooth 18.

18. Anterior margin of clypeus on each side with a moderately large acute tooth. Hind gut with six Malpighian tubules. SOUTH AMERICA
Macrelmis Mots. (1859).
 Anterior margin of clypeus not toothed. Hind gut with only four Malpighian tubules. NORTH and SOUTH AMERICA
Neelmis Musgr. (1935).

In this key I have included all the genera represented in my collection as well as *Dupophilus* Muls., which is known to me only by the description of Bertrand (1936). The larvae of three other genera, *Ancyronyx* Er., *Macronychus* Mull., and *Stenelmis* Duf., have been described and figured in the literature at various times, but in none of these descriptions have the important generic characters been mentioned, so that it is not possible to deal with them here.

No character has been found which will serve to separate the larvae of the Larini from those of the Elmini. As may be seen from the key, some members of the Larini, e.g. *Phanocerus*, are much more closely related to members of the Elmini than they are to members of their own tribe. Most Larini are much larger than the largest Elmini, so that the large size of the mature larvae (usually more than 7.0 mm. long and 1.5 mm. broad) is a useful character for distinguishing the larvae of the two tribes. This in combination with those forms determined by elimination and locality and by breeding has enabled me to identify the larvae of all American genera of Larini with the doubtful exception of *Disersus* Sharp.

THE MEXICAN LARINI.

Two species of Larini occur in Mexico, *Hexanchorus gracilipes* Sharp and *Phanocerus clavicornis* Sharp. A redescription of these two species with a description of their immature stages follows.

HEXANCHORUS Sharp.

1882. *Hexanchorus* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2) : 127.

1896. *Hexanchorus* (err. typ. ?) Grouvelle, *Bull. Soc. ent. Fr.*, 1896 : 78.

Body elongate, subparallel; clothed for the most part with dense, moderately long, usually recumbent hairs. *Head* when seen from below not capable of being retracted into prothorax beyond the basal portion of the submentum. Antenna as figured (text-fig. 8), 11-segmented. Mandibles with one obtuse subapical and two obtuse apical teeth; prosthoea large and entirely membranous. Maxillary palp (text-fig. 11) 4-segmented and stipes with a well-developed palpifer; galea and lacinia separate and each densely spinose. Labial palp 3-segmented and prementum with a palpiger. Mentum broader than and as long as submentum. Gula at apex as broad as first segment of antenna. *Pronotum* with a complete and deep apical impression which at middle is about on apical third and at sides on apical fifth; without longitudinal carinae. *Elytra* striate and punctate; without accessory striae and without longitudinal carinae. Hind wing (text-fig. 12) without a radial cross vein and without an anal cell, with the second branch of the second anal absent; first anal present only apically; cubito-anal cross vein complete or incomplete and joining cubitus to first anal. *Prosternum* (text-fig. 16) very short in front of anterior coxae; process long and acute. Mesosternum with a deep and narrow groove for the reception of the

prosternal process, this groove being posteriorly very broad and nearly as broad as long where its posterior wall is formed by the mesosternum. Metasternum with a longitudinal impressed line. Abdomen with the sixth ventral segment externally visible. Legs with the front coxae transverse; with the externally visible part of the trochantin large. Claws without teeth. *Alimentary canal* with six Malpighian tubules. *Male reproductive system* with two long and narrow sperm tubes to each testis. The details of the internal anatomy are based on a single pupa in poor condition. The number of caeca on the anterior margin of the mid-gut, if any, could not be determined.

The wing venation is quite unlike that of any other Larini known to me, but perhaps, in the absence of an anal cell, it is nearest to *Phanocerus*, a genus with which it also agrees in having no accessory striae on the elytra and in possessing two sperm tubes to each testis. The structure of the larvae would place this genus very far from *Phanocerus* and near those genera having an anal cell in the hind wing.

All legs have at the ventral apex of the fourth tarsal segment a fine nearly erect seta which is about half as long as the fifth segment. This seta occurs in all species I have been able to examine, e.g. *gracilipes* Sharp, *caraiibus* Coquer., *thermarius* Coquer., *tarsalis* Hinton and *tibialis* Hinton, and is probably a good generic character. Certainly no other Larini I have seen have a similar seta.

GENOTYPE: *Hexanchorus gracilipes* Sharp.

The specific characters of most importance seem to be the following:

- (1) General proportions, length and breadth. It is particularly important to measure the length exactly, as this character is most useful in associating species with descriptions, there being but little intra-specific variation in size.
- (2) Punctuation of all parts of the dorsal surface. I have not considered the punctuation of the ventral surface, for it is generally concealed by the pubescence and besides there is an abundance of good specific characters.
- (3) Outline of the pronotum and the depth and general proportions of the impressions on its surface.
- (4) Proportion of scutellum and if flat or convex.
- (5) Form of elytral apices.
- (6) Shape of prosternum.
- (7) Shape of apical margin of fifth and sixth abdominal segments.
- (8) Structure of the abdominal spicule.
- (9) Secondary sexual characters. These are among the most highly specific characters I have been able to find.
- (10) Structure of the male genitalia. Here are found the most important specific characters, and no one should describe a new species without illustrating this organ.

The following secondary sexual characters have been observed in the species before me:

- (1) Female with the inner apices of the elytra turned up vertically (*gracilipes*).
- (2) Front tibia of the male slightly shorter and more curved than that of the female (*gracilipes*).
- (3) Male with the inner apex of the fifth segment of the front tarsi dilated (*tarsalis*).

- (4) Male with a fine, short, and nearly longitudinal carina on the inner apex of the middle tibia (*gracilipes*, *caraiibus*).
- (5) Male with a fine tubercle on the inner apex of the middle and hind tibiae (*tarsalis*).
- (6) Male with a short and obliquely longitudinal tubercle on the inner apex of the hind tibiae (*tibialis*).
- (7) The disc of the metasternum and first three abdominal sterna is strongly concave in all males and convex in all females.
- (8) Apical margins of the fifth and sixth abdominal sterna always differently emarginate in the two sexes.
- (9) The structure of the abdominal spicule is completely different in the male and female.

This genus is widely distributed in Central and South America. One species occurs on Martinique and Guadeloupe.

Hexanchorus gracilipes Sharp.

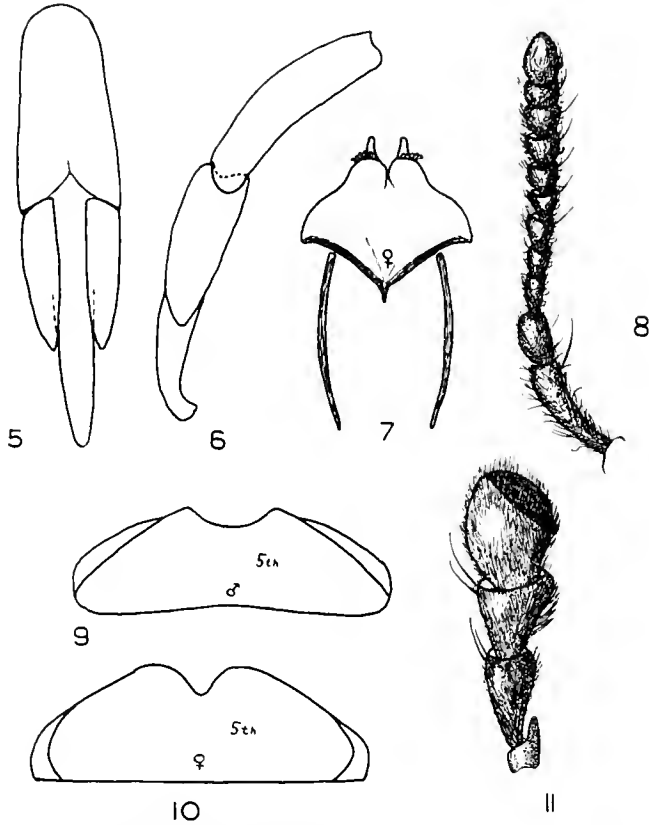
(Text-figs. 5-20.)

1882. *Hexanchorus gracilipes* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2) : 128, t. 4, f. 7.

1937. *Hexanchorus gracilipes* Hinton, *Ent. mon. Mag.*, 73 : 99, 3 figs.

Male : Length, 3.5 mm.-4.0 mm. ; breadth (across elytral humeri), 1.32 mm.-1.55 mm. Elongate, subparallel, moderately convex. Dorsal surface clothed with fine, dark, suberect to erect, moderately dense hairs which are about 0.06 mm. long, and also densely pubescent with much finer and shorter hairs which are recumbent and usually greyish, though these often have a greenish iridescence. Ventral surface with both types of hairs longer, more like one another, and distinctly paler ; tibiae of middle legs pubescent only at extreme base. Cuticle black to rufopiceous ; two basal segments of antenna, mouthparts, trochanter, base of femora, all of tibiae, and claws paler. *Head* without distinct impressions. Anterior margin of clypeus truncate, with the angle on each side broadly rounded. Anterior margin of labrum shallowly and arcuately emarginate at middle, with the angle on each side broadly rounded. Eyes purplish in colour, narrowed posteriorly, and protected by an arch of long black setae which arise from the head near the dorsal and ventral sides of the eyes and meet above the eye at middle. Antenna as figured (text-fig. 8). Surface with two types of punctures as follows : coarse punctures (about 0.008 mm. in diameter) round and confluent to separated by once their diameters ; and fine punctures about a third as coarse and separated by one to three times their diameters. *Pronotum*, across broadest point, which is at basal two-fifths, broader than long (1.10 mm. : 0.85 mm.) and base broader than apex (1.07 mm. : 0.75 mm.). Pronotum with the impressions as figured (text-fig. 20) and with the surface punctate as head. Sharp (*loc. cit.*) said the pronotum had no punctures, but he can scarcely have looked at it very closely. *Elytra* more than three times as long as pronotum (2.80 mm. : 0.85 mm.), and with the broadest point across humeri being only slightly broader than broadest point at apical third. Inner side of apex of each elytron rounded. Lateral margins smooth. Humeri moderately gibbous. Sutural interval on posterior two-thirds feebly raised ; other intervals flat ; surface of intervals with the punctures no larger than finest of head and

pronotum and separated by two to ten times their diameters. Strial punctures on mid-discal region round to subquadrate, separated longitudinally by less than to once their diameters, and usually a third to half as broad as intervals; basally on disk they become finer and the intervals broader so that a ratio of one-eighth as broad here often prevails; at sides the punctures become slightly finer; towards apex they become much finer and the striae shallower, so that on apical sixth striae and punctures have nearly completely disappeared. *Scutellum*

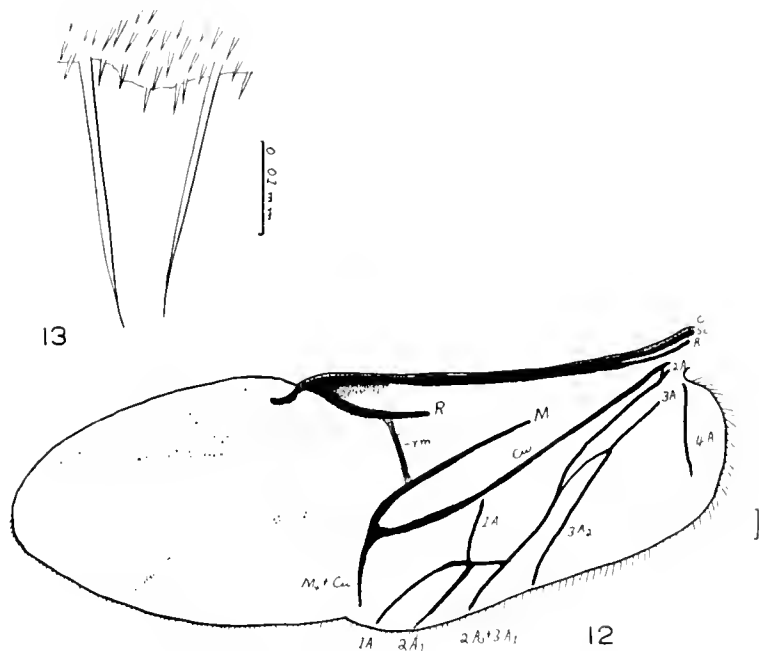


TEXT-FIGS. 5-11.—*Hexanchorus gracilipes* Sharp. (5) Dorsal view of male genitalia. (6) Lateral view of right side of male genitalia. (7) Female genitalia. (8) Antenna. (9) Ventral view of fifth abdominal sternite of male. (10) Ventral view of fifth abdominal sternite of female. (11) Maxillary palp.

slightly longer than broad (0.17 mm. : 0.15 mm.) and moderately convex, being distinctly elevated above the adjacent elytral intervals. *Prosternum* (text-fig. 16) with the process long. *Metasternum* concave, the concave portion broadening out posteriorly so that at posterior margin it embraces most of the disk; with an acute but low median longitudinal carina which extends from base forwards for about 0.12 mm. and from end of this carina a narrow, shallow, impressed line extends forwards, becoming narrower and shallower anteriorly so that it scarcely attains the anterior margin of the metasternum. Abdomen with the entire disk of the first two segments and the anterior half of the third strongly concave;

first segment with the discal carina extending to posterior fourth or fifth; apical margin of fifth and sixth as figured (text-figs. 9 and 15); spicule as figured (text-fig. 19). *Legs* with the front tibiae feebly curved inwards near apical third. Middle tibiae glabrous except for extreme base, and with a fine, short, nearly longitudinal carina on inner apex. *Genitalia* as figured (text-figs. 5, 6).

Female: Externally similar to male except as follows: (1) The inner apex of each elytron is turned upwards at right angles to the general surface; (2) front tibiae are slightly less curved than those of male; (3) middle tibiae without a carina on inner apex; (4) disc of metasternum much more feebly and less extensively concave; (5) disc of first three ventral abdominal segments convex,



TEXT-FIGS. 12, 13.—*Hexanchorus gracilipes* Sharp. (12) Hind wing. Venation after Forbes. (13) Microtrichia near inner apical margin of wing.

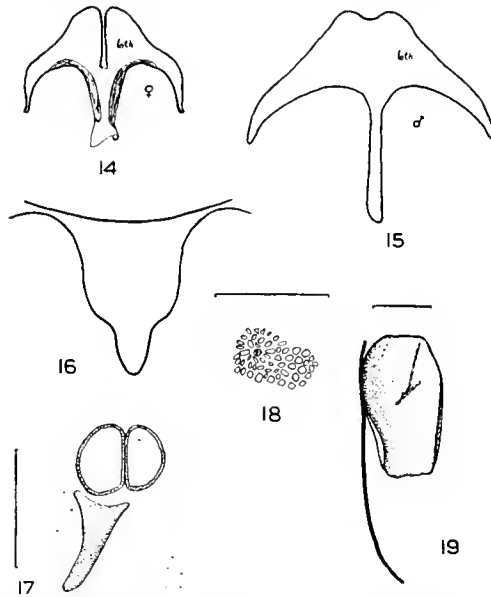
not concave; (6) apical margin of fifth abdominal segment as figured (text-fig. 10); (7) apical margin of sixth abdominal segment as figured (text-fig. 14); (8) spicule as figured (text-fig. 17).

The eggs are nearly round with a diameter of about 0.30 mm. The surface is densely reticulate throughout. The pattern near the micropyle is shown in text-fig. 18.

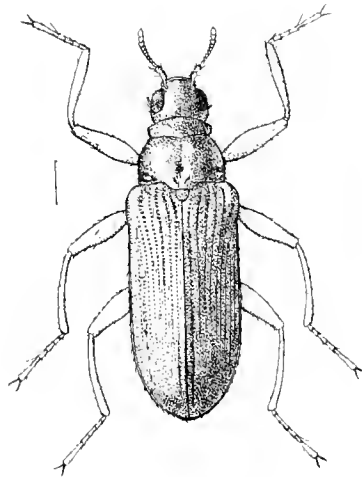
Type: ♂ in the collection of the British Museum (Nat. Hist.). MEXICO: Chinantla (Salle).

Specimens examined: Five with data as above. 784, MEXICO: Dist. de Temascaltepec, Temascaltepec, alt. about 5000 ft., vi-vii. 1933 (*H. E. Hinton*, *R. L. Usinger*) and vi-vii. 1934 (*H. E. Hinton*); 160, in the same district but at Tejupileo, 3500-4000 ft., vii. 1934 (*H. E. Hinton*); 217, MEXICO: Estado de Morelos, Cuernavaca, alt. 4800 ft., vi. 1934 (*H. E. Hinton*). 1, PANAMA: Bugaba

(*Champion*) and 1, Chargres Basin, Upper Pequini Riv. (*A. H. Jennings*). 2, COSTA RICA: San Jose, La Caja, ii-vii. 1932 (*H. Schmidt*).



TEXT-FIGS. 14-19.—*Hexanchorus gracilipes* Sharp. (14) Ventral view of sixth abdominal sternite of female. (15) Same of male. (16) Prosternum. (17) Spicule of female. (18) Pattern on surface of egg near microphyle. (19) Spicule of male.



20

TEXT-FIG. 20.—*Hexanchorus gracilipes* Sharp illustrated from the type.

Variations: The variations in the large series before me are mainly confined to size and slight differences in punctuation. In many specimens the greenish iridescence of the fine hairs on the dorsal surface is not present. The series from

Cuernavaca is with few exceptions greyer than those from other localities, and the size appears to be very slightly (0.20 mm.) but constantly greater (this has not been verified statistically). A few individuals have the third elytral interval feebly convex in the discal region.

Comparative notes: The secondary sexual characters plus the structure of the male genitalia will readily separate the male from all other described species. This species is probably nearest to *H. tarsalis* Hinton, from which the female may be distinguished at once by the elevated apices of the elytra and the deeper emargination of the apex of the fifth abdominal sternite.

Biology: They are found in small to large streams (1-30 metres) on the downstream sides of stones, where they are often present in large numbers above the water level. The writer has netted over 300 at one time from the side of a large stone. They appear to be feeding on the algae growing near the water level on such stones, and with sudden rises in the water level they are occasionally submerged for a few seconds, but this apparently does not alarm them, for they remain clinging to the same spot on the stone. When submerged they are completely surrounded by a film of air.

When the larvae are mature they crawl up a stone and burrow under the algal or moss matting, often more than three feet above the water level. Under this matting they construct a small cell in which they pupate. While in the water the larvae feed on decaying vegetable material, as may be seen from an examination of their gut contents.

PUPAE.

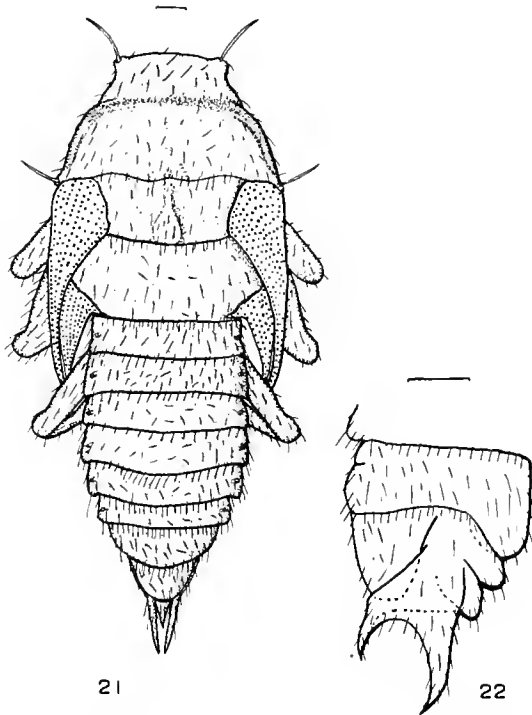
A single specimen was taken by peeling off the moss matting which was growing above the water level on a large stone in a torrential stream. The pupal cell was in the earth surrounding the roots of the moss, but the ventral side of the cell was formed by the surface of the stone. Since only a single pupa was taken it was allowed to mature for several days, and when it appeared the adult was about to emerge, it was preserved in spirit and determined beyond question as that of *H. gracilipes* by dissecting out the sclerotized parts of the male genitalia.

Description of Pupa of H. gracilipes Sharp.

(Text-figs. 21, 22.)

Male: Length, 4.25 mm.; breadth (across broadest point which is at base of prothorax), 1.32 mm. *Head* completely concealed from above by the pronotum. At middle near anterior margin of frons with a feeble, transverse gibbosity which is 0.20 mm. long and has on each side an acute tubercle which is 0.075 mm. high. Surface sparsely pubescent with fine, erect, pale hairs which are 0.07 mm. to 0.12 mm. long and are moderately densely distributed on the epicranium, genae and frons, but form a dense transverse row near anterior margin of frons, clypeus and labrum. Antennae extend posteriorly and downwards to a point exactly opposite posterior margin of front coxae. *Pronotum* similar in shape and various impressions to that of the adult; with two anterior and two posterior long stout spines as figured (text-fig. 21); surface clothed with hairs which are similar in length and density to those of the posterior region of the head. *Mesonotum* with a large oval gibbosity representing the scutellum beneath (text-fig. 21) on middle posterior margin, and from this gibbosity a fine carina extends along middle line to anterior margin. *Mesothorax* and abdominal

segments as figured; ninth at apex with a median dorsal and two lateral projections (text-figs. 21 and 22). Surface of these segments throughout pubescent as pronotum but slightly more finely and sparsely so. *Wings* with the anterior pair extending to ventral side, attaining middle of fourth abdominal segment, and near apex separated from each other by a distance equal to their greatest breadth; posterior wings similarly extending to ventral side but contiguous near apex and attaining middle of fifth abdominal segment. *Legs* with the front pair extending to posterior portion of metathorax and tarsi separated by half their own lengths from each other on the middle line of the body; second pair



TEXT-FIGS. 21, 22.—*Hexanchorus gracilipes* Sharp. (21) Dorsal view of pupa. (22) Left side of the end of the abdomen of the same.

extending to middle of first abdominal segment and with their claws contiguous; hind pair with the coxae, trochanters, base of femora, apex of tibiae and base of tarsi concealed by the hind wings; apical three segments of tarsi contiguous; claws attaining middle of sixth abdominal segment. *Abdominal spiracles* placed on dorso-lateral sides and opening at apices of small tubercles.

Specimen examined: MEXICO: Dist. de Temascaltepec, Temascaltepec, alt. about 5600 ft., vii. 1934 (*H. E. Hinton*).

LARVAE.

The larva of *H. gracilipes* has been definitely determined as such, for the cast skin of the last instar larva was found in the same cell as the pupa. In 1937 three species of larvae which apparently belong to the genus *Hexanchorus* were collected in South America. Of these, one can be reasonably determined by

elimination and locality as that of *H. tibialis* Hinton. Of the two remaining, one is from French Guiana, a region from which until now no adults have been recorded, and the other was collected in Brazil without adults. The latter, which was collected in localities as far apart as 1000 miles, may be *H. thermarius* Coquer. or a new species. No exact locality record is extant for *thermarius*, but if it is ever collected in the Amazon basin it may be reasonably associated with this larva, which seems to be the common and possibly only one here. In addition to these I have been able to study the larvae of *H. tarsalis* Hinton collected by Dr. Fritz Plaumann in the same locality as the adult type. A key to the five species is given below, and the two undetermined species are included, for names can be assigned to them with reasonable certainty as soon as the adults are recorded from the same region. In no known case does the distribution of one species of *Hexanchorus* overlap that of another.

A KEY TO THE LARVAE OF THE SPECIES OF *Hexanchorus*

1. Head with one ocellus on each side 2.
 Head with more than one ocellus on each side 3.
2. Mesothoracic and abdominal spiracles opening at the apices of very long and slender spines; ninth abdominal tergite strongly emarginate at apex; tergites of mesothorax and first two abdominal segments densely and evenly tuberculate. FRENCH GUIANA (St. Laurent du Maroni) *H. sp. ?*
 Mesothoracic and abdominal spiracles not opening on the apices of very long and slender tubercles; ninth abdominal tergite truncate at apex; mesothorax and first two abdominal segments with complete and transverse belts free of tubercles on anterior and middle part of each tergite. BRAZIL (Manaos, Belem) *H. sp. ?*
3. Head with six ocelli on each side. Mesothoracic and abdominal spiracles opening at the apices of large and conspicuous tubercles. CENTRAL AMERICA *H. gracilipes* Sharp.
 Head with five ocelli on each side 4
4. Mesothoracic and abdominal spiracles not opening on large tubercles. BOLIVIA (Yungas Valley) *H. tibialis* Hinton.
 Mesothoracic and abdominal spiracles opening at the apices of large and conspicuous tubercles. BRAZIL (Santa Catharina) *H. tarsalis* Hinton.

From a study of these five species a brief generic diagnosis may be made, since it is now possible to distinguish between those characters that are of specific and those that are of generic importance.

Generic Characters of Larvae of Hexanchorus.

Body parallel, cylindrical. *Head* when viewed dorsally exposed and not concealed by the pronotum; anterior margin between base of antenna and clypeus toothed; with one to six ocelli on each side. Antenna 3-segmented, not retractile. Mandibles of both sides similar and with three obtuse apical teeth; protheca long, slender, and densely spinose. Maxilla with the palp 4-segmented and stipes showing no differentiation into a palpifer; galea and lacinia separate and apex of each densely spinose. Labium with the post-mentum

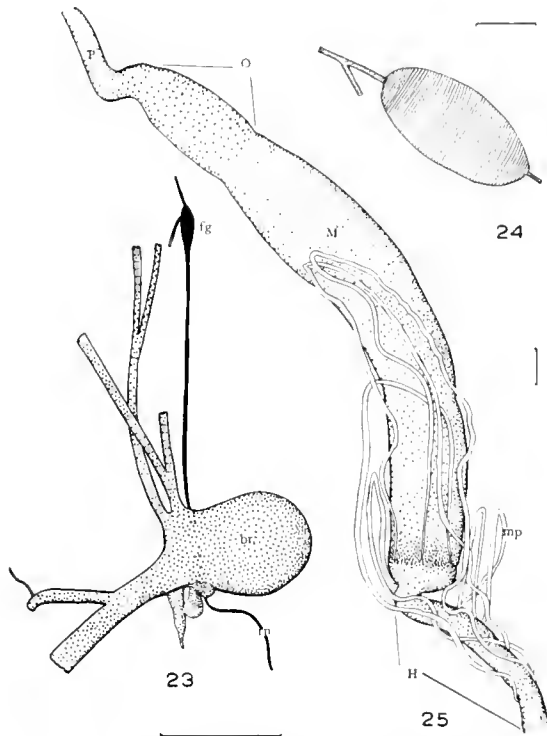
undivided and the submentomental muscles absent; labial palp 2-segmented and prementum with a palpiger. Gula well developed. *Prothoracic pleura* divided into three parts on each side, while those of the meso- and metathorax are divided into two parts. Prosternum divided into an anterior and a posterior sclerite; other thoracic segments with the sternum not divided. First six abdominal segments with pleura bounded by tergo- and sterno-pleural sutures; segments seven and eight forming complete sclerotized rings. Operculum with two strongly sclerotized claws attached to its dorsal membrane. Apex of ninth segment rounded to strongly emarginate. *Spiracles* present on mesothorax and first eight abdominal segments, and they may open at the level of the cuticle or on prominent spines or tubercles; sometimes they are present a short distance from the median line on each side and again in some species they are found only on the lateral margins. Tracheae with a number of well-developed air sacs or without any. Three tufts of retractile, anal, tracheal gills are present. *Alimentary canal* (text-fig. 25) with the six Malpighian tubules ending freely in the body cavity near the rectum. *Central nervous system* with three thoracic and eight abdominal discrete ganglia.

Description of Mature Larva of H. gracilipes.

(Text-figs. 23-47.)

Length, 5.1 mm.; breadth (across broadest point, which is at base of mesothorax), 1.5 mm. Elongate, subparallel, and cylindrical to subtriangular in cross section. Cuticle brownish; with the antennae, mouth-parts and legs paler brown to testaceous. *Head* slightly broader than long (0.65 mm. : 0.55 mm.); posterior margin broadly emarginate at middle; coronal suture short; frontal sutures beginning on posterior sixth of head and diverging forwards to meet anterior margin opposite base of antenna on each side; anterior margin between base of antenna and clypeus narrowly projecting forwards as far as the anterior margin of the clypeus. Cuticle sparsely pubescent with fine, erect hairs which are about 0.12 mm. long; finely and densely alutaceous throughout; anterior five-sixths set with round, convex tubercles which are about 0.04 mm. broad and are usually separated by less than to one and a half times their diameters; each tubercle with a coarse hairy seta which is at most slightly longer than the diameter of the tubercle from which it arises; dorsally with the basal sixth and ventrally with the basal fifth free of tubercles. Eyes of five large and one smaller and slightly ventral ocellus. Antenna (text-fig. 27) not retractile. Clypeus nearly as long as second segment of antenna; anterior margin feebly and broadly emarginate, nearly truncate, with the angle on each side broadly rounded. Labrum as figured (text-fig. 30), epipharynx entirely membranous. Mandible (text-fig. 28) with three, short, obtuse apical teeth; outer lateral side with a small hairy seta; prostheca (p) long and densely spinose. Maxilla (text-fig. 29) with the setae as figured. Labium (text-fig. 26) with the setae as figured. *Thoracic and abdominal tergites* for the most part sculptured as frontal region of head but with the tubercles slightly larger and also with two other types of tubercles as follows: (1) Median and lateral well-defined areas on thoracic and first six abdominal segments (text-fig. 34) with very dense tubercles (text-fig. 31) which are about half normal size; and (2) tubercles about three-fourths the size of the latter, nearly as dense, and occurring on irregular areas near the median line of the thoracic and first five abdominal segments. The sculpture of

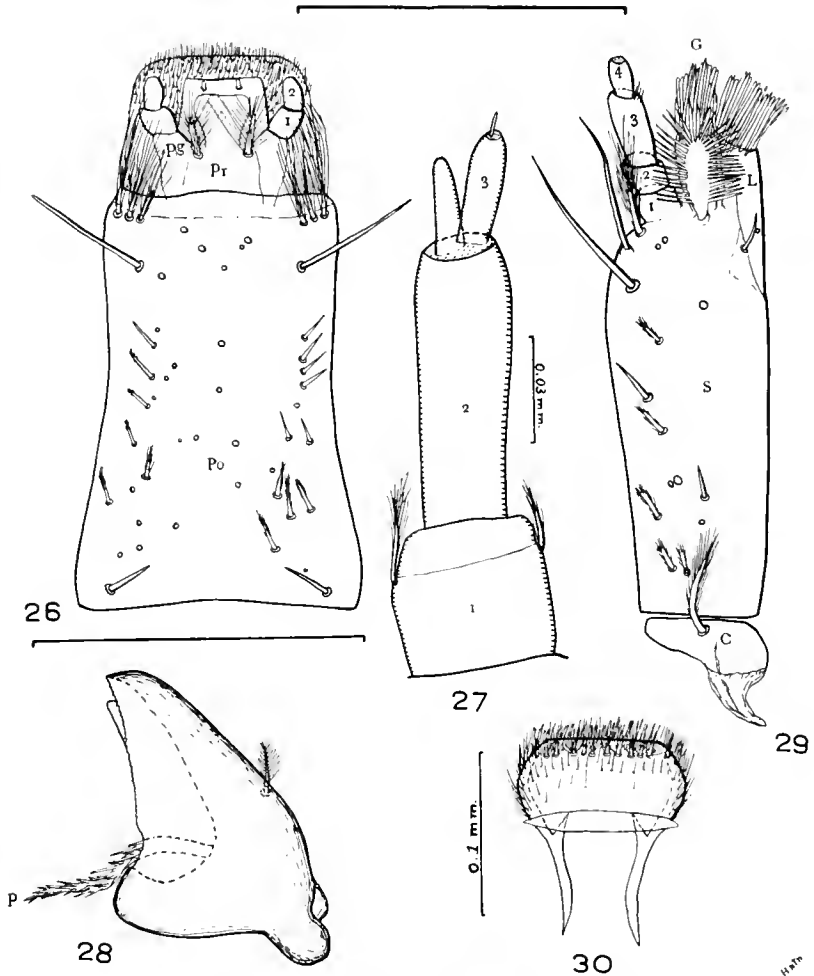
a section on the right side of the fifth abdominal segment is figured (text-fig. 36) ; posterior margin with a single row of tubercles (text-fig. 39) similar to the posterior row of all segments except ninth abdominal which has no special posterior row ; lateral margins of thoracic segments with two close and complete parallel rows of tubercles from which arise long, flat setae (text-fig. 40) ; lateral margins of first eight abdominal segments tuberculate as lateral margins of thorax but with the dorsal row of tubercles present only posteriorly ; ninth abdominal segment without a distinct lateral margin and with the sides throughout tuberculate as on dorsum. Thoracic and abdominal tergites gibbous and depressed



TEXT-FIGS. 23-25. (23) Brain of *Hexanchorus* sp. (24) Tracheal air sac of *Hexanchorus* sp. ? (25) Alimentary canal of *Hexanchorus gracilipes* Sharp. (*br*) brain (*fg*) frontal ganglion of stomodeal nervous system ; (*H*) hind gut ; (*M*) mid-gut ; (*mp*) Malpighian tubule ; (*O*) oesophagus ; (*P*) pharynx.

as shown in text-fig. 32 ; ninth abdominal segment with the apex rounded (text-figs. 32 and 43). *Sternum* of thorax and first abdominal segment sclerotized as figured (text-fig. 41). First six abdominal segments with pleura bounded by tergo- and sterno-pleural sutures ; segments seven and eight forming complete sclerotized rings, though in some species there is a pale line on these two segments which is apparently the trace of a sterno-pleural suture. Cuticle tuberculate similarly to dorsum but with the tubercles slightly finer and without areas of fine, dense tubercles. Operculum (text-fig. 42) with two toothed claws attached to its dorsal membrane (text-fig. 47). Legs with the front pair shortest and the hind pair longest ; posterior legs sculptured similarly to front legs (text-fig. 35).

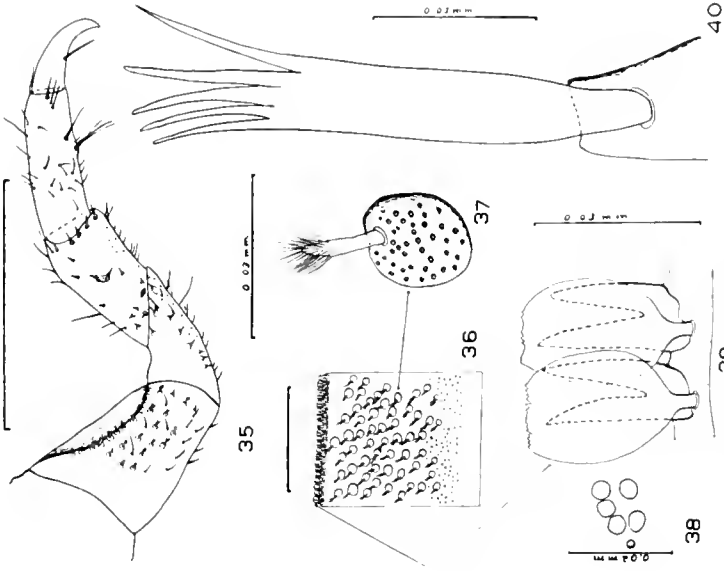
Spiracles opening on the apices of large tubercles which on the mesothorax are lateral on anterior third of segment and on first seven abdominal segments are laterally on posterior third, while on the eighth the tubercles are on the apices of the median gibbositities; spiracles all similar in structure to that of the last abdominal segment (text-figs. 45 and 46).



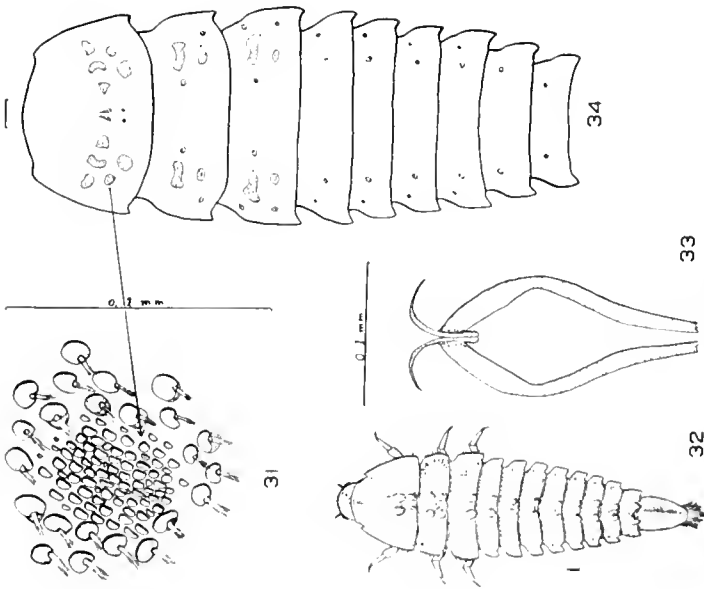
TEXT-FIGS. 26-30.—Larva of *Hexanchovus gracilipes* Sharp. (26) Ventral view of labium. Setae of apical portion of the prementum are only approximately correct. (27) Antenna. (28) Ventral view of left mandible. (29) Ventral view of right maxilla. Apical spines of galea and lacinia only approximately correct. (30) Dorsal view of labrum with the setae drawn to give the general appearance.

Specimens examined: MEXICO: 14, Dist. de Temascaltepec, Real de Arriba, alt. 6000-7000 ft., Temascaltepec, alt. 5600 ft., and Tejupilco, alt. 3500-4000 ft., all in vi-vii. 1934 (*H. E. Hinton*); 12, Estado de Morelos, Cuernavaca, alt. 4, 800 ft., vi. 1934 (*H. E. Hinton*).

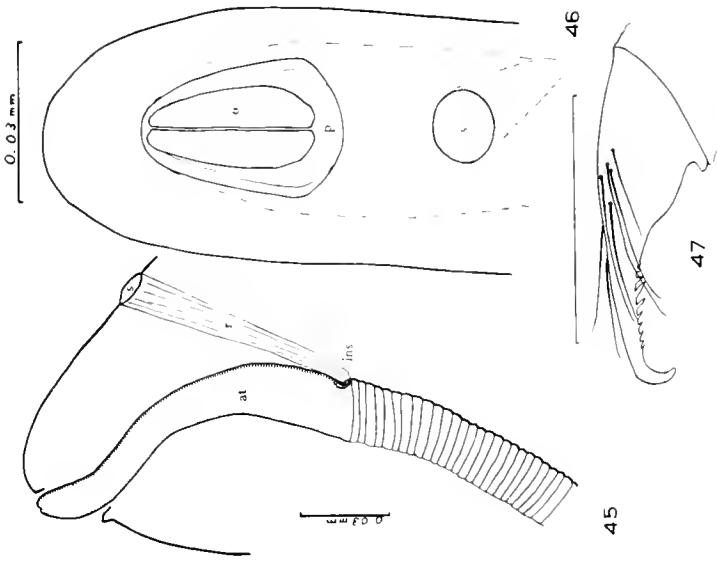
All the larvae before me are apparently mature.



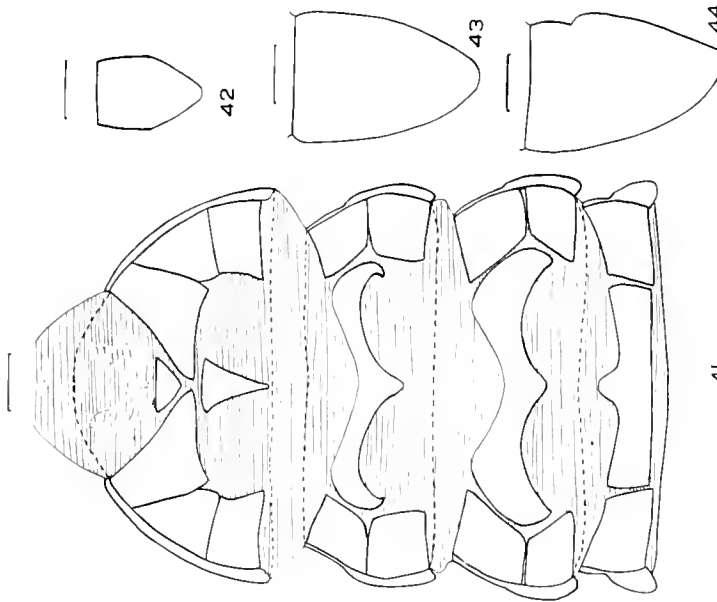
TEXT-FIGS. 35-40.—Larva of *Hexanchorus gracilipes* Sharp. (35) Posterior outer view of right front leg. (36) Left side of the middle of fifth abdominal tergite. (37) Enlarged view of one of the tubercles of the fifth abdominal tergite. (38) Eye to show arrangement of ocelli. (39) Part of the posterior marginal row of setae of the fifth tergite. (40) Seta from lateral marginal row of mesothorax.



TEXT-FIGS. 31-34.—Larva of *Hexanchorus gracilipes* Sharp. (31) Enlarged portion of tuberculate area of pronotum. (32) Dorsal view of larva to show general appearance. (33) Dorsal view of oesophageal sclerite. (34) Dorsal view of thorax and first six abdominal segments to show the distribution of the densely tuberculate areas.



TEXT-FIGS. 45-47.—Larva of *Hexanchorus gracilipes* Sharp. (45) Lateral view of last abdominal spiracle. (46) Dorsal view of same. (47) Dorsal view of right opercular claw. (at) atrium; (ins) inner scar; (p) peritreme; (r) remnant of preceding spiracle; (s) outer scar of preceding spiracle opening to atrium.



TEXT-FIGS. 41-44.—Larva of *Hexanchorus gracilipes* Sharp. (41) Ventral view of thorax and first abdominal segment to show sclerites. (42) Operculum. (43) Dorsal view of ninth abdominal segment. (44) Left lateral view of same.

PHANOCERUS Sharp.

1882. *Phanocerus* Sharp, *Biol. Centr.-Amey. Col.*, **1** (2) : 128.

1896. *Phanocerus* Grouvelle, *Bull. Soc. ent. Fr.* : 78.

Body elongate, subparallel; clothed for the most part with moderately long and dense, usually recumbent hairs. *Head* when seen from below not capable of being retracted into the prothorax beyond the base of the prementum. Antennae as figured (text-fig. 54) with the last six segments forming a compact club. Mandible with two acute apical teeth; with a well-developed but entirely membranous prostheca. Maxillary palp (text-fig. 53) 4-segmented and stipes with a well-developed palpifer; galea and lacinia separate and each densely spinose. Labial palp (text-fig. 52) 3-segmented and prementum with a well-developed palpiger. Mentum shorter and narrower than submentum; submentum (text-fig. 55) strongly concave posteriorly and at middle forming a slight depression which is partly under the anterior margin of the gula. *Pro-notum* (text-fig. 56) with a broad longitudinal impression on each side, which anteriorly turns outwards to meet the lateral margin at apical half. *Elytra* punctate and striate. Without accessory striae and without longitudinal carinae. Hind wing (text-fig. 57) without an anal cell or radial cross vein; with the first branch of the second anal absent; first anal very short, present only distally and not connected to cubito-anal cross vein; cubito-anal cross vein joining second anal to cubitus. *Prosternum* moderately short in front of the anterior coxae; process long and acute. Mesosternum anteriorly with a narrow groove for the reception of the prosternal process; this groove merges posteriorly into a larger and deeper depression the posterior margin of which is formed by the metasternum. Metasternum with a complete longitudinal impressed line. Abdomen with the sixth ventral segment not externally visible. *Legs* with the anterior trochantin visible externally only if coxae are rotated caudally. Claws without teeth. *Alimentary canal* (text-fig. 58) with eight caeca on the anterior margin of the mid-gut. Hind gut with six Malpighian tubules which extend forwards, often as far as the prothorax, and end freely in the body cavity near the rectum. *Male reproductive system* (text-fig. 60) with two sperm tubes to each testis, and with the testes always in the abdomen, seldom being as far forwards as the first segment; vas deferens with the proximal ectodermal part swollen to serve as vesiculae seminalis which are connected to the ejaculatory duct proximally to the two pairs of accessory glands. Accessory glands with the median pair dorsal and much shorter than the slightly ventral and lateral pair. Female reproductive organs (text-fig. 59) with nine egg tubes to each ovary. Spermathecal duct opening into bursa copulatrix near base. *Central nervous system* (text-fig. 61) with the thoracic ganglia not fused and with the first abdominal ganglion fused to the third thoracic, third to fourth discrete, and five to eight partly fused together. Stomodaeal nervous system with the occipital ganglion unpaired (text-fig. 61).

GENOTYPE: *Phanocerus clavicornis* Sharp.

The internal anatomy of two species was studied, a new one from Bolivia and *P. congener* Grouvelle from Trinidad. The new species is illustrated. Both agree in all essential details. The relative size of both reproductive systems, though particularly that of the male, differs enormously according to the sexual phase of the individual.

This genus is not close to any other in the Larini, though this is not so evident from the structure of the adults, which in many ways is close to *Hexanchorus*,

as from that of the larvae. The larvae are very different from all known larvae of the tribe, but very close to those of *Phanoceroïdes* Hinton (Elmini).

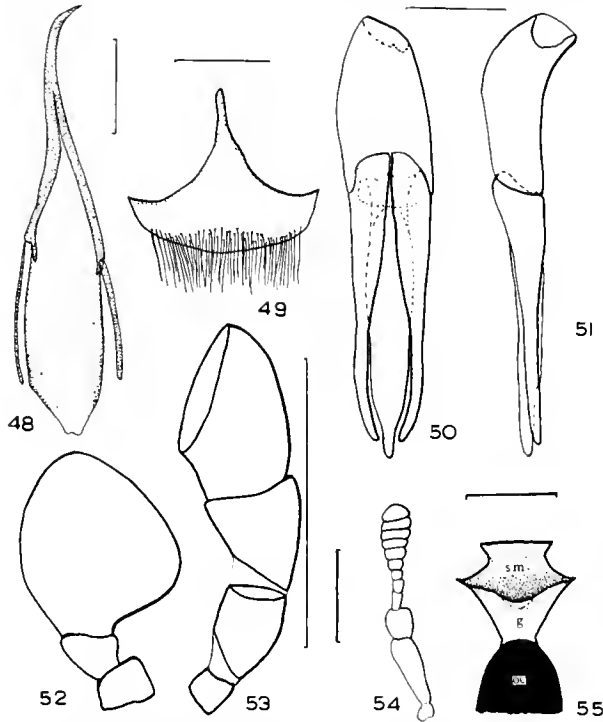
The species are widely distributed in America, including the West Indies. The most northern record is that of *Phanocerus clavicornis* found in Texas.

***Phanocerus clavicornis* Sharp.**

(Text-figs. 48-61.)

1882. *Phanocerus clavicornis* Sharp, *Biol. Centr.-Amer. Col.*, I (2) : 120, t. 4, f. 8.
 1911. *Phanocerus clavicornis* Schaeffer, *J. N.Y. ent. Soc.*, 19 : 118.
 1937. *Phanocerus clavicornis* Hinton, *Ent. mon. Mag.*, 73 : 95.

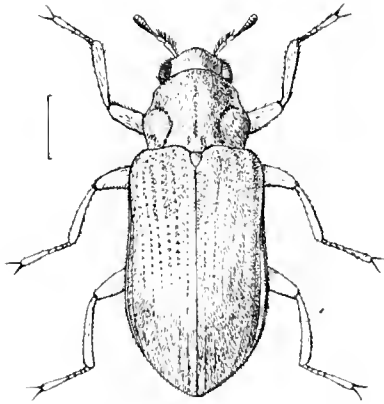
Male: Length, 2.0 mm.-3.0 mm.; breadth (across humeri which is the broadest point), 0.85 mm.-1.1 mm. Elongate, subparallel, moderately convex.



TEXT-FIGS. 48-55.—*Phanocerus clavicornis* Sharp. (48) Spicule of male. (49) Ventral view of sixth abdominal sternite of male. (50) Dorsal view of male genitalia. (51) Right lateral view of same. (52) Labial palp. (53) Maxillary palp. (54) Antenna. (55) Submentum (*sm*) and gula (*g*).

Dorsal surface clothed with partly erect brownish hairs which are about 0.05 mm. long and are usually separated from each other by about a third of their lengths; also more densely clothed with hairs which are finer, about a third as long, and frequently in certain lights golden and shining. Ventral surface for the most part with only the longer hairs which are here recumbent and frequently so dense that the cuticle beneath cannot be seen. Cuticle shining and rufo-piceous to pale brown; mouth-parts, basal segments of antennae, and legs paler. *Head* without distinct impressions. Eyes narrowed posteriorly; margins around eyes

laterally and posteriorly with very long, stout, black setae which curve across the eye and generally meet about middle over eye. Antenna as figured (text-fig. 54). Surface with punctures which are usually round, about 0.010 mm. broad, and are contiguous to separated by once their diameters. Clypeus with the anterior margin truncate and the angle on each side broadly rounded. Labrum with the anterior margin feebly, broadly, arcuately emarginate, and with the angle on each side broadly rounded; anterior margin except at middle with a dense fringe of long testaceous hairs and on each side just behind angle with a tuft of longer and denser hairs. Gula and submentum as figured (text-fig. 55); mentum with the anterior margin truncate or at most very feebly rounded. *Pronotum* across broadest point, which is at basal two-fifths, broader than long (0.92 mm. : 0.77 mm.) and base broader than apex (0.87 mm. : 0.60 mm.). *Pronotum* as figured (text-fig. 56); surface similarly but more sparsely punctate



56

TEXT-FIG. 56.—*Phanocerus clavicornis* Sharp.

than head. *Elytra* between humeri and apical two-fifths nearly parallel. Humeri feebly gibbous. Apices conjointly, feebly rounded but the apex of each elytron is itself feebly rounded. Lateral margins smooth. Intervals flat and surface of each punctate as pronotal disk. Striae feebly impressed but narrower and slightly deeper towards apex; strial punctures on disc round to subquadrate, separated longitudinally by about their diameters, and from a half to a third as broad as intervals; towards sides these punctures become a little finer, but towards apex much finer so that on apical fourth they are seldom as much as one-third as broad as an adjacent interval. *Scutellum* flat, broader than long (0.12 mm. : 0.10 mm.), with the base broadly arcuate and posteriorly coming to a rounded point. *Prosternum* moderately short in front of anterior coxae. *Metasternum* with an impressed median longitudinal line which suddenly broadens out and becomes deeper near anterior margin; anterior margin on each side projecting slightly, but distinctly over depression formed by the median line. Abdomen with the apical margin of the fifth sternite broadly rounded. Sixth sternite as figured (text-fig. 49). Spicule as figured (text-fig. 48). *Genitalia* as figured (text-figs. 50, 51).

Female: Externally similar to male except as follows: (1) The posterior

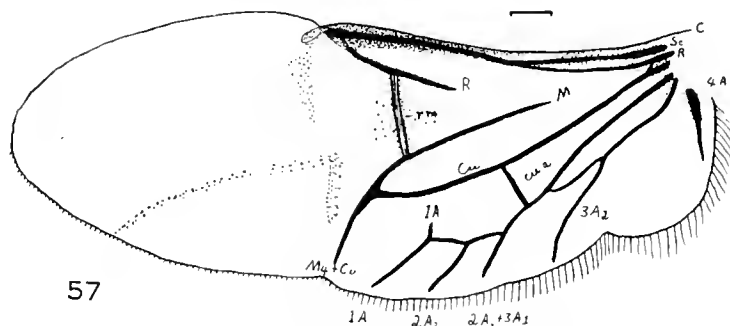
projection of the concealed sixth abdominal sternite is much longer; (2) the spicule of the male has no homologous sclerotized part in the female. Eggs are oval to nearly round, and the surface is marked with a close network of cells which are usually round.

Type: In the British Museum (Nat. Hist.). GUATEMALA: Vera Paz, Corban (*Champion*).

Specimens examined: 6, with same data as above, 2, MEXICO: Dist. de Temascaltepec, Real de Arriba, alt. 6000–7000 ft., vii. 1933 (*H. E. Hinton*, *R. L. Usinger*); 2, MEXICO: Estado de Morelos, Cuernavaca, vi. 1934 (*H. E. Hinton*). 160, BRAZIL: Santa Catharina, Nova Teutonia, 1934–1935 (*F. Plaumann*).

Other records: This species has been recorded from Texas by Schaeffer (1911).

Variations: The absolute length and breadth in the series before me vary very much. The elytral striae punctures in some rare individuals may be only two-thirds as large and dense as in the specimen described.



TEXT-FIG. 57.—Wing of *Phanocerus clavicornis* Sharp. Venation after Forbes.

Comparative notes: This is the only genus known to me in the Larini in which there are apparently no differences in the structure of the male genitalia of the different species. My figures of the male genitalia of *P. clavicornis* will apply equally well to seven species before me.

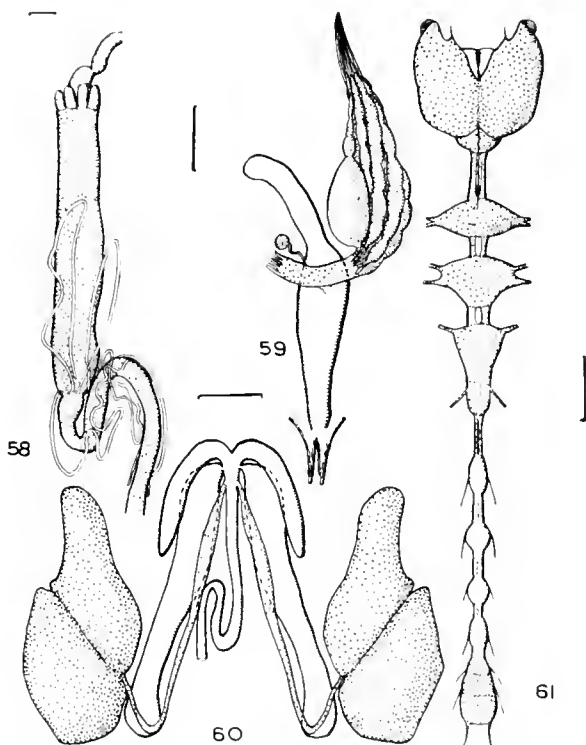
There have been two other species described from continental America, one from Columbia and the other from Argentina, but both are known to me only from descriptions which are so inadequate that I am unable to say in what manner, if any, they differ from *P. clavicornis*.

Biology: This species is generally found feeding on algae growing above the water level on stones and sticks either in the stream or lying along the margin. It may enter the water to oviposit, but is not generally found below the water level as is the allied *Phanoceroidea*.

LARVAE.

By elimination and according to locality the larvae of several species of *Phanocerus* have been associated with their adults. Although no evidence as conclusive as breeding is available, I regard the generic determination of these larvae as fairly certain for the following reasons: (1) the distribution of the larvae exactly coincides with that of the adults over North and South America; (2) in Central Mexico, the Yungas Valley of Bolivia, and Trinidad, B.W.I., where

I have made very large collections of the Elmidae, the larvae of all other genera (except in Mexico where the larvae of *Xenelmis* and *Austrolimnius* are still unknown) have been determined (those of *Xenelmis* and *Austrolimnius* must be too small to be confused with *Phanocerus*); (3) the mature larva is of a size to produce an adult equal in size to *Phanocerus*; and (4) in the streams about Manaos, Brazil, *Phanocerus* seems to be replaced by the closely allied genus *Phanoceroïdes*, and the larvae of the latter are very nearly related to the larvae I consider to belong to *Phanocerus*.



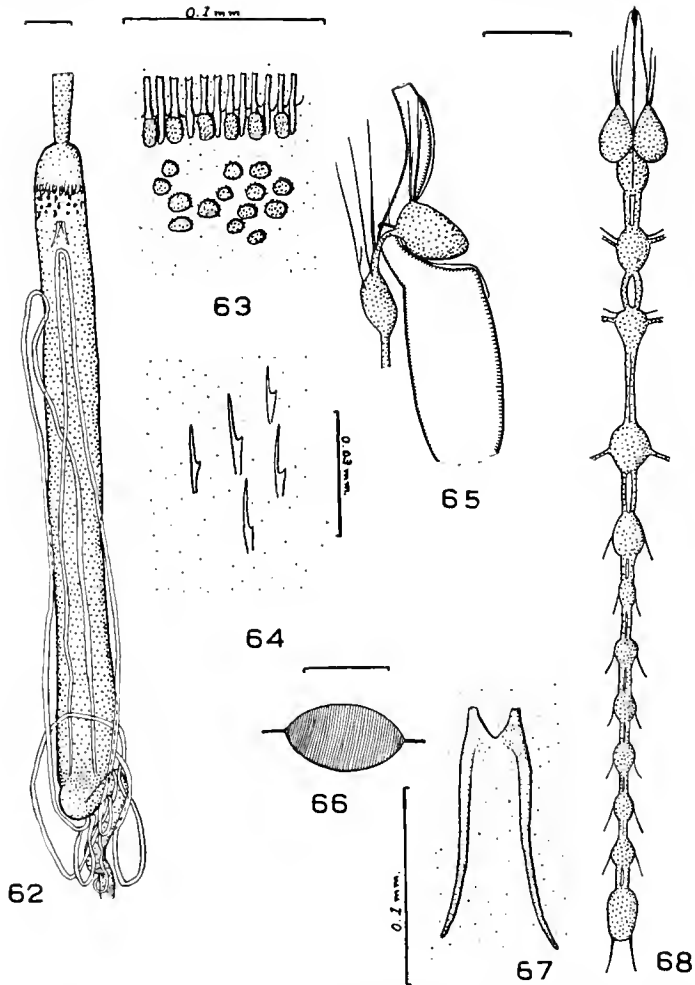
TEXT-FIGS. 58-61.—*Phanocerus clavicornis* Sharp. (58) Alimentary canal. (59) Female reproductive system. (60) Male reproductive system. (61) Central and stomodeal nervous systems.

From a study of the larvae before me, it has been possible to draw up a brief generic characterization of *Phanocerus*.

Generic Characters of Larvae of Phanocerus.

Flattened, subparallel. *Head* when viewed dorsally exposed and not concealed from above by the pronotum. With one ocellus on each side. Antenna 3-segmented, not retractile. Clypeus completely fused with the frons. Mandibles of both sides similar and with three subacute apical teeth; prostheca long, slender and densely hairy. Maxilla with the palp 4-segmented and stipes showing no differentiation into a palpifer; galea and lacinia separate and apex of each densely spinose. Labium with the postmentum undivided; palp 2-segmented, prementum without a palpiger. *Prothoracic pleura* divided into two parts and with the anterior part meeting on the middle line. Meso- and metathoracic pleura

divided into two parts on each side. First eight abdominal segments with pleura bounded by tergo- and sterno-pleural sutures. Operculum with two strongly sclerotized claws attached to its dorsal membrane. Apex of ninth segment rounded or strongly emarginate. *Spiracles* annular and biforous; present on mesothorax

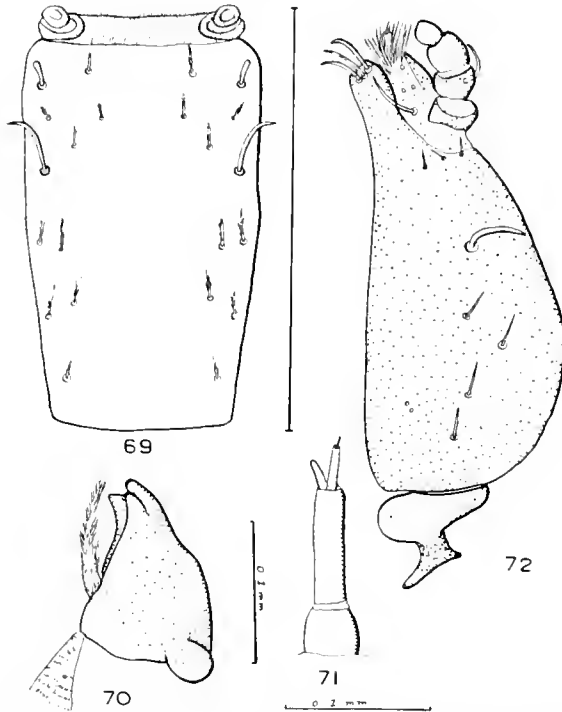


TEXT-FIGS. 62-68.—Larva of *Phanocerus clavicornis* Sharp. (62) Alimentary canal. (63) Oesophageal ring of tubercles and spines. (64) Portion of oesophagus anterior to ring to show shape and distribution of spines. (65) Left lateral view of brain. (66) Tracheal air sac. (67) Oesophageal sclerite. (68) Dorsal view of central and stomodeal nervous systems.

and first eight abdominal segments and opening at the cuticle level or on the apices of small tubercles. Tracheae with a number of well-developed air sacs. Three tufts of retractile, anal, tracheal gills are present. Alimentary canal with a dorsal oesophageal sclerite and anterior to this with a complete ring of spines and tubercles. With six Malpighian tubules which end freely in the body cavity generally near the rectum. *Central nervous system* (text-fig. 68) with three thoracic and eight abdominal discrete ganglia.

Description of Mature Larva of P. clavicornis.
(Text-figs. 62-83.)

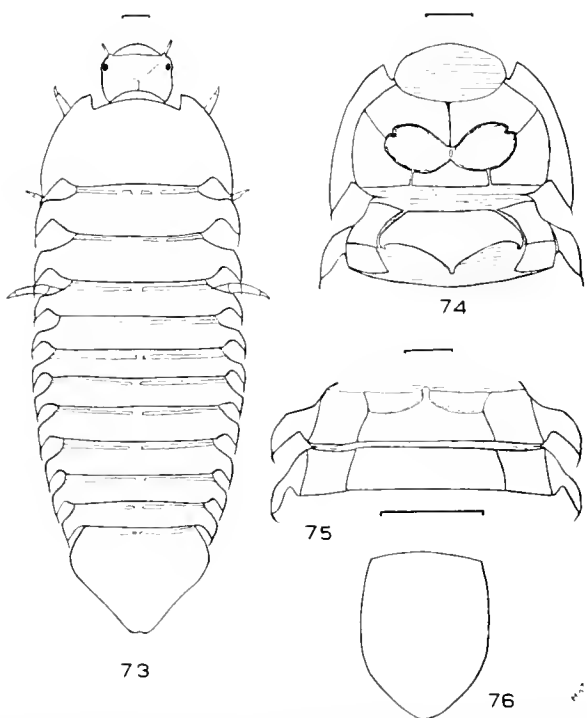
Length, 5.0 mm.; breadth (across broadest point which is near base of metathorax), 1.5 mm. Cuticle brownish-testaceous to brown. *Head* rectangular, longer than broad (0.50 mm. : 0.42 mm.); coronal suture straight and 0.22 mm. long; frontal suture extending nearly in a straight line on each side to margin of head opposite base of antenna. Cuticle on basal belt nearly as long as epicranial



TEXT-FIGS. 69-72.—Larva of *Phanocerus clavicornis* Sharp. (69) Ventral view of labium. Setae of prementum are only approximate. (70) Ventral view of left mandible. (71) Dorsal view of right antenna. (72) Ventral view of left maxilla. Spines on apex of galea are only approximately correct.

(coronal) suture not punctate, elsewhere with round punctures which are about 0.013 mm. broad and are separated usually by less than to once their diameters; from these punctures arise fine setae which are only slightly longer than the diameters of their respective punctures. With a single ocellus on each side. Antenna as figured (text-fig. 71). Clypeus fused to the front of the head and fronto-clypeal suture not visible even when the head is cleared and stained. Labrum transverse (0.16 mm. : 0.10 mm.); anterior margin feebly arcuate and with the angle on each side broadly rounded; epipharynx smooth. Mandible (text-fig. 70) with three subacute apical teeth; outer lateral side apparently without setae; with a long, narrow, slender, and hairy prostheca. Labium with the setae as figured (text-fig. 69). Maxilla with the setae as figured (text-fig. 72). *Thoracic and abdominal terga* with proportions as shown in text-fig. 73. Surface throughout punctate as frontal region of head but with the punctures slightly

larger and sparser; anterior part of each segment except pronotum with a transverse row of acute tubercles and large flat setae (text-figs. 79 and 81); a belt anterior to this is always finely and transversely rugose (text-figs. 79 and 82); at middle each row is interrupted by a space of about 0.07 mm. to 0.10 mm., and this row is also interrupted laterally on meso- and metathorax (text-fig. 73); at the posterior lateral apex of each segment is a very long and narrow seta (text-fig. 83); lateral ventral margins of each segment have a single row of seta (text-fig. 80). The posterior margin of each segment except ninth has a complete row of large,

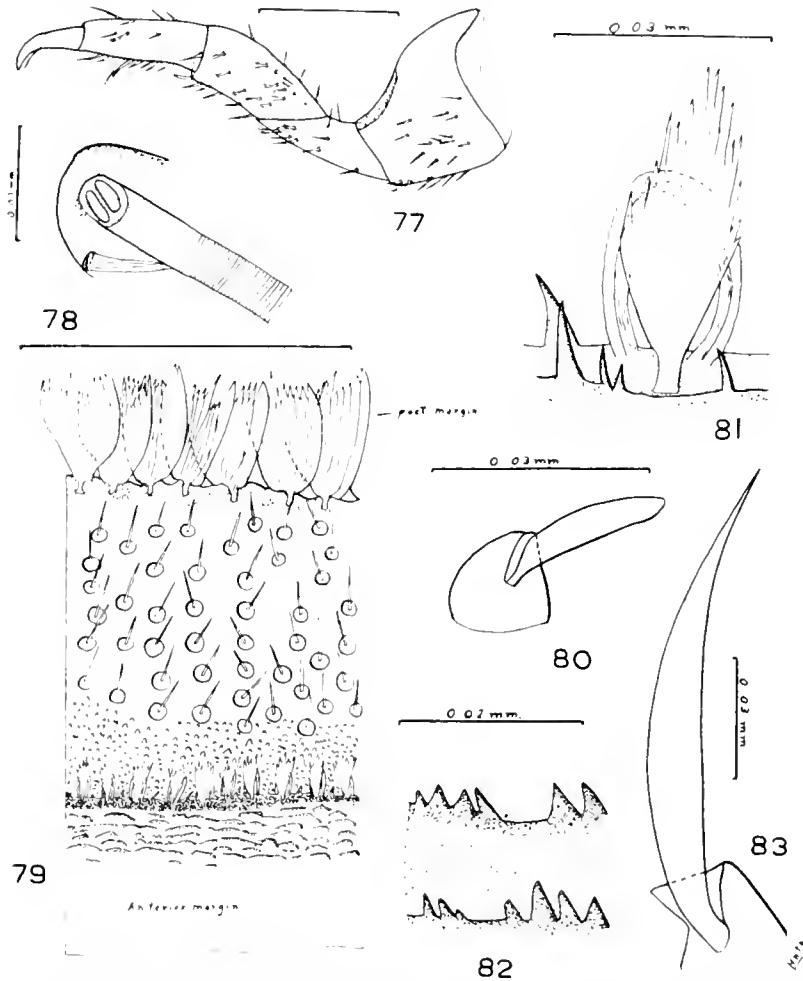


TEXT-FIGS. 73-76.—Larva of *Phanocerus clavicornis* Sharp. (73) Dorsal view of larva to show general shape. (74) Ventral view of pro- and mesothorax to show sclerites. (75) Ventral view of first two abdominal segments to show sclerotization. (76) Operculum.

flat, partly overlapping setae (text-fig. 79). *Sternum* of pro- and mesothorax sclerotized as figured (text-fig. 74); sternum of metathorax similar to that of mesothorax. First two abdominal sterna as figured (text-fig. 75); sterna of abdominal segments three to eight sclerotized similarly to that of second; ninth sternum with an apical operculum (text-fig. 76) which has attached to its dorsal membrane two well-sclerotized claws. Surface of sterna of thoracic and abdominal segments finely and sparsely setose, but anterior third of abdominal pleura with a transverse row of larger and denser setae. *Legs* all fairly close in size and chaetotaxy to front leg (text-fig. 77). *Spiracles* opening laterally on mesothorax and first eight abdominal segments; all similar to that of fifth abdominal segment (text-fig. 78); with the cuticle around each of the spiracles slightly elevated but not forming well-developed tubercles. On each side of the gut there are seven tracheal air sacs (text-fig. 66) which occupy a position from first to sixth abdominal

segments. *Alimentary canal* as figured (text-fig. 62). *Central nervous system* as figured (text-fig. 68).

Immature stages: Before me are larvae representing at least two earlier instars, but these apparently differ only in size from the mature larvae.



TEXT-FIGS. 77-83. Larva of *Phanoicus clavicornis* Sharp. (77) Anterior face of right front leg. (78) Fifth abdominal spiracle. (79) Third abdominal tergite on right side of middle line. (80) A seta of the ventral and lateral marginal rows. (81) Flat seta of anterior row of third tergite. (82) Section of anterior rugose belt of third tergite. (83) Seta of posterior lateral apex of third tergite.

Biology: The larvae are found in small to large streams (about 1-30 metres) of fast and clear water. They seem to prefer the swifter parts of the streams. Examination of the gut contents of a number of specimens seems to show that they are living on algae (diatoms, etc.).

Specimens examined: 50, MEXICO: Estado de Morelos, Cuernavaca, alt. 4800 ft., vi.1934 (*H. E. Hinton*); 32, MEXICO: Dist. de Tehuacaltepec, alt.

3500-7000 ft., vi-vii, 1933 (*H. E. Hinton, R. L. Usinger*) and vi-vii, 1934 (*H. E. Hinton*); 7, GUATEMALA: Escuintla, El Salto, 1100 ft., 1934 (*F. X. Williams*).

THE MEXICAN ELMINI.

TOLRIOLUS, gen. n.

Body subparallel. Non-tomentose areas clothed with sparse and short, recumbent hairs; fine scale-like or hairy tomentum confined to the following areas: (1) genae; (2) epipleura; (3) hypomera; (4) sides of prosternum, mesosternum, metasternum, and abdominal sternites; and (5) most of femora. *Head* when seen from below capable of being retracted so that none of the mouth-parts is visible. Antennae 11-segmented. Mandibles with three blunt apical teeth; prosthema entirely membranous and with numerous fine spines or hairs apically. Maxilla with the palp 4-segmented (text-fig. 87) and stipes with a well-developed palpifer; galea and lacinia separate and apex of each spinose. Labium with the palp 3-segmented and prementum without a distinct palpiger. Mentum transverse and as broad as, but only half as long as, submentum. Gula at anterior margin three-fifths as broad as submentum, with the sides converging so that at posterior margin it is only half as broad as submentum, and about a fifth longer. *Pronotum* with the anterior margin moderately arcuate at middle and on each side behind eye before apical angle deeply and broadly sinuate; base broadly and moderately deeply sinuate on each side and feebly rounded in front of scutellum. *Pronotum* with a sublateral carina on each side extending from near base nearly to anterior margin; disk without distinct impressions. *Elytra* punctate and striate; each elytron with a single prominent sublateral carina on eighth interval. Hind wing (text-fig. 93) without a radial cross vein or an anal cell; first anal absent; second anal with the second branch absent; third anal with the second branch absent; fourth anal well-developed; and cubito-anal cross vein complete and joining cubitus to second anal. *Prosternum* very long in front of anterior coxae; process as figured (text-fig. 91). *Mesosternum* with a broad and moderately deep groove for the reception of the prosternal process. *Metasternum* with a median longitudinal impressed line. *Legs* with the visible portion of the front coxae rounded and the trochantin completely concealed by the hypomera and sternum. Claws each with a large and acute sub-basal tooth (text-fig. 99).

GENOTYPE: *Limnius ungulatus* Hinton.

No properly preserved specimens have been available for a study of the internal anatomy.

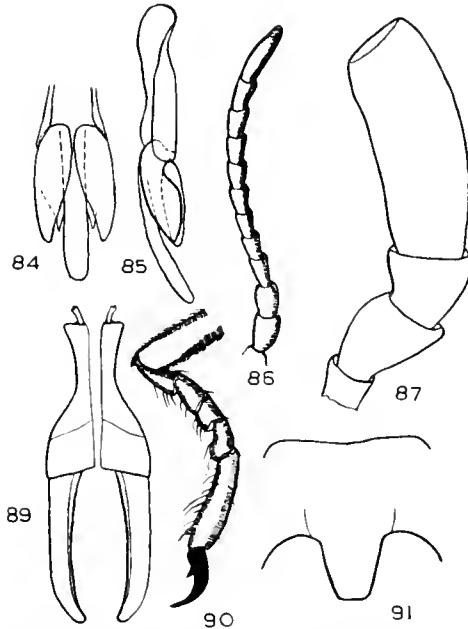
T. ungulatus has recently (Hinton, 1936) been referred to the genus *Macronychooides* Champion (1923), but though *Tolriolus* is most closely related to this genus, it may be distinguished as follows: (1) the genae are tomentose; (2) the hypomera are tomentose; (3) the pronotum has a distinct sublateral carinae, whereas in *Macronychooides* there is no trace of carinae here; (4) each elytron has a sublateral carina on eighth interval, whereas in *Macronychooides* the lateral intervals of each elytron are flat; (5) the first anal of the hind wing is absent, whereas in *Macronychooides* it is present; (6) the prosternum in front of the anterior coxae is long (equal to about one and a half times the greatest breadth of the front coxae), whereas in *Macronychooides* it is here short (equal to about a third of the greatest breadth of the front coxae); and (7) the mesosternum has the groove for the reception of the prosternal process broad, while in *Macronychooides* it is narrow.

Tolriolus unguilatus (Hinton).

(Text-figs. 84-93.)

1934. *Limnius unguilatus* Hinton, *Rev. Ent., Rio de J.*, **4** (2) : 200.1936. *Macronychoides unguilatus* (Hinton), *Trans. R. Ent. Soc. Lond.*, **85** (18) : 428, figs. 27-29; pl. 1, fig. 4.

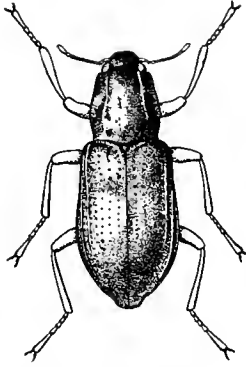
Male : Length, 2.12 mm.-2.37 mm. ; breadth, 0.95 mm.-1.12 mm. Cuticle shining and black ; basal three to five segments of antennae, mouth-parts, and legs rufo-piceous. *Head* without distinct impressions ; surface with round, low, often indistinct granules which are slightly finer than facets of eyes or about



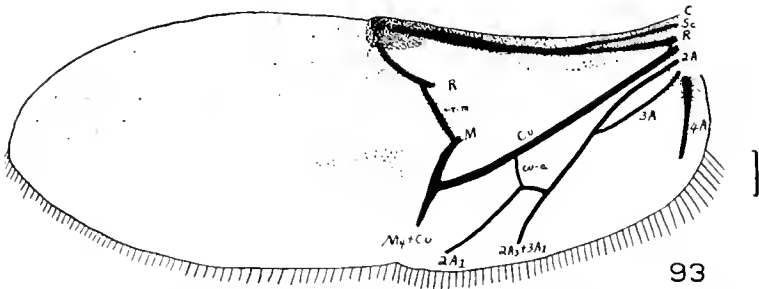
TEXT-FIGS. 84-91. — *Tolriolus unguilatus* Hinton. (84) Dorsal view of male genitalia. (85) Left lateral view of same. (86) Antenna. (87) Maxillary palp. (89) Female genitalia. (90) Tarsus of hind leg. (91) Prosternum.

0.012 mm. broad and are separated by two to four times their diameters ; surface between granules sparsely to densely microscopically alutaceous. Clypeus with the fronto-clypeal suture straight and indistinct ; anterior margin broadly, arcuately and deeply emarginate and with the angle on each side obtusely rounded ; surface sculptured as head. Labrum with the anterior margin nearly truncate and the angle on each side broadly rounded ; surface alutaceous as clypeus, without granules, at middle on anterior third with a few punctures which are about as coarse as granules of head, and on each side with a few fine, recumbent, testaceous setae which are about 0.04 mm. long. *Pronotum* across broadest point, which is at basal two-fifths, slightly broader than long (0.72 mm. : 0.70 mm.) and base broader than apex (0.63 mm. : 0.45 mm.). Sublateral carinae and impressions as figured (text-fig. 92). Surface with the apical third between sublateral carinae with fine (about 0.10 mm. broad), irregularly shaped, obscure punctures which are usually separated by two to four times their diameters and

surface between these punctures only sparsely alutaceous; surface on basal two-thirds of disk with low, round granules which are about as coarse or slightly coarser than facets of eyes and are separated by one to four times their diameters; surface between these punctures for the most part contiguously to confluent punctate with very fine punctures (about 0.007 mm. broad); surface between



92



93

TEXT-FIGS. 92, 93.—*Tolriolus ungulatus* Hinton. (92) Adult to show general appearance. (93) Hind wing. Venation after Forbes.

lateral margins and sublateral carinae sculptured as basal two-thirds of disk but with the punctures slightly finer and sparser. Lateral margins nearly smooth. *Elytra* slightly more than twice as long as pronotum (1.50 mm. : 0.70 mm.) and at broadest point, which is across apical two-fifths, broader than broadest point across humeri (1.07 mm. : 0.67 mm.). Lateral margins nearly smooth. Apices feebly and broadly produced and conjointly rounded. Surface with the striae feebly impressed on sides and apex but not impressed on disk; discal striae punctures round to subquadrate, about a third to a half as broad as

intervals, and separated longitudinally by once or, more rarely, twice their diameters; these punctures become finer towards apex and coarser, denser and deeper towards sides. Intervals flat and with the surface moderately densely to sparsely alutaceous, and with a few obscure granules at base and sides which are similar in size to those of sides of pronotum. *Scutellum* flat, subparallel, longer than broad (0.10 mm. : 0.075 mm.), base very feebly rounded, and apex broadly rounded; surface sculptured as adjacent parts of elytra. *Prosternum* with the carinae short and present only on basal third (text-fig. 91); when viewed laterally the anterior three-fourths (not including process) is gradually but moderately strongly bent ventrally; process shaped as figured (text-fig. 91); surface of base of prosternum and all of that of process sculptured like that of head except that surface of process is also feebly rugose; surface of prosternum elsewhere, and also that of hypomera, with the granules similar in size to those of sides of pronotum but feebly oblong and with the surface between granules alutaceous like that of head. *Mesosternum* with the groove for the reception of the prosternal process broad and long, posterior two-fifths deeper and about a third broader, and extending to posterior eighth of mesosternum; surface on each side of groove sculptured as head but with the granules not distinct. *Metasternum* with the median longitudinal impression extending to anterior sixth, basally as broad as scutellum and half as deep as broad, and apically shallower and a third to a fourth as broad; disk feebly depressed posteriorly and on each side in front of posterior coxae with a deep, nearly oval impression which is about 0.05 mm. broad; carina on each side of disk extending posteriorly and slightly outwards half way to hind coxa; surface of disk with round and shallow punctures which are about 0.02 mm. broad and are usually separated by twice their diameters; surface between punctures for the most part only very sparsely microscopically alutaceous; surface of sides of metasternum sculptured somewhat similarly to basal portion of pronotal disk but with the granules distinctly oblong instead of round. *Abdomen* with the carina on each side of the middle of the first sternite extending posteriorly and outwards to posterior fourth of segment; surface of sternites at sides sculptured as sides of metasternum but with the granules slightly finer and sparser; middle region of basal four sternites, and to a slight extent that of fifth sternite, with the granules sparser than at sides, rounded, and the surface between the granules often smooth and polished. *Genitalia* as figured (text-figs. 84, 85).

Female: Externally similar to male.

Type: In the U.S. National Museum. MEXICO: Dist. de Temascaltepec, Real de Arriba, alt. 6000-7000 ft., v. vii. 1933 (*H. E. Hinton, R. L. Usinger*).

Specimens examined: 154, with same data as type; 1, collected in the same district at Tejupilco, alt. about 4000 ft., ii-vi. 1933 (*H. E. Hinton, R. L. Usinger*); 433, Real de Arriba, v. vii. 1934 (*H. E. Hinton*); 362, in the same district, but at Rio Verde, alt. about 8000 ft., 14. vi. 1934 (*H. E. Hinton*).

Variations: In this long series there appears to be very little variation, the most notable variation being in the length of the metasternal discal carinae which in some specimens are confined to anterior fourth, while in some they extend three-fifths of the way to hind coxae.

LARVAE.

The larvae of this genus were determined by elimination and according to locality. A brief generic diagnosis follows.

Generic Characters of Larvae of Tolriolus.

Body subparallel and cylindrical to subtriangular in cross section; dorsal surface with numerous gibbosities. *Head* when seen from above exposed and not concealed by pronotum; anterior margin toothed on each side between base of antenna and clypeus. Clypeal suture distinct. With one ocellus on each side. Antennae 3-segmented (text-fig. 95) and feebly retractile. Mandibles of both sides similar and with three obtuse apical teeth; prostheca long, slender, and densely spinose. Maxilla (text-fig. 102) with the palp 4-segmented and stipes showing no differentiation into a palpiter; galea and lacinia separate and apex of each densely spinose. Labium (text-fig. 101) with the postmentum undivided; labial palp 2-segmented and prementum without a distinct palpiger. Gula well-developed. *Prothoracic pleura* divided into two parts and anterior part meeting on middle line of body so that the sternum is here completely suppressed. Meso- and metapleura divided into two parts. Abdominal segments one to seven with the pleura bounded by tergo- and sternopleural sutures and these two sutures converge and meet at apex of seventh segment; segment eight forming a complete sclerotized ring. Operculum with two strongly sclerotized claws attached to its dorsal membrane. Apex of ninth segment deeply and acutely emarginate. *Spiracles* present on mesothorax and first eight abdominal segments and opening on the apices of small tubercles. Tracheae without air sacs. *Alimentary canal* with an oesophageal sclerite on the dorsal posterior margin of the oesophagus. Hind gut with six? (my material is not sufficiently well preserved to be sure of this number) Malpighian tubules. *Central nervous system* with three thoracic and eight abdominal discrete ganglia.

The larvae of this genus are close to *Elsianus*, but may at once be distinguished by the gibbosities on the dorsal surface. All species of *Elsianus* (about 15 have been examined) have the dorsal surface evenly convex.

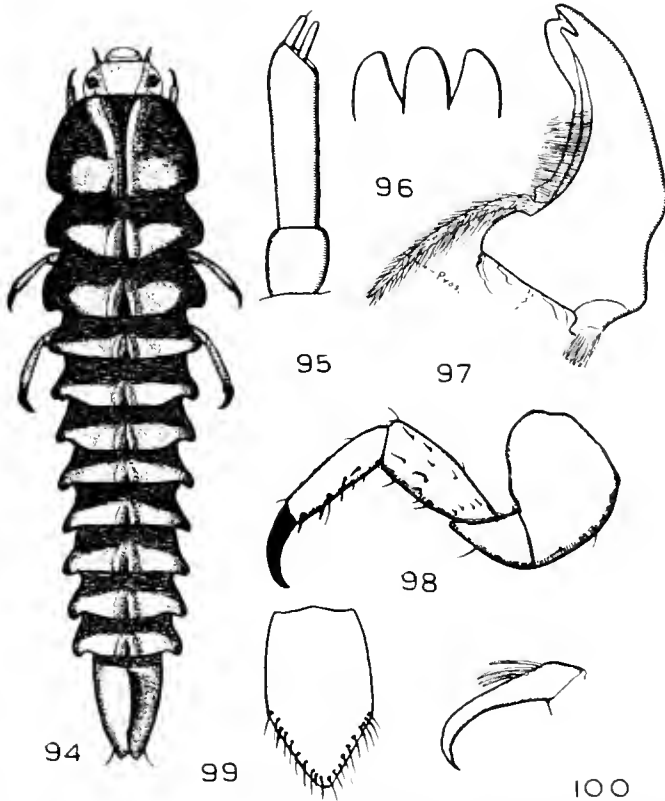
Description of Mature Larva of T. ungulatus.

(Text-figs. 94-104.)

1936. *Macronychoides ungulatus* (Hinton), *Trans. R. Ent. Soc. Lond.*, **85** (18): 420, figs. 30-40.

Length 4 mm. (text-fig. 94). Body subtriangular to nearly cylindrical in cross section. Pro-, meso-, and metanotum subequal in breadth; abdominal segments feebly narrowed caudally. More heavily sclerotized parts of body fusco-testaceous; antennae, mouth-parts, legs, opercular claws, and inter-segmental membranes pale testaceous. Dorsal and ventral sclerotized areas mostly tuberculate, each tubercle (except fine tubercles at anterior margin of segments) with a short seta near apex on posterior side (text-fig. 103 *a*); also with a few sparsely scattered, extremely fine setae arising independently of tubercles. *Head capsule* abruptly rounded and truncate behind, not constricted to form a neck. Anterior four-fifths of dorsal surface and sides slightly coarsely tuberculate, with the tubercles separated mostly by about one to three times their diameters; surface also with sparse minute pale areas from which arise setae, on basal one-fifth with three similar but much larger areas on each side and from each arises a single seta. Ventral surface with only the area between the ventral sutures tuberculate; elsewhere not tuberculate. Frontal sutures well-developed and extending on each side from near the base of the antenna to unite at middle just before posterior

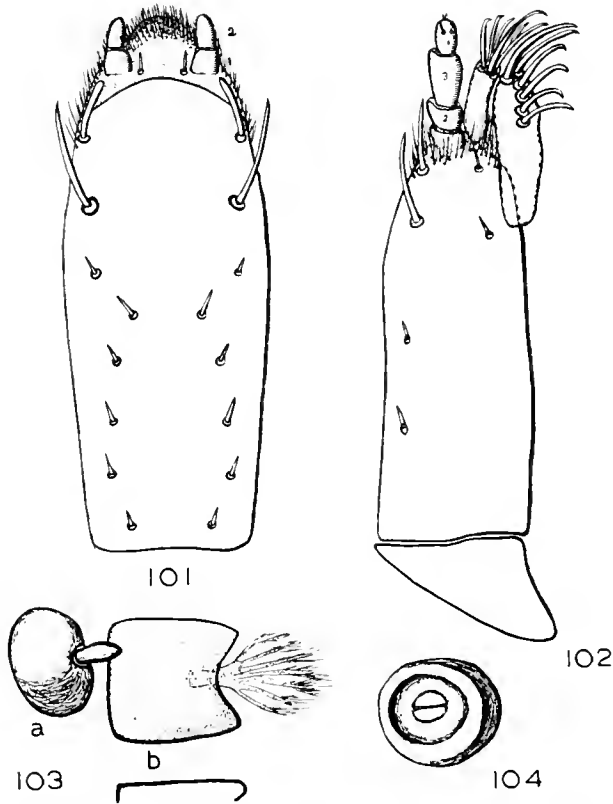
margin. Single ocellus on each side in a large pigment spot. Labrum transverse; anterior margin feebly rounded, and anterior angles broadly rounded. Antennae as figured (text-fig. 95). Mandibles as figured (text-fig. 97), and maxilla and labium as figured (text-figs. 101, 102). *Pronotum* about a third broader than long; narrowed anteriorly; angles rounded; with two prominent longitudinal ridges parallel near base and from apical half diverging moderately towards apex; near base on



TEXT-FIGS. 94-100. Larva of *Toxotulus unguatus* Hinton. (94) Mature larva. (95) Antenna. (96) Inner view of tip of mandible. (97) Mandible. (98) Left inner view of middle leg. (99) Ventral view of operculum. (100) Dorsal view of opercular claw.

each side with a rounded and elevated area. Surface slightly coarsely tuberculate with tubercles which are mostly separated by once to twice their diameters; anteriorly with the tubercles slightly finer and denser; anterior and posterior margins with a row of flat quadrate tubercles (text-fig. 103b) from each of which arises a multi-branched seta. Mesonotum more than twice as broad as long (0.875 mm.; 0.375 mm.); similar to pronotum but with the longitudinal ridges joining in front and not attaining apex; with the hind angles feebly produced; anterior belt of very fine tubercles with the tubercles separated mostly by less than their diameters. Metanotum generally similar to mesonotum. *Dorsal abdominal segments* similar to metanotum but more strongly transverse and gradually narrowing caudally; caudal segments with the hind angles increasingly strongly

produced posteriorly. Eighth abdominal segment with the channel between the dorsal ridges very feeble. Ninth dorsal three-fifths as broad as long (0.375 mm. 0.625 mm.), triangular, subconical, with a single median longitudinal ridge, and with the caudal end deeply and triangularly emarginate. *Pleural areas* mostly finely tuberculate as anterior margins of dorsal segments; posterior margins of these also with a row of flat and subquadrate tubercles. *Ventral surface* tuberculate as dorsal; with the anterior margin of the prosternum and posterior



TEXT-FIGS. 101-104.—Larva of *Tolroilus unguilatus* Hinton. (101) Ventral view of labium. (102) Ventral view of right maxilla. (103a) Dorsal tubercle. (103b) Tubercle of posterior marginal row of mesothorax. (104) Mesothoracic spiracle.

margin of all other sterna except the ninth with a row of flat and subquadrate tubercles; metasternum with two small median longitudinal and carina-like tubercles at anterior margin; first abdominal sternite with a single similar tubercle at anterior margin. Operculum as figured (text-fig. 99); opercular claws (text-fig. 100) very slender and strongly curved. *Legs* all similar to that of mesothorax (text-fig. 98) but increasing in length posteriorly. *Spiracles* all similar to that of mesothorax (text-fig. 104).

Specimens examined: 20, MEXICO: Dist. de Temascaltepec, Real de Arriba and Rio Verde, alt. 6000-8000 ft., vi-vii. 1934 (H. E. Hinton).

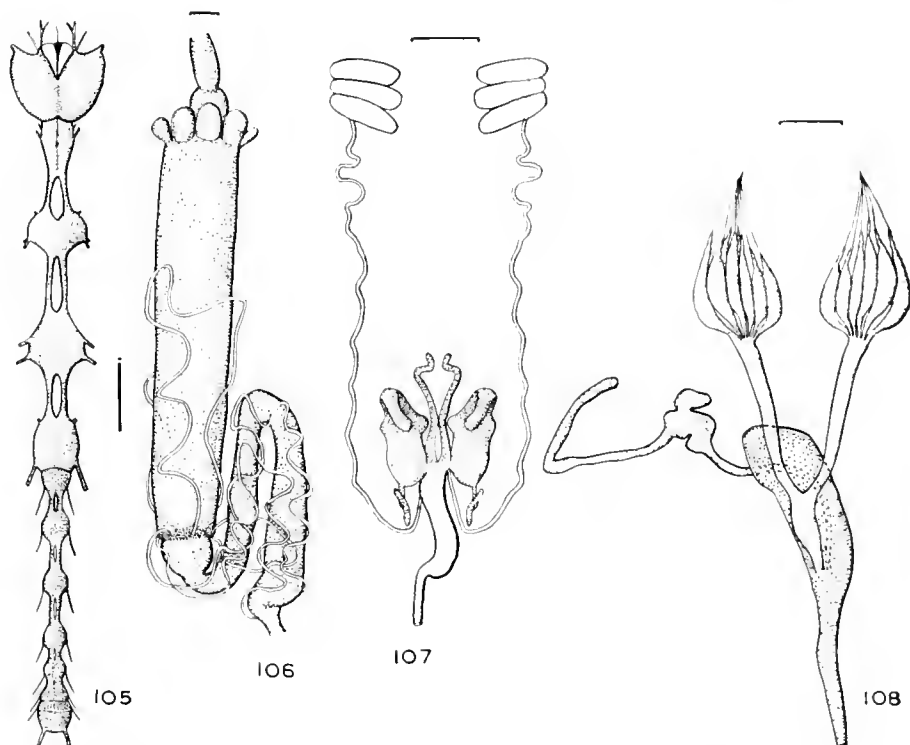
The largest available larva is 5.0 mm. and the smallest 2.0 mm. long, but

these seem to differ only in size. All specimens were taken in company with the adults clinging to roots of *Salix* and *Alnus* in cold and torrential mountain streams.

ELSIANUS Sharp.

1882. *Elsianus* Sharp, *Biol. Centr.-Amer. Col.*, **1** (2) : 131.

At the time of writing 18 species have been described, and the genus is now known to occur from Texas to South Brazil. This genus will probably take

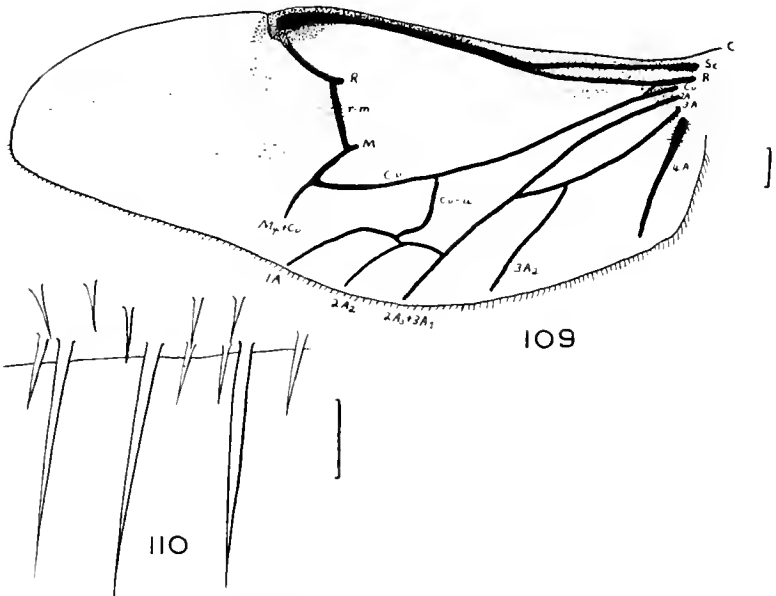


TEXT-FIGS. 105-108. —*Elsianus bicolor* Hinton. (105) Central nervous system from a dorsal view. (106) Alimentary canal. (107) Male reproductive system. (108) Female reproductive system.

second place to *Cylloepus* Erichson in number of species. Though to-day only 18 species have been described there are over 20 new species in my collection from South America. A redescription of the genus follows.

Body elongate, subparallel. Dorsal surface clothed with short, sparse or dense, usually recumbent hairs. Tomentum confined to the following areas: (1) genae; (2) epipleurae; (3) hypomera; (4) sides of prosternum, mesosternum, and abdominal sternites, but in many species nearly the entire ventral surface is clothed with scale-like or hairy tomentum; and (4) all of legs except tarsi, though in many species the scale-like tomentum is sparse or absent on the tibiae. Head when seen from below capable of being retracted so that none of the mouth-parts are visible. Antennae 11-segmented. Mandibles with three apical acute teeth; protheca large and entirely membranous with the apex spinose or hairy. Maxilla

with the palp 4-segmented and stipes with a well-developed palpifer; galea and lacinia separate and apex of each densely spinose. Labium with the palp 3-segmented and prementum with a well-developed palpiger. Mentum transverse and about as broad as and about half again as long as submentum. Gula as long as mentum, anteriorly more narrow or as broad as submentum, and always narrowed posteriorly. *Pronotum* with the anterior margin moderately arcuate at middle and on each side behind eye before apical angle deeply sinuate. Base trisinate, broadly and moderately deeply so on each side and more narrowly and shallowly so in front of scutellum. With or without a sublateral carina; if a carina is present it may be complete or evident only near base; in front of scutellum sometimes with a gibbosity; disk with or without a median longitudinal



TEXT-FIGS. 109, 110.—*Elsanus striatus* Sharp. (109) Hind wing. Venation after Forbes. (110) Microtrichia from inner apical margin.

impression. *Elytra* striate and punctate; with an accessory stria on each elytron on basal sixth or fifth between sutural and second striae; without sublateral carinae. Hind wings without a radial cross vein and without an anal cell; with the first branch of the second anal absent; and with a cubito-anal cross vein. *Prosternum* very long in front of anterior coxae; prosternal process long and posterior margin broadly rounded or acute. Mesosternum with a broad and deep groove for the reception of the prosternal process. Metasternum with a median longitudinal impressed line. *Legs* with the visible portion of the front coxae globular and trochantin completely concealed by the hypomera. Claws without teeth. *Alimentary canal* (text-fig. 106) with seven caeca on the anterior margin of the mid-gut. Hind gut with six Malpighian tubules which end near the rectum freely or embedded in the fatty tissue. *Male reproductive system* (text-fig. 107) with the lateral accessory glands with several lobes. Each testis with three sperm tubes. *Female reproductive system* (text-fig. 108) with eight egg tubes to each ovary. Spermathecal duct opening near base of bursa

copulatrix. *Central nervous system* (text-fig. 105) with three thoracic discrete ganglia. First abdominal ganglion partly fused to third thoracic, two to four free, and five to eight partly fused together though the limits of each are distinguishable.

GENOTYPE: *Elsianus striatus* Sharp.

The internal anatomy of four species has been examined and found to agree in essential details. *E. bicolor* Hinton of Bolivia is figured.

Elsianus may be immediately distinguished from the other genera in the tribe Elmini (except *Stenelmis* Dufour) by the accessory stria on each elytron at basal fifth or sixth between sutural and second stria. With the exception of *Stenelmis* Dufour, it is the only genus known to me which has three sperm tubes to each testis. From *Stenelmis* it may be distinguished by the densely pubescent apices of the tibiae and the presence of caeca on the anterior margin of the mid-gut.

The specific characters of most importance in separating the species of *Elsianus* seem to be the following:

- (1) General proportions, length and breadth.
- (2) Size and distribution of the punctures and tubercles on the various sclerites.
- (3) Condition of fronto-clypeal suture.
- (4) Anterior margin of clypeus, whether rounded, truncate, emarginate, or sinuate; and also shape of angle on each side.
- (5) Condition of anterior margin of labrum.
- (6) Outline of pronotum and extent and depth of the impression or gibbosity on its surface. Shape and extent of sublateral carinae if present.
- (7) Shape of elytral apices.
- (8) Condition of lateral margin of elytra, whether crenate or smooth.
- (9) Shape of scutellum and if convex or flat.
- (10) Shape of prosternal process.
- (11) Shape of mesosternal groove and depth.
- (12) Impressions on disk of metasternum.
- (13) Condition of carinae of first abdominal sternite.
- (14) Extent and depth of impression on middle of first abdominal sternite.
- (15) Extent and depth of depressions on other sternites. A depression is frequently present on apex of fifth sternite.
- (16) Secondary sexual characters.
- (17) Structure of male genitalia.
- (18) Relative size of the dorsal and ventral caeca on the anterior margin of the mid-gut. In some species the ventral caeca are very much smaller than dorsal, while in other species all caeca are the same size.
- (19) Shape of median and lateral accessory glands of male reproductive system.

The following secondary sexual characters have been observed by examining the 30 or so species in my collection:

- (1) Male with the anterior portion of the labrum very densely clothed with fine, long, erect, pale hairs, while in the female the hairs are at most two-thirds as long and are confined to sides (*clypeatus*, *tarsalis*).
- (2) Metasternum of males on each side of disk with an area clothed with long, fine, testaceous, recumbent hairs (*clypeatus*, *tarsalis*).

- (3) Metasternal disk on each side with a large and deep depression in males and with a broad, scarcely noticeable depression in females (*clypeatus*).
- (4) Metasternum with the median longitudinal line much more broadly impressed in male than in female (*clypeatus*).
- (5) Middle of first abdominal sternite more depressed in male than in female (*scutellaris*).
- (6) Apical margin of fifth abdominal sternite differently formed in male than in female (sp. n., BOLIVIA).
- (7) Male with the shape of the depression on the apical abdominal sternite different to that of the female (*aequalis*, *clypeatus*).
- (8) Apical abdominal sternite of male with a broad, basal, non-granulate and nearly impunctate area, while in the female this area is granulate (*clypeatus*, *scutellaris*).
- (9) Apical third of fifth abdominal sternite of male with an area on each side which is densely clothed with very long, fine, golden hairs, while in the female the same area is only clothed with very much shorter and sparser hairs (*clypeatus*, *tarsalis*).
- (10) Male with the apex of the hind tibiae broadened and on inner side concave (sp. n., BRAZIL).
- (11) Hind tibiae of male with the inner apical spur long and flexed inwards, whereas in the female the corresponding spur is short and straight (*tarsalis*).
- (12) Hind tibia of male with the inner apical spur relatively broader than corresponding spur of female (*clypeatus*).
- (13) Males with long and fine hairs on ventral side of four basal segments of all tarsi, whereas in the female there are only short and stout hairs or spines (*aequalis*).
- (14) Males with long and fine hairs on ventral apices of four basal segments of hind tarsi (*sandersoni*, *striatoides*).

A KEY TO THE MEXICAN SPECIES OF *Elsianus*.

1. Pronotum with a prominent gibbosity near base in front of scutellum 2.
 Pronotum without a gibbosity 3.
2. Species over 4.0 mm. long. Prosternal process with the apex acute; mesosternum with the posterior part of the groove for the reception of the prosternal process narrowed to an acute point. MEXICO.
E. scutellaris Hinton (1934).
 Species 4.0 mm. long or less. Prosternal process with the apex broadly rounded; mesosternum with the posterior part of the groove for the reception of the prosternal process very broadly and feebly rounded.
 COSTA RICA, MEXICO *E. graniger* Sharp (1882).
3. Species usually about 6.0 mm. and never less than 5.5 mm. long. MEXICO
E. grandis Hinton (1934).
 Species never more than 5.0 mm. long 4.
4. Male with no long and fine hairs on ventral apex of first four segments of hind tarsi. GUATEMALA, MEXICO. *E. striatus* Sharp (1882).
 Males with numerous long (about equal to lengths of their respective segments) and fine hairs on ventral apex of first four segments of hind tarsi 5.

5. Male genitalia with the median lobe extending much beyond apices of lateral lobes. MEXICO *E. striatoides* Hinton (1936).
 Male genitalia with the median lobe not extending to apices of lateral lobes. MEXICO *E. sandersoni* Hinton (1936).

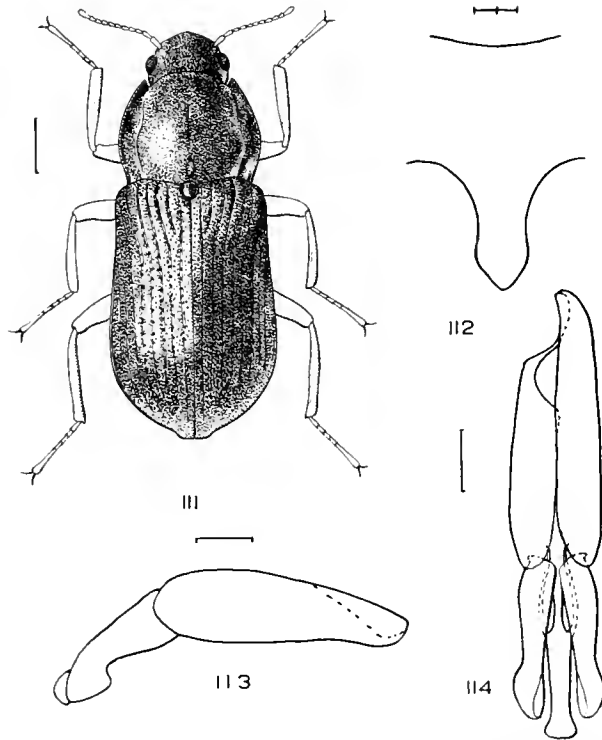
***Elsianus scutellaris* Hinton.**

(Text-figs. 111-114.)

1934. *Elsianus scutellaris* Hinton, *Rev. Ent., Rio de J.*, 4 (2) : 109.

Male: Length, 4.6 mm.; breadth, 1.9 mm. Cuticle shining and black, with the antennae, mouth-parts, and tarsi rufo-piceous. *Head* without distinct impressions; surface with feebly oblong granules which are about a third coarser than facets of eyes or 0.025 mm. broad and are separated usually by slightly less than to once their diameters; surface between the granules microscopically alutaceous. Clypeus with the fronto-clypeal suture moderately deep and feebly and arcuately emarginate for its entire breadth; anterior margin feebly and arcuately emarginate for its entire breadth, with the angle on each side very broadly rounded; surface sculptured as head but with the granules slightly flatter and sparser. Labrum with the anterior margin feebly rounded and with the angle on each side broadly rounded; surface with the basal and lateral parts extremely densely and very finely alutaceous, middle apical region not alutaceous and with punctures which are about a third as coarse as granules of head and are separated by one to five times their diameters; sides with a few long (0.075 mm.), fine, testaceous hairs. *Pronotum* across broadest point, which is about at basal third, broader than long (1.62 mm. : 1.50 mm.) and base broader than apex (1.40 mm. : 0.97 mm.). Sides arcuate, moderately strongly and shortly sinuate before basal angles and very feebly and broadly sinuate at apical two-fifths. Lateral margins feebly and somewhat regularly crenate. Sublateral carina prominent, extending from near base to apical seventh, and feebly sinuate and for short distance much less prominent at about basal two-fifths; on basal seventh in front of scutellum with a longitudinal gibbosity which is 0.10 mm. broad, 0.22 mm. long, and about 0.07 mm. high; disk with a very shallow moderately broad median longitudinal impression which extends from apical two-fifths to near anterior part of gibbosity. Surface of pronotum sculptured similarly to that of head but with the granules round, not oblong, very slightly coarser, and usually separated by once to twice their diameters; extreme base and inner sides of sublateral carinae on basal fourth with the alutaceous microsculpture much less dense than elsewhere. *Elytra* more than twice as long as pronotum (3.4 mm. : 1.50 mm.) and broadest point, which is at apical third, slightly broader than broadest point across humeri (1.9 mm. : 1.8 mm.). Lateral margins finely and regularly crenate. Apices moderately produced and each apex obliquely truncate so that the more anterior part of the truncation is mesal. Surface with the striae coarse and becoming finer towards apex and slightly coarser towards sides; discal striae punctures usually round, about a half to a third as coarse as intervals, and separated longitudinally by one to a little more than one diameter. Intervals more or less flat but with the third (or fourth if accessory interval is included) feebly convex from basal fifth to eighth; surface of intervals sculptured as pronotum but intervals at middle apical three-fourths with the granules much sparser. *Scutellum* subovate, strongly convex, particularly posteriorly, longer than broad (0.25 mm. : 0.22 mm.), base broadly and feebly rounded, and much narrowed to the feebly rounded apex; surface sculptured as the adjacent elytral intervals

but with the granules slightly denser. *Prosternum* with the process (text-fig. 112) acute at apex and the margin opposite front coxae raised so that middle part of process and basal part of prosternum appear moderately depressed; surface of process coarsely and densely rugose and anteriorly transversely and more sparsely so; anterior portion of prosternum granulate somewhat similarly to clypeus and sides as well as hypomera granulate as pronotal disk. *Mesosternum* with the groove for the reception of the prosternal process deep and broad and posteriorly narrowed to an acute point; surface at sides sculptured as middle apical region



TEXT-FIGS. 111-114.—*Elsianus scutellaris* Hinton. (111) Adult to show general appearance. (112) Prosternum. (113) Lateral view of male genitalia. (114) Dorsal view of male genitalia.

of prosternal process. *Metasternum* with the median longitudinal impressed line extending to anterior eighth; disk with the posterior four-fifths deeply depressed; surface of disk with the granules about a third coarser than those of pronotum, oblong and separated mostly by a third to once their length; sides of metasternum granulate as disk of pronotum. *Abdomen* with the first sternite feebly depressed at middle and anterior and basal lateral margins moderately strongly raised; carinae of first sternite straight and complete; surface of middle of first sternite densely rugose and granulate, surface of other sternites granulate somewhat similarly to pronotum; basal middle of fifth abdominal sternite without granules or punctures but only microscopically alutaceous; apex of fifth sternite with a large, transversely oval, moderately deep depression. *Genitalia* as figured (text-figs. 113, 114).

Female : Externally similar to male except as follows : (1) the middle of the first abdominal sternite is only very feebly depressed ; (2) there is no middle basal impunctate and non-granulate area on the fifth abdominal sternite ; and (3) the apical depression of the fifth sternite is much shallower.

Type : ♀ in the British Museum (Nat. Hist.). MEXICO : Dist. de Temascaltepec, Temascaltepec, alt. about 5600 ft., 28.v.1933 (H. E. Hinton, R. L. Usinger).

Specimens examined : 13, with same data as above but collected in 1934 (H. E. Hinton).

Variations : In some males the basal impunctate area of the fifth abdominal sternite is confined to the extreme basal middle part, while in other specimens it extends on middle as far as apical two-thirds.

Comparative notes : This species belongs to a small group which is characterized by having a prominent gibbosity on the pronotum in front of the scutellum. The only other representative of this group in North America is the Guatemalan and Mexican *E. graniger* Sharp. From *graniger* it may be distinguished as follows : (1) *scutellaris* is larger (4.6 mm. : 4.0 mm.—largest specimen of *graniger* I have seen) ; (2) apices of elytra obliquely truncate with the most anterior part of the truncation lateral, whereas in *graniger* the most anterior part of the truncation is mesal ; (3) prosternal process with the apex acute instead of broadly rounded ; and (4) mesosternum with the anterior part of the groove for the reception of the prosternal process narrowed to an acute point instead of broadly rounded. The male genitalia of the two species are also quite different (*cf.* figures).

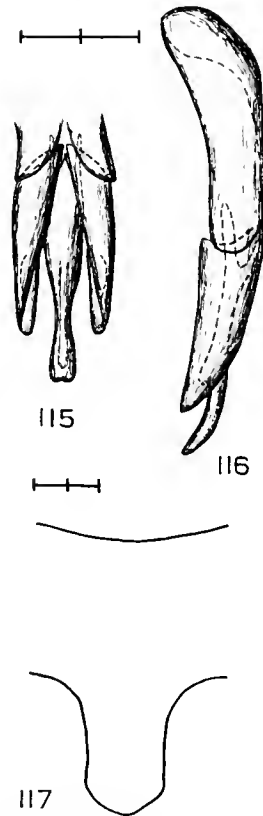
***Elsianus graniger* Sharp.**

(Text-figs. 115-117.)

1882 *Elsianus graniger* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2) : 133.

Male : Length, 3.4 mm.—4.0 mm. ; breadth, 1.3 mm.—1.8 mm. Cuticle shining and rufo-piceous to black ; antennae, mouth-parts and legs paler rufo-piceous. *Head* without distinct impressions ; surface with round to feebly oblong granules which are about 0.024 mm. broad or about a third coarser than facets of eyes and are usually separated by once their diameters or a little more ; surface between granules microscopically alutaceous. Clypeus with the fronto-clypeal suture moderately deep and so shaped that the anterior margin of the head is feebly and arcuately emarginate for its entire breadth between antennae ; anterior margin very feebly emarginate or nearly truncate for its entire breadth ; and with the angle on each side very broadly rounded ; surface sculptured as head but with the granules slightly flatter. Labrum with the anterior margin broadly rounded and the angle on each side broadly rounded ; surface at sides and on basal middle sculptured as clypeus but more finely so ; surface on a middle apical belt with punctures only, which are about two-thirds as coarse as granules and are separated by one to four times their diameters ; each side with a few fine, long (about 0.05 mm.), recumbent, testaceous hairs. *Pronotum* at broadest point, which is at basal third, broader than long (1.35 mm. : 1.22 mm.) and base broader than apex (1.20 mm. : 0.80 mm.). Sides arcuate, less strongly so at basal and apical third but nowhere sinuate. Lateral margins feebly and regularly crenate. Sublateral carinae prominent, extending from very near base to apical ninth, and feebly sinuate and for a short distance much less prominent at basal two-fifths ; on basal seventh in front of scutellum with a gibbosity which is 0.12 mm. long,

0.07 mm. broad, and about 0.04 mm. high; disk with a narrow, very shallow, and indistinct median longitudinal impression extending from basal fourth to apical fourth. Surface of pronotum sculptured similarly to that of head but with the granules always round, often slightly coarser, and separated mostly by once to twice their diameters; surface along extreme base with the alutaceous microsculpture much less dense. *Elytra* more than twice as long as pronotum (2.45 mm. : 1.22 mm.) and broadest point, which is at apical third, slightly broader than



TEXT-FIGS. 115-117.—*Elstanus graniger* Sharp. (115) Dorsal view of male genitalia (116) Left lateral view of same. (117) Prosternum.

broadest point across humeri (1.40 mm. : 1.30 mm.). Lateral margins finely and regularly crenate. Apices moderately produced and each apex obliquely truncate so that the most anterior part of the truncation is mesal and not as usual lateral. Surface with the striae moderately coarse and becoming coarser towards sides and finer towards apex; discal strial punctures usually round, from a third to two-fifths as coarse as intervals, and separated longitudinally by once their diameters or a little more. Intervals all more or less flat but with the third (not including extra interval formed by accessory stria) more obviously convex from basal sixth to eighth; surface of intervals sculptured as pronotum but on discal part of apical half with the granules distinctly sparser. *Scutellum* sub-ovate, strongly convex, broader than long (0.21 mm. : 0.20 mm.), base broadly

and feebly rounded, and slightly narrowed towards apex which is broadly rounded; surface sculptured like adjacent intervals. *Prosternum* with the process (text-fig. 117) broadly rounded at apex and margin near base feebly raised so that area opposite this point appears feebly depressed; surface of process coarsely and densely rugose and also with the granules about a fourth coarser than those of elytra and separated by two to four times their diameters; anterior portion of prosternum, sides, and hypomera sculptured somewhat like pronotum. *Mesosternum* with the groove for the reception of the prosternal process deep and broad and with the posterior margin broadly rounded; surface at sides sculptured as middle apical region of prosternal process but more finely so. *Metasternum* with the median longitudinal impressed line broad and extending to about anterior fifth; surface of disk with the granules about a third to half again as coarse as those of elytra and separated mostly by once their lengths, though very occasionally they are contiguous; sides of metasternum granulate as base of elytra. *Abdomen* with the first sternite at middle only feebly and broadly depressed and anterior and lateral basal margins moderately strongly raised; carinae of first sternite straight and complete. Surface of first sternite at middle sculptured nearly as that of prosternal process, surface elsewhere and that of other sternites granulate as pronotum but with the granules slightly flatter and often feebly oblong. Apex of fifth sternite with a broad, transverse, and shallow impression. *Genitalia* as figured (text-figs. 115, 116).

Female: Externally similar to male.

Type: In the British Museum (Nat. Hist.). COSTA RICA: Cache (*H. Rogers*).

Specimens examined: 52, MEXICO: Dist. de Temascaltepec, Temascaltepec, alt. about 5600 ft., vi-vii, 1933 (*H. E. Hinton, R. L. Usinger*); 23, same locality but vi-vii, 1934 (*H. E. Hinton*); 3, same data as above but at Tejupilco, alt. about 4000 ft., vii, 1934 (*H. E. Hinton*); and 4, MEXICO: Estado de Morelos, Cuernavaca, vi, 1934 (*H. E. Hinton*).

Variations: In some the sides of the pronotum are distinctly sinuate before basal angles. The basal gibbosity of the pronotum varies from being distinctly longer than broad to being quite round, and as regards prominence, from 0.05 mm. to 0.015 mm. high.

Comparative notes: This species can be compared only with the larger *E. scutellaris* Hinton, as these two are the only North American species possessing a gibbosity in front of the scutellum on the pronotal base. The differences between these two are given under the description of *scutellaris*.

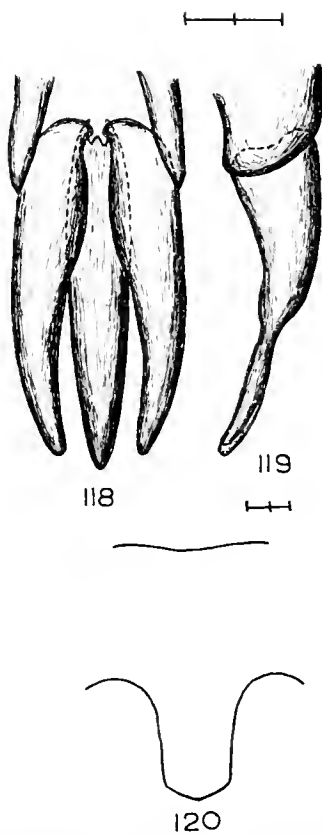
***Elsianus grandis* Hinton.**

(Text-figs. 118-120.)

1934. *Elsianus grandis* Hinton, *Rev. Ent., Rio de J.*, 4 (2): 195.

Male: Length, 5.7 mm. 6.0 mm.; breadth, 2.3 mm. 2.6 mm. Cuticle shining and rufo-piceous to black; antennae, mouth-parts, and legs paler rufo-piceous. *Head* without distinct impressions; surface with round, high granules which are about 0.018 mm. broad or about as coarse as facets of eyes and are usually separated by two to three times their diameters; surface between the granules densely and microscopically alutaceous. Clypeus with the fronto-clypeal suture deep and formed so that the anterior margin of the head is very feebly and arcuately emarginate for its entire breadth between antennae; anterior

margin arcuately and very feebly emarginate for its entire breadth and with the angle on each side very broadly rounded; surface sculptured as that of head. Labrum with the anterior margin feebly rounded and with the angle on each side broadly rounded; surface without distinct granules but densely and microscopically alutaceous except for a narrow anterior belt which is broadest at middle and which is only sparsely alutaceous; sides with a few long (0.07 mm.), fine, recumbent testaceous hairs. *Pronotum* across broadest point, which is at basal



TEXT-FIGS. 118-120.—*Elsianus grandis* Hinton. (118) Dorsal view of male genitalia. (119) Left lateral view of same. (120) Prosternum.

two-fifths, broader than long (2.05 mm. : 1.62 mm.) and base broader than apex (1.85 mm. : 1.17 mm.). Sides arcuate, nearly straight or scarcely noticeably sinuate at apical fourth, and feebly sinuate before basal angles. Lateral margins finely and regularly crenate. Sublateral carinae prominent, extending from base to apical fifth, and sinuate and for a short distance less prominent at basal two-fifths; disk without a distinct median impression; with a moderately shallow and broad depression beginning on inner side of sublateral carina at basal two-fifths and extending obliquely backwards for a distance equal to a little more than the length of the scutellum. Surface sculptured similarly to that of head but with

the granules on disk not so high and separated by three to four times their diameters, the surface between the granules much less densely alutaceous, and the granules at sides of pronotum about a third coarser and slightly denser; area near inner side of sublateral carina near basal fourth nearly free of granules. *Elytra* more than two and a half times as long as pronotum (4.4 mm. : 1.6 mm.) and broadest point, which is at apical third, broader than broadest point across humeri (2.45 mm. : 2.15 mm.). Lateral margins finely and regularly crenate. Apices broadly and moderately produced so that each apex is obliquely truncate and the most anterior part of the truncation is lateral. Surface with the striae coarse and becoming finer towards apex and slightly coarser towards sides; discal striae punctures usually round, deep, about a third as broad as intervals, and separated longitudinally by slightly more than their diameters. Intervals more or less flat; surface of intervals sculptured as sides of pronotum but with the granules slightly sparser and on middle apical three-fifths and lateral half much sparser and finer, here often being separated by as much as five times their diameters. *Scutellum* strongly convex, nearly round but slightly longer than broad (0.37 mm. : 0.32 mm.), and base and apex broadly rounded; surface sculptured as sutural interval. *Prosternum* with the process (text-fig. 120) broadly rounded at apex and the margin opposite middle coxae very thickly and feebly raised; surface of process sculptured as sides of elytra and also feebly rugose; surface of anterior portion of prosternum, sides and hypomera sculptured as sides of pronotum. *Mesosternum* with the groove for the reception of the prosternal process broad and deep but posteriorly much narrowed and much deeper than elsewhere; sides with the surface coarsely rugose. *Metasternum* with the median longitudinal impressed line extending to anterior sixth; disk with the posterior four-fifths feebly depressed; surface of disk with the granules oblong, about 0.05 mm. long, and usually separated by once their lengths though occasionally contiguous; sides of metasternum granulate as hypomera. Abdomen with the middle of the first sternite broadly and moderately deeply depressed on most of the middle area; first sternite without carinae; surface of sternites granulate as sides of metasternum but with the granules becoming finer and slightly sparser towards apex; middle apical portion of first sternite and middle basal portion of second sternite with the surface between the granules nearly free of the alutaceous microsculpture and highly polished. *Genitalia* as figured (text-figs. 118, 119).

Female: Externally similar to male.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Real de Arriba, alt. about 7000 ft., 13.vi.1933 (*H. E. Hinton*, *R. L. Usinger*).

Specimens examined: 3, with data as above; 5, with same data but taken vi-vii.1934 (*H. E. Hinton*); and 2, in the same district at Rio Verde, alt. 7000-8000 ft., 14.vi.1934.

Variations: The scutellum is in some specimens moderately narrowed in apical half, whereas in others it is nearly round. The apical sixth of the scutellum of one specimen is very abruptly flattened whereas in the remainder of the series the scutellum is fairly evenly convex.

Comparative notes: This is the largest species of North American Elmidi. From its close allies *E. striatus*, *E. striatoides* and *E. sandersoni* it may at once be distinguished by its much larger size (the largest specimen of these three species which I have seen is 5.0 mm., while the smallest of *grandis* is 5.7 mm.) and the structure of the male genitalia (*cf.* figures).

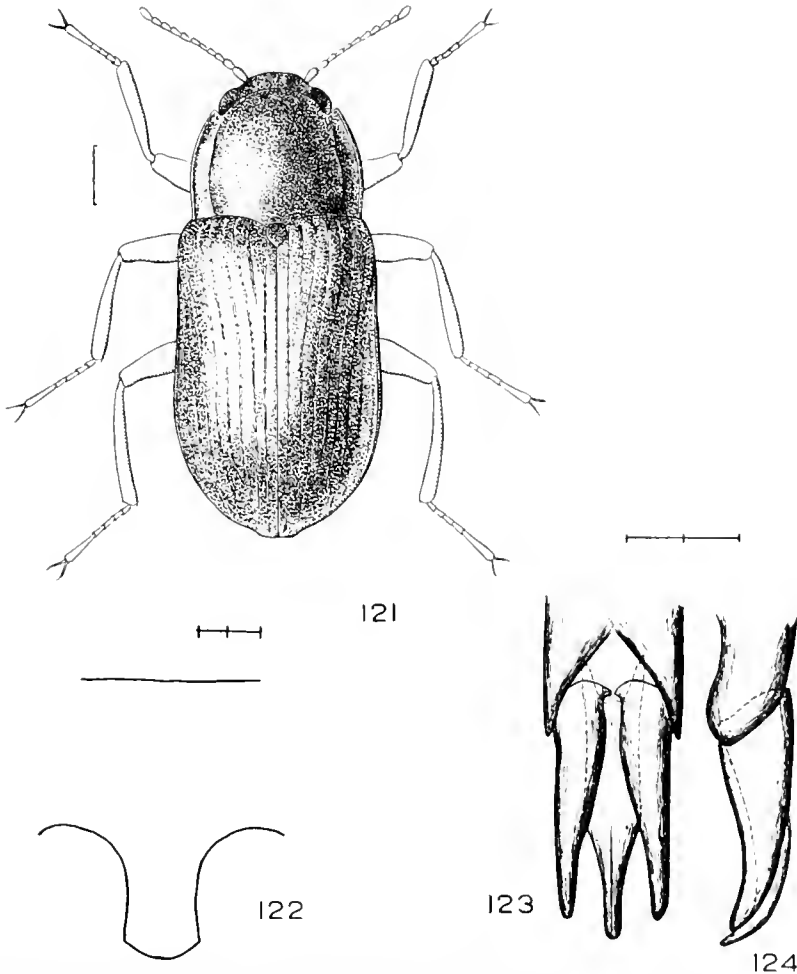
Elsianus striatus Sharp.

(Text-figs. 109, 110, 121-124.)

1882. *Elsianus striatus* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2) : 132.

Male : Length, 3.3 mm.-4.5 mm. ; breadth, 1.5 mm.-1.8 mm. Cuticle shining and rufo-piceous to black ; antennæ, mouth-parts and legs paler rufo-piceous. *Head* without distinct impressions ; surface with round high granules which are about 0.012 mm. broad or about as coarse as facets of eyes and are usually separated by once to twice their diameters or occasionally slightly more ; surface between the granules densely and microscopically alutaceous. Clypeus with the fronto-clypeal suture moderately deep and so shaped that the anterior margin of the head is arcuately and moderately feebly emarginate for its entire breadth between antennæ ; anterior margin of clypeus moderately strongly, arcuately emarginate for its entire breadth and with the angle on each side very broadly rounded ; surface sculptured as head. Labrum with the anterior margin feebly rounded and with the angle on each side broadly rounded ; surface without distinct granules and rather densely and microscopically alutaceous except for a narrow anterior belt which is broader at middle and which is without the alutaceous microsculpture ; the surface of this belt is frequently with punctures which are about a fourth to two-thirds as coarse as granules of clypeus and are contiguous to separated by five times their diameters ; surface at middle of apex often impunctate ; at sides with a few fine, long (about 0.05 mm.) recumbent, testaceous hairs. *Pronotum* across broadest point, which is about at basal third, broader than long (1.30 mm. : 1.15 mm.) and base broader than apex (1.15 mm. : 0.82 mm.). Sides arcuate, broadly and distinctly sinuate before basal angles, and very feebly scarcely noticeably sinuate at apical two-fifths. Lateral margins feebly and regularly crenate. Sublateral carina prominent, extending from very near base to apical seventh, and very feebly sinuate at about basal two-fifths ; disk without impressions. Surface granulate as head but with the granules on disk slightly finer, separated by two to three times their diameters, and with the surface between them set with fine punctures which are half as coarse as granules and are confluent to separated by once their diameters ; towards sides the granules become slightly larger and the punctures denser so that finally at sublateral carina the surface is again microscopically alutaceous as on head ; surface between sublateral carinae and lateral margins with the granules about a third coarser and slightly denser than those of head. *Elytra* nearly twice as long as pronotum (2.62 mm. : 1.15 mm.) and broadest point, which is at apical third, slightly broader than broadest point across humeri (1.55 mm. : 1.45 mm.). Lateral margins finely and regularly crenate. Apices moderately produced and each apex obliquely truncate so that the most anterior part of the truncation is lateral. Surface with the striae coarse and becoming slightly finer towards apex and slightly coarser towards sides ; discal strial punctures usually round to feebly subquadrate, two-thirds as coarse as intervals and separated longitudinally by once their lengths or a little more. Intervals flat but near base discal intervals are very feebly convex ; surface of intervals sculptured as sides of pronotum mesal to sublateral carina but with the granules sparser and the surface between the granules not punctate and only occasionally alutaceous ; discal region on apical half with the granules much finer and sparser. *Scutellum* subovate to nearly round, strongly convex, longer

than broad (0.22 mm. : 0.17 mm.), base broadly and feebly rounded, and apex narrowed and feebly rounded; surface sculptured as adjacent elytral intervals. *Prosternum* with the process (text-fig. 122) broadly rounded at apex and the lateral margins feebly and broadly raised so that the middle part of the process is moderately concave; surface of process sculptured as area of pronotum between



TEXT-FIGS. 121-124. *Elstanus striatus* Sharp. (121) Adult to show general appearance. (122) Prosternum. (123) Dorsal view of male genitalia. (124) Left lateral view of same.

lateral margins and sublateral carinae but with the granules about a fourth coarser and slightly sparser; anterior area of prosternum granulate as basal discal part of elytra; sides and hypomera with the granules about as coarse as those of anterior part of prosternum but distinctly oblong and never round and usually separated by once their diameters. Mesosternum with the groove for the reception of the prosternal process deep and broad and narrowed posteriorly

where it is much deeper than elsewhere ; surface at sides sculptured as prosternal process. Metasternum with the median longitudinal impressed line extending to anterior fourth or fifth ; disk nearly flat, posteriorly only very feebly depressed, and surface with the granules about as coarse as those of prosternal process but flatter and usually confluent to separated by nearly once their diameters so that the whole surface has a subrugose appearance ; sides of metasternum with the granules similar to those of sides of prosternum. Abdomen with the middle of the first sternite broadly and moderately strongly depressed ; first sternite without carinae ; surface of basal middle of first sternite sculptured as prosternal process ; surface elsewhere and that of other sternites granulate as sides of metasternum but with the granules less oblong and more nearly round ; surface of apical middle of first, all of middle of second, and basal middle of third sternite highly polished between granules. *Genitalia* as figured (text-figs. 123, 124.)

Female : Externally similar to male.

Type : In the British Museum (Nat. Hist.). GUATEMALA : Rio Naranjo, alt. 450 ft. (*Champion*).

Specimens examined : 3, MEXICO : Dist. de Temascaltepec, Tejupilco, alt. 4000 ft., vii. 1932 (*H. E. Hinton*) ; 205, with same data as above but collected in vi. 1933 (*H. E. Hinton, R. L. Usinger*) ; 11, as above but taken in vii. 1934 (*H. E. Hinton*) ; and 6, MEXICO : Estado de Morelos, Cuernavaca, vi. 1934 (*H. E. Hinton*).

Variations : No variations worthy of mention have been noted.

Comparative notes : This is very closely related to *E. striatoides* Hinton and *E. sandersoni* Hinton. From both of these only the males can be positively distinguished by not having the ventral apical tufts of long and fine hairs on the four basal segments of the hind tarsi and by the structure of the male genitalia. The females of *striatus* are inseparable from those of *striatoides*, but from those of *sandersoni* they may be distinguished by their smaller size—being never more than 4.5 mm., whereas 5.0 mm. appears to be the normal size of females of *sandersoni*.

***Elsianus striatoides* Hinton.**

(Text-figs. 125–127.)

1939. *Elsianus striatoides* Hinton, *Trans. R. Ent. Soc. Lond.*, 85 (18) : 422, figs. 15–17.

Male : Length, 4.5 mm. ; breadth, 1.9 mm. Identical to *striatus* except as follows : (1) at ventral apex of each of the four basal segments of the hind tarsi with about two to four very fine, partly erect testaceous hairs which are about as long as their respective segments ; and (2) male genitalia with the apex of the median lobe extending much further beyond apices of lateral lobes than is the case in *striatus* (*cf.* figures).

Female : Externally similar to male except that the ventral apices of the four basal segments of the hind tarsi have no long and fine hairs.

Type : ♂ in the British Museum (Nat. Hist.). MEXICO : Dist. de Temascaltepec, Temascaltepec, alt. 5600 ft., 28.v. 1933 (*H. E. Hinton, R. L. Usinger*).

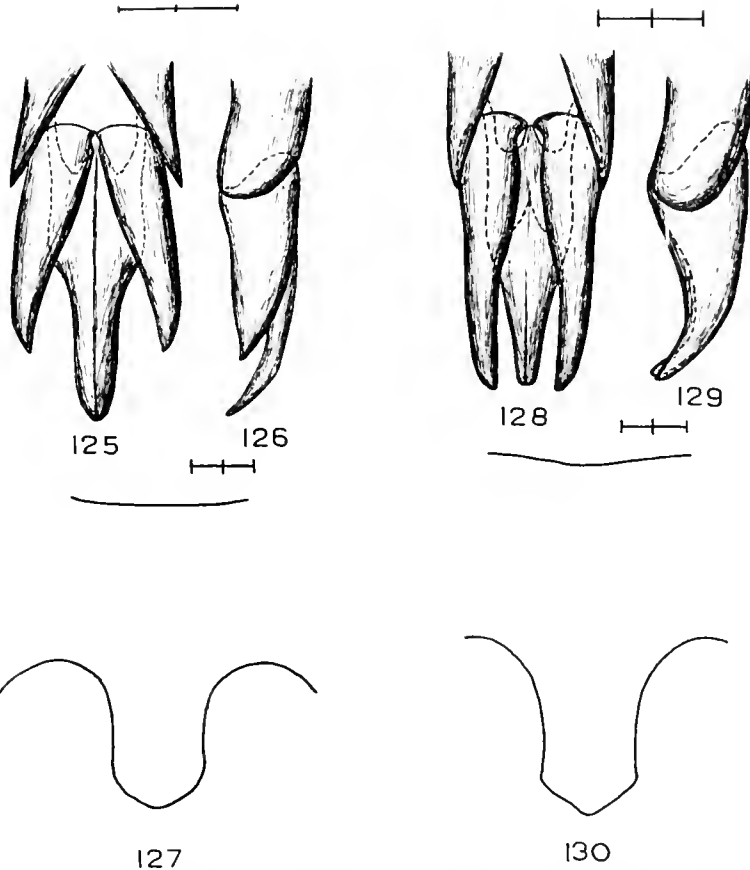
Specimens examined : 1, ♂ with data as above but collected on 5.vi. 1933 ; and 4, ♀♀ which may belong to this species collected in the same district but at Real de Arriba, alt. about 7000 ft., 25.v. 1933.

***Elsianus sandersoni* Hinton.**

(Text-figs. 128-130.)

1936. *Elsianus sandersoni* Hinton, *Trans. R. Ent. Soc. Lond.*, 85 (18): 120, figs. 12-14

Male: Length, 4.5 mm.-5.0 mm.; breadth, 1.87 mm.-2.05 mm. Identical to *striatoides* except that the genitalia have the apices of the lateral lobes extending



TEXT-FIGS. 125-130. —(125) Dorsal view of male genitalia of *Elsianus striatoides* Hinton. (126) Left lateral view of same. (127) Prosternum of same species. (128) Dorsal view of male genitalia of *E. sandersoni* Hinton. (129) Left lateral view of same. (130) Prosternum of same species.

slightly beyond the apex of the median lobe (*cf.* figures). First segment of front and middle tarsi with long and fine hairs on the ventral apex which are similar to those of first segment of hind tarsi. *E. striatoides* apparently has not fine long hairs on the ventral apex of the middle and front tarsi, but this may be due entirely to the fact that my two male specimens are badly rubbed.

Female: Externally similar to male but without the long and fine hairs on the tarsi.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Tejuipilco, alt. 4000 ft., vii. 1934 (*H. E. Hinton*).

Specimens examined: 1, ♂, MEXICO: Estado de Morelos, Cuernavaca, vi. 1934 (H. E. Hinton); and 4 ♀♀ with same data.

I have placed these females with this species because of their large size (5.0 mm.) though, apart from size, I have no good evidence that they belong to *sandersoni*, as *striatus* has also been taken in this locality.

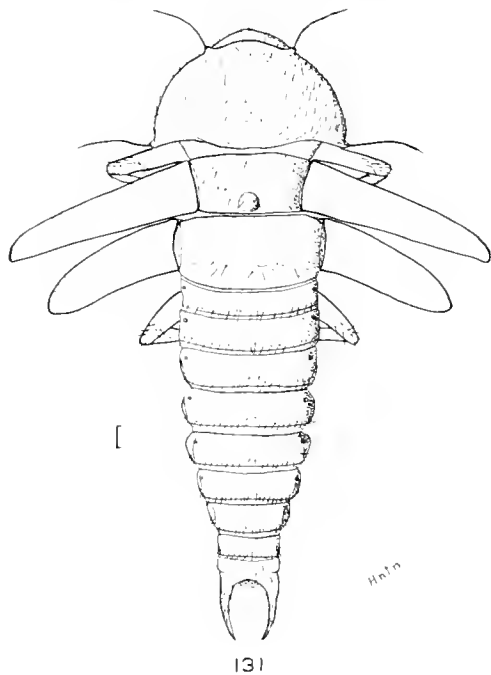
PUPAE.

About 18 specimens of the pupa of *Elsianus graniger* Sharp were taken by peeling off the moss matting which was growing above the water level on large stones in a small torrential stream. The pupal cells were formed in the earth held by the roots of the moss, and occasionally the ventral side of the cell was formed by the surface of the stone. A few of the pupae were allowed to emerge, and in this way the species was determined beyond doubt.

Description of Pupa of E. graniger Sharp.

(Text-fig. 131.)

Male: Length, 4.4 mm.—5.5 mm.; breadth (across metathorax and including front wings), 1.7 mm.—1.9 mm. *Head* concealed from above by pronotum so



TEXT-FIG. 131.—Pupa of *Elstanus graniger* Sharp.

that only the vertex is visible; without distinct impressions; surface densely microscopically alutaceous and with fine, erect pale hairs which are about 0.10 mm. long or more and arise at intervals from less than to one and a half their lengths. Antennae in normal position extending posteriorly and downwards to a point opposite anterior margin of front coxae. Clypeus with the

fronto-clypeal suture deep and straight; anterior margin nearly truncate and the angle on each side broadly rounded; surface as head but with a complete transverse row of setae at middle which are similar to the longer ones of head. Labrum with the anterior margin broadly, deeply, and arcuately emarginate and with the angle on each side broadly rounded; surface alutaceous as head but with only a few fine, short, recumbent setae. *Pronotum* similar in shape to that of the adult but with the sublateral carinae only feebly raised and the gibbosity in front of the scutellum not evident. Each apical and basal angle with a long (about 0.50 mm.), stout, curved seta; apical setae curved outwards and usually slightly shorter than basal; surface similar to that of head but with the hairs slightly denser. *Mesonotum* with a large and round gibbosity (text-fig. 131) which represents the scutellum beneath. Thoracic and abdominal segments as figured (text-fig. 131); ninth abdominal segment at apex with two lateral projections. *Wings* with the anterior pair extending to ventral side, attaining middle of third abdominal segment, and near apex separated from each other by a distance equal to more than their greatest breadth; posterior wings similarly extending to ventral side but much closer near apex and attaining apical margin of third abdominal segment. *Legs* with the front pair extending to posterior third of metathorax and tarsi separated from each other by about a third of their lengths; middle pair extending to posterior margin of metathorax and at apex seldom separated by more than the length of the fifth tarsal segment; hind pair with the coxa, trochanter, basal three-fourths of femur, apical half of tibia, and base of tarsus concealed by hind wings and the apical segments of the tarsi are contiguous along the middle line of the body and the claws extend to posterior margin of fifth abdominal sternite. *Abdominal spiracles* placed on dorso-lateral sides and opening on apices of small tubercles.

Female: Externally similar to male except that the middle apical margin of the eighth abdominal sternite (this is the sternite which corresponds to the sixth from base in the adults) is rounded and not moderately deeply emarginate as in male. The sexes may also be distinguished by the developing external genitalia.

LARVAE.

The larvae of this genus have been definitely determined as such, for the cast skin of a last instar larva was found with a pupa in a cell, and when the pupa emerged it proved to be that of *Elsianus graniger*.

The following brief generic diagnosis is the result of a study of the larvae of about 15 species in my collection.

Generic Characters of Larvae of Elsianus.

Body parallel, cylindrical. *Head* when viewed dorsally exposed and not concealed by the pronotum; anterior margin on each side between base of antenna and clypeus toothed. With one ocellus on each side. Antennae 3-segmented and feebly retractile. Mandibles of both sides similar and with three obtuse apical teeth; prostheca long, slender, and densely spinose. Maxilla with the palp 4-segmented and the stipes showing no differentiation into a palpifer; galea and lacinia separate and apex of each densely spinose. Labium with the postmentum undivided; labial palp 2-segmented and prementum without or with only a very feebly developed palpifer. Gula well-developed. *Prothoracic pleura* (text-fig. 132) divided into two parts and anterior part meeting on middle

line of body so that the sternum is here completely suppressed. Meso- and meta-pleurae divided into two parts. Abdominal segments one to seven with the pleurae bounded by tergo- and sterno-pleural sutures; segments two to seven with a dorsal suture parallel to the suture usually considered to be the tergo-pleural, and if this dorsal suture is in fact the true tergo-pleural, then we must consider the pleurae to be longitudinally divided on segments two to seven; segment eight forming a complete sclerotized ring. Operculum with two strongly sclerotized claws attached to its dorsal membrane. Apex of ninth segment feebly to strongly emarginate. *Spiracles* present on mesothorax and first eight abdominal segments and usually opening on small tubercles. Tracheae without air sacs. Three tufts of retractile, anal, tracheal gills are present. *Alimentary canal* with an oesophageal sclerite on the posterior dorsal margin of the oesophagus. Hind gut with six Malpighian tubules which end freely near the rectum. *Central nervous system* with three thoracic and eight abdominal discrete ganglia.

This genus is close to no other known to me. The larvae of four Mexican species have been studied and of these it has only been possible with any certainty to give names to two. A table for the separation of these species follows:

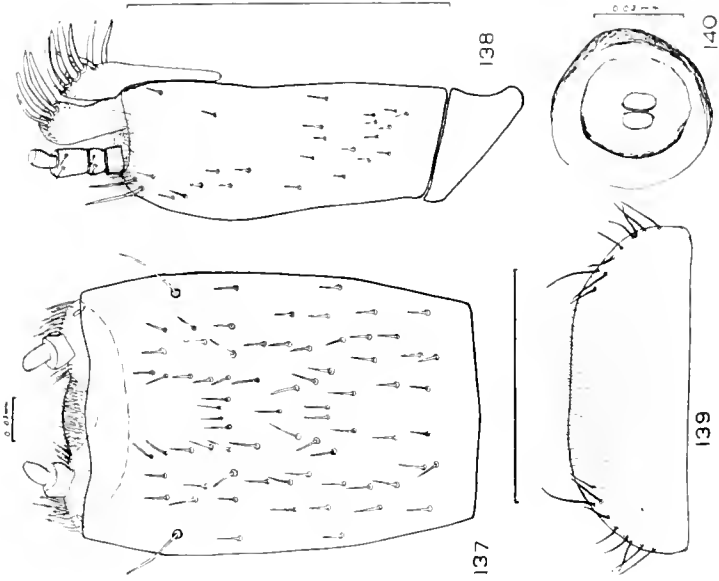
A KEY TO THE LARVAE OF THE MEXICAN SPECIES OF *Elsianus*.

1. Metasternum and first abdominal sternite anteriorly at middle with a longitudinal carina *E. graniger* Sharp.
Metasternum and first abdominal sternite without longitudinal carinae 2.
2. First abdominal sternite with the transverse and anterior reticulate belt extending to posterior fourth at middle of segment *E. striatus* Sharp.
First abdominal sternite with the transverse and anterior reticulate belt never extending at middle as far as posterior two-thirds of segment 3.
3. Setae which arise from posterior row of all segments except ninth round and densely and finely hairy; anterior middle portion of prosternum very strongly produced and anterior angles moderately strongly produced *E.* sp. ?.
Setae which arise from posterior row of tubercles of all segments except ninth flat and apically branched; anterior middle portion of basal prosternal sclerite only moderately produced and anterior angles not produced *E.* (?) sp. ?.

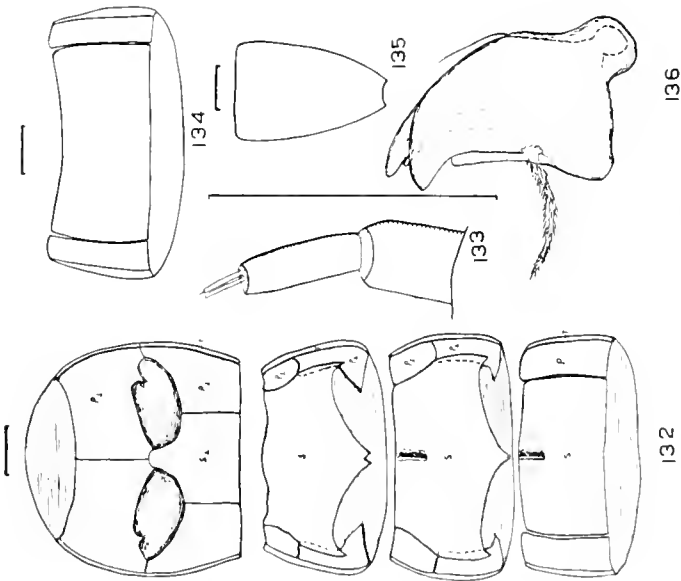
Description of mature larva of E. graniger.

(Text-figs. 132-146, 150.)

Length, 8.0 mm.; breadth (across broadest point which is near base of metathorax), 1.15 mm. Elongate, subparallel, and cylindrical to subtriangular in cross section. Cuticle moderately shining and brownish; antennae, mouth-parts, and legs paler brown to testaceous. *Head* at broadest point which is at basal third slightly broader than long (0.70 mm.: 0.57 mm.); coronal suture 0.07 mm. long, very broad at base and narrow anteriorly; frontal suture on each side extending in a nearly straight line to anterior margin of head near base of antenna; anterior margin between base of antenna and clypeus with a tooth-like projection which extends slightly beyond anterior margin of clypeus; surface sparsely pubescent with fine and erect hairs which are about 0.04 mm. long;

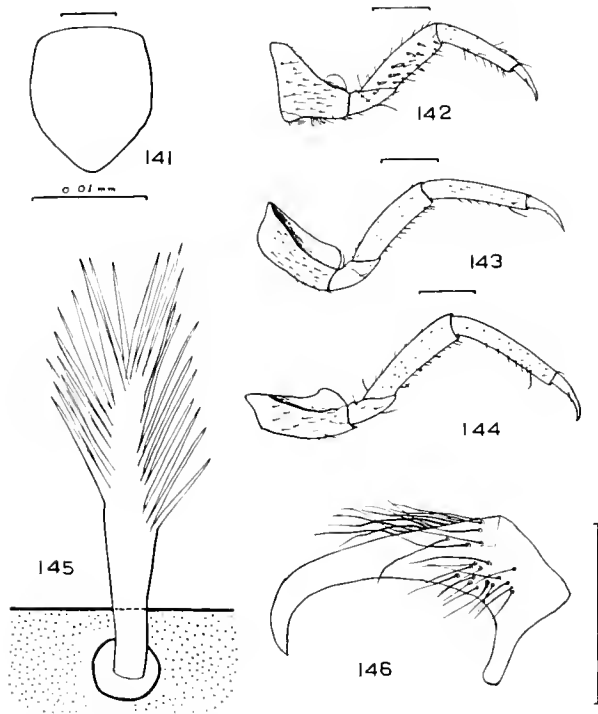


TEXT-FIGS. 137-140. Larva of *Lisianskiella grangeri* Sharp. (137) Ventral view of labrum. Setae of prementum are only approximately correct. (138) Ventral view of right maxilla. (139) Dorsal view of labrum. Fine setae are only approximately correct. (140) Mesothoracic spiracle.



TEXT-FIGS. 132-136. Larva of *Lisianskiella grangeri* Sharp. (132) Ventral view of thorax and first abdominal segment to show sclerotization. (133) Antenna. (134) Ventral view of second abdominal segment to show sclerotization. (135) Dorsal view of ninth abdominal segment. (136) Mandible.

surface finely and densely alutaceous throughout; surface on a basal belt as long as epicranial suture only alutaceous and elsewhere set with round to feebly oblong granules which are about 0.03 mm. broad and are usually separated by once their diameters, each granule with a coarse seta which is as long or a little longer than its respective granule. *Thoracic* and *abdominal tergites* for the most part sculptured as head but with the granules slightly coarser and the alutaceous microsculpture sparse or absent; pronotum with a number of small oval or irregular areas which are free of granules; meso- and metanotum with these



TEXT-FIGS. 141-146.—Larva of *Elsimus graniger* Sharp. (141) Operculum. (142) Anterior view of right front leg. (143) Posterior view of left middle leg. (144) Posterior view of left hind leg. (145) A seta from the ventral margin of the operculum. (146) Dorsal view of right opercular claw.

areas less numerous; and abdominal tergites one to seven with a single anterior and lateral oval non-granulate area which is from a sixth to a fourth as long as its segment; tergites of segments eight and nine with the granules largely replaced by punctures of the same size and density as the granules of other segments. Posterior margin of all segments except ninth with a complete ring of close tubercles from which arise flat and apically slightly branched setae (text-fig. 150). All tergites, pleurites and sternites except those of pronotum with an anterior transverse, short belt which is free of granules and is coarsely and reticulately alutaceous; sternites of abdominal segments two to five with a complete row of close tubercles along posterior margin of this belt. Sternites and pleurites for the most part sculptured as tergites; first abdominal sternite with the sculpture as figured (text-fig. 150). Metasternum and first abdominal sternite

with a longitudinal carina on the middle of the posterior third to fourth (text-fig. 132). Apex of ninth abdominal segment (text-fig. 135) deeply and transversely emarginate. Operculum (text-fig. 141) with the claws (text-fig. 146) not toothed. Legs as figured (text-figs. 142-144). Spiracles opening on small tubercles and all similar to those of mesothorax (text-fig. 140).

Specimens examined: 58, MEXICO: Dist. de Temascaltepec, Temascaltepec, alt. 5600 ft., vi-vii.1934 (H. E. Hinton); 4, with same data but collected at Tejupilco, alt. about 4000 ft.; and 13, MEXICO: Estado de Morelos, Cuernavaca, vi.1934 (H. E. Hinton).

Among my series there are several specimens representing at least one earlier instar, but these differ in apparently no way but size from the mature larvae.

Comparative notes: This larva may be distinguished at once from all others known by the presence of a longitudinal carina on the mesosternum and the first abdominal sternite.

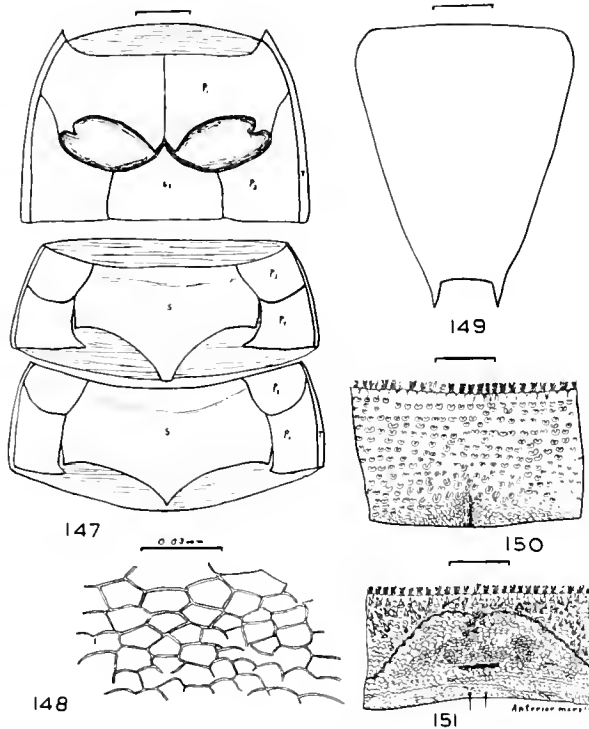
Description of Mature Larva of E. striatus.

(Text-figs. 147-149, 151.)

The larvae of this species were determined by elimination and according to locality.

Length, 9.0 mm.; breadth (across broadest point which is near base of metathorax), 1.15 mm. Elongate, subparallel, and cylindrical to subtriangular in cross section. Cuticle moderately shining and brownish; antennae, mouth-parts and legs paler brown to testaceous. Head across broadest point, which is at basal fourth, slightly broader than long (0.75 mm.: 0.72 mm.); posterior margin of head broadly and arcuately emarginate at middle; epicranial suture 0.05 mm. long; frontal suture extending on each side in a line which is slightly curved outwards to anterior margin opposite base of antenna; anterior margin on each side between base of antenna and clypeus with a tooth-like projection which extends slightly beyond anterior margin of clypeus and is feebly curved inwards. Cuticle sparsely pubescent with fine, erect hairs which are usually 0.075 mm. long and on each side mesal to and slightly behind eye with an erect seta which is three times this length; surface finely and sparsely or densely alutaceous, though often free of this alutaceous microsculpture; surface on a basal belt as long as epicranial suture only densely alutaceous and elsewhere with granules which are about 0.012 mm. broad and at sides of head are usually separated by once to twice their diameters, while on middle they are frequently replaced by equally small punctures which are similarly distributed; from each puncture or granule a coarse, short seta arises which is about a third longer than its respective granule or puncture. Clypeus with the fronto-clypeal suture visible but indistinct; broader and shorter than labrum; anterior margin truncate, with the angle on each side rounded; surface basally sculptured as middle region of head while on anterior middle region it is only sparsely alutaceous. Labrum as long as second antennal segment and slightly narrower than clypeus; anterior margin feebly rounded and the angle on each side broadly rounded; surface punctate and setose as middle region of head but anteriorly with fine punctures from which arise fine, erect, golden hairs which are slightly larger than the usual coarse setae. Mandibles similar to those of *graniger* but with the fine non-plumose seta on the middle of the outer margin proportionally only about half as long. Maxilla and labium fairly close to that figured for *graniger* (text-figs. 137, 138) but with the stipes of the first maxilla slightly more densely setose. Thoracic and

abdominal tergites for the most part sculptured as head but usually only with granules which are slightly coarser and on posterior segments have the apices acute and produced ; pronotum with a number of irregularly oval areas which are free of granules ; meso- and metanotum with a similar oval area on lateral fourth and another on lateral two-fifths ; and first eight abdominal tergites with a similar area on lateral fourth which may vary from being a sixth to a fourth as long as its respective segment. Posterior margin of all segments except ninth with a complete ring of close tubercles from which arise flat and apically slightly branched



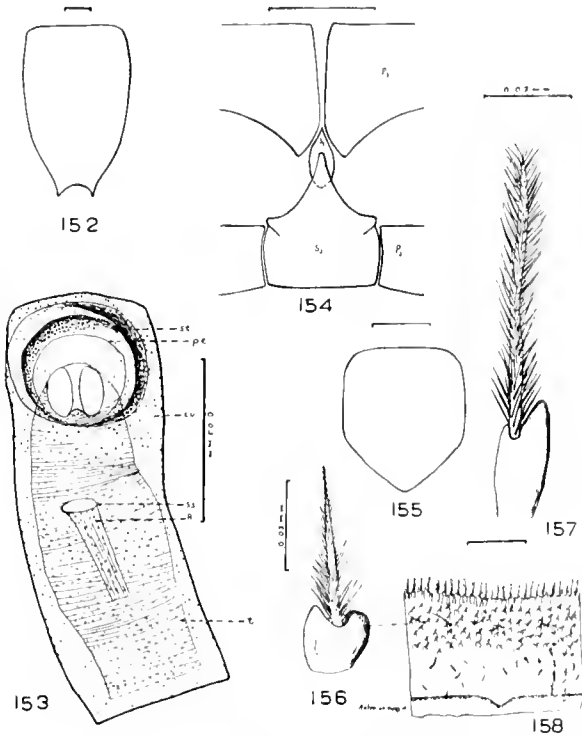
TEXT-FIGS. 147-151.—(147) Ventral view of thorax of larva of *Elsianus striatus* Sharp to show sclerotization. (148) Reticulate sculpture of anterior region of first abdominal sternite of same. (149) Dorsal view of ninth abdominal tergite of same. (150) Sternite of first abdominal segment of *E. graniger* Sharp. (151) Sternite of first abdominal segment of *E. striatus*.

setae (text-fig. 151). All tergites, pleurites, and sternites except those of pronotum with an anterior transverse belt which is usually free of granules and is coarsely and reticulately alutaceous ; this belt is generally about a fourth to a third as long as its respective segment but that of ninth is less than a sixth as long as that segment ; all sternites except that of prosternum and ninth abdominal segment with a complete and transverse heavily sclerotized belt or ridge along posterior margin of reticulate belt. Sternites and pleurites with acute tubercles similar to tubercles of tergites ; first abdominal sternite sculptured as figured (text-fig. 151). Postero-lateral angles of all abdominal segments strongly and acutely produced. Apex of ninth abdominal tergite (text-fig. 149) deeply and truncately emarginate. Operculum with the claws not toothed and at base on dorsal surface

with a number of very long, fine, recumbent hairs. *Legs* similar in size and shape to those figured for *graniger* but with the chaetotaxy slightly different. *Spiracles* similar to those of *graniger*.

Specimens examined: 103, MEXICO: Dist. de Temascaltepec, Tejupilco, alt. about 4000 ft., vii. 1934 (*H. E. Hinton*); and 13, MEXICO: Estado de Morelos, Cuernavaca, vi. 1934 (*H. E. Hinton*).

Included in this material there are specimens representing at least two earlier instars, but these differ apparently only in size from the mature larvae.



TEXT-FIGS. 152-158.—Larva of *Elsianus* sp. ? (152) Dorsal view of ninth abdominal segment. (153) Spiracle of first abdominal segment. (154) Prosternum. (155) Operculum. (156) One of the usual tubercles of the first abdominal sternite. (157) A tubercle from the posterior marginal row of the fifth abdominal tergite. (158) First abdominal sternite.

Comparative notes: This species may be distinguished from *E. graniger* in not having a longitudinal carina on the metasternum and first abdominal sternite. The sculpture of the first abdominal sternite (text-fig. 151) differs markedly from all species known to me.

Description of Mature Larva of Elsianus sp. ?.

(Text-figs. 152-158.)

Length, 0.0 mm.; breadth (across broadest point which is near base of metathorax), 1.12 mm. Resembles *striatus* but may be distinguished as follows: (1) thoracic and abdominal tergites with the setae which arise from the tubercles plumose and not smooth; (2) posterior margin of all segments except ninth with

a complete ring of close tubercles from each of which arises a long, round, and densely hairy seta, instead of, as in *striatus*, a flat seta with a few apical branches; (3) middle of anterior margin of posterior prosternal sclerite very strongly instead of moderately produced (*cf.* text-figs. 154 and 147); (4) anterior angles of posterior prosternal sclerite (text-fig. 154) strongly produced and rounded, whereas in *striatus* they are not produced and are angulate; (5) sternite of first abdominal segment with the anterior reticulate belt at middle confined to anterior fifth of sternite whereas in *striatus* it extends to posterior fourth; and (6) apex of ninth abdominal segment (text-fig. 152) slightly arcuately instead of truncately emarginate.

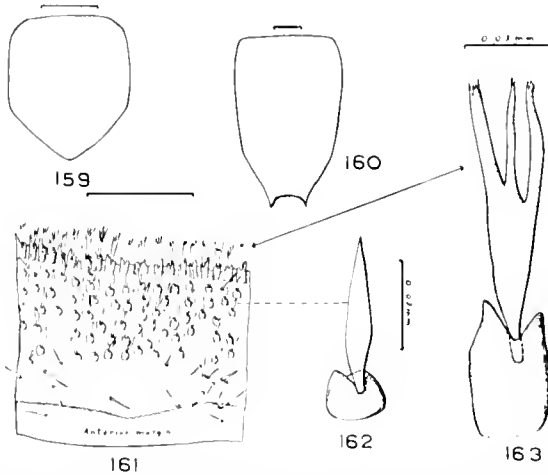
Specimen examined: 1, apparently mature larva. MEXICO: Dist. de Temascaltepec, Temascaltepec, alt. 5600 ft., vii. 1934 (*H. E. Hinton*.)

Description of Mature Larva of Elsianus (?) sp. ?.

(Text-figs. 159-163.)

Length, 8.5 mm.; breadth (across broadest point which is near base of metathorax), 0.82 mm. Elongate, subparallel, and cylindrical to subtriangular in cross section. Cuticle feebly shining and brownish-testaceous; antennae, mouth-parts, and legs paler testaceous. *Head* across broadest point which is at basal fourth broader than long (0.75 mm.: 0.65 mm.); posterior margin of head at middle very broadly and only feebly arcuately emarginate; epicranial suture 0.12 mm. long and narrow; frontal suture on each side extending in a moderately sinuate line to anterior margin opposite base of antenna; anterior margin on each side between base of clypeus and antenna with a large and straight tooth which is nearly twice as long as clypeus. Cuticle sparsely pubescent with fine, erect hairs which are usually 0.15 mm. long; surface on a basal belt as long as epicranial suture smooth to moderately densely alutaceous and without distinct granules or punctures; surface elsewhere occasionally moderately densely alutaceous though usually smooth and with flat round granules which are about 0.03 mm. broad and are separated mostly by once their diameters; from these granules arise setae which are about as long or a little longer than their respective granules; surface of head with the area enclosed by the frontal sutures, except for a small antero-lateral area on each side, free of granules. Antennae retractile up to apex of first segment. Clypeus with the fronto-clypeal suture visible; broader than labrum and as long as second segment of antenna; anterior margin truncate and with the angle on each side rounded; surface, except at sides where there are a few granules, free of granules and sculptured as frontal region of head. Labrum narrower and slightly shorter than clypeus; anterior margin nearly truncate and with the angle on each side broadly rounded; surface similar to that of clypeus but near middle with a complete transverse row of close, fine, erect hairs which are slightly shorter than usual ones of head. Mandibles with the seta on middle of outer margin proportionally as long as that of *graniger*. First and second maxilla in general form similar to that figured for *graniger*, but with the apical region of the postmentum about a fourth broader than the basal. *Pronotum* with the surface similar to that of frontal region of head but with the erect setae generally about a fourth longer, and at anterior third there is a short (about two granules wide) transverse belt of tubercles which extends from lateral margin on each side of the middle third of pronotum; lateral margins basally and anteriorly with a few granules similar to those of head; meso- and metanotum similar but with the transverse band at middle three times as long (four to six

granules broad) and extending right across middle, though basally interrupted at lateral third; first three abdominal tergites with only a short posterior belt and an oval lateral area, which is about a third as long as any segment, free of granules; tergites four to seven without a posterior belt free of tubercles but with the lateral, oval, non-tuberculate area present; tergites eight and nine without the lateral, oval, non-tuberculate area. Anterior reticulate or coarsely alutaceous belt of tergites, pleurites, and sternites present on all segments except pronotum, usually about a fifth as long as any segment, and along posterior margin with a complete transverse heavily sclerotized ridge which may or may not be tuberculate and is present except on pleurites, though on eighth and ninth segments it forms a complete ring; on abdominal segments one to seven it is on the sternites arcuately



TEXT-FIGS. 159-163.—Larva of *Elstianus* (?) sp. ? (159) Operculum. (160) Dorsal view of ninth abdominal segment. (161) First abdominal sternite. (162) Tubercle from first abdominal sternite. (163) Tubercle from posterior marginal row of first abdominal sternite.

curved so that at middle it is nearer anterior margin than elsewhere. Posterior margin of all segments except ninth abdominal with a complete ring of close, large tubercles from which arise flat setae which are about twice as long as their respective tubercles and are branched apically (text-figs. 161 and 163). First abdominal sternite sculptured as figured (text-fig. 161). Anterior margin of posterior prosternal sclerite similar to that of *striatus* (cf. figure). Posterior margin of meso- and metasternum strongly and acutely produced. Pleurae of abdominal segments two to seven longitudinally not divided and tergo-pleural suture ventral. Postero-lateral angles of tergites rounded and not produced. Apex of ninth abdominal segment (text-fig. 160) broadly, deeply, and arcuately emarginate. Operculum (text-fig. 159) with the claws not toothed and at base on dorsal surface with a number of very long, fine, recumbent hairs. *Legs* similar in shape and size to those figured for *E. graniger*. *Spiracles* similar to those of *graniger* and *striatus*.

Specimens examined: 3, apparently mature larvae, MEXICO: Dist. de Temascaltepec, Temascaltepec, alt. 5600 ft., vii. 1934 (*H. E. Hinton*).

Comparative notes: This is the only species of about 15 I have examined

belonging to this genus which has not the pleurae of abdominal segments two to seven longitudinally divided. It may possibly belong to a genus as yet unrecorded from Mexico.

AUSTROLIMNIUS Carter & Zeck.

1929. *Austrolimnius* Carter & Zeck, *Aust. Zool.*, **6** (1) : 61.

1929. *Neosolus* Carter & Zeck, *Aust. Zool.*, **6** (1) : 68.

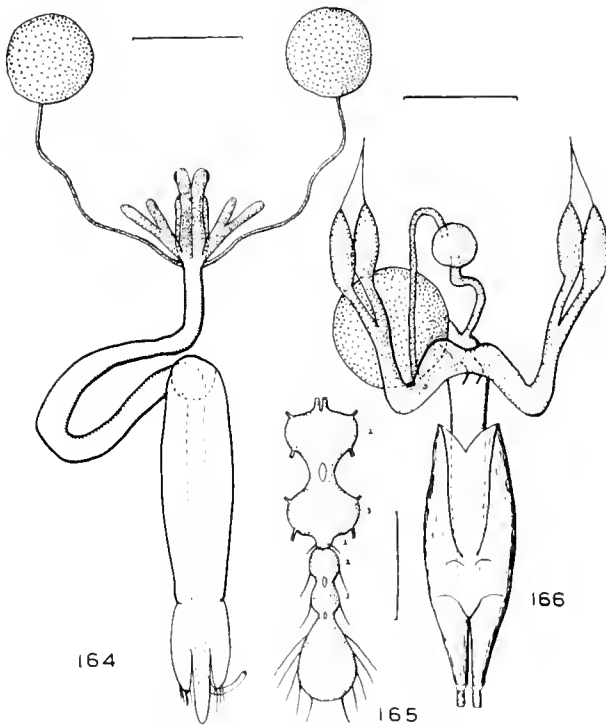
1932. *Austrolimnius* Carter & Zeck, *Aust. Zool.*, **7** (3) : 204.

Carter and Zeck (1929) in their monograph of the Australian Dryopidae erected the genus *Austrolimnius* to contain two species described by King (1865) in the genus *Elmis* Latreille and two new species. In the same monograph they erected the genus *Neosolus* to contain a single new species, *N. tropicus*. *Neosolus* was later (1932) sunk by them as a synonym of *Austrolimnius*. Altogether ten species and three varieties have been described from Australia. The following North and South American species should be referred to *Austrolimnius*: *A. chilensis* (Champion) (*Elmis prothoracica* Hinton); *A. curtulus* (Sharp) (*Elmis*); *A. formosus* (Sharp) (*Elmis*); *A. laevigatus* (Grouvelle) (*Elmis*); *A. pilulus* (Grouvelle) (*Elmis*); and *A. sulcicollis* (Sharp) (*Elmis*). Altogether eight species are known from North and South America, and of these two have been collected as far north as Mexico, *A. formosus* and *A. sulcicollis*.

A redescription of the genus follows :

Body obovate to subparallel. Dorsal surface glabrous or clothed with sparse and short recumbent hairs. Tomentum confined to the following areas : (1) genae ; (2) epipleura ; (3) occasionally (*A. luridus* C. and Z. and *A. minutus* Hinton) sides of elytra between inner margin of epipleura and outer sublateral carina ; (4) hypomera ; (5) sides of prosternum, mesosternum, metasternum, and abdominal sternites, but in some species nearly the entire sternum of the abdomen is clothed with fine tomentum ; (6) part or all of legs except tibiae and tarsi. *Head* when seen from below capable of being retracted so that none of the mouth-parts are visible. Antennae 11-segmented. Mandibles with three apical blunt teeth ; prostheca large and entirely membranous with numerous fine spines or hairs apically. Maxilla with the palp 4-segmented and stipes with a well-developed palpifer ; galea and lacinia separate and apex of each densely spinose. Labium with the palp 3-segmented and prementum with a well-developed palpiger. Mentum transverse and about as broad as and two-thirds to three-fourths as long as submentum. Gula slightly narrower than submentum, about a third longer, and with the sides nearly parallel. *Pronotum* with the anterior margin moderately to strongly arcuate at middle and on each side behind eye before apical angle shallowly to deeply sinuate. Base trisinate, broadly and moderately deeply so on each side and more narrowly and shallowly so in front of scutellum. Pronotum with a sublateral carina on each side which extends from base nearly to apical margin and may or may not be prominent ; disk with or without a median longitudinal impression. *Elytra* impunctate or with distinct seriate punctures but seldom with striae which if present are only very feebly impressed ; each elytron with two prominent sublateral carinae. Epipleura with a longitudinal line of granules which on anterior two-fifths is halfway between dorsal and ventral margins, while on posterior three-fifths it is close to and parallel to ventral margin. Hind wings with the venation much reduced ; with a well-developed anal lobe (text-fig. 168) ; without a radial cross vein and without an anal cell ; first anal absent ; second anal without

branches ; third anal only present basally and joined to second anal at extreme base ; fourth anal short and indistinct ; and cubito-anal cross vein arising from second anal at about the middle of the length of the latter but not complete to cubitus. Prosternum very long in front of anterior coxae ; prosternal process long and very broad and posterior margin broadly rounded. Mesosternum with a broad and deep groove for the reception of the prosternal process. Metasternum with a median longitudinal impressed line. *Legs* with the visible portion of the front coxae rounded and trochantin completely concealed by hypomera and



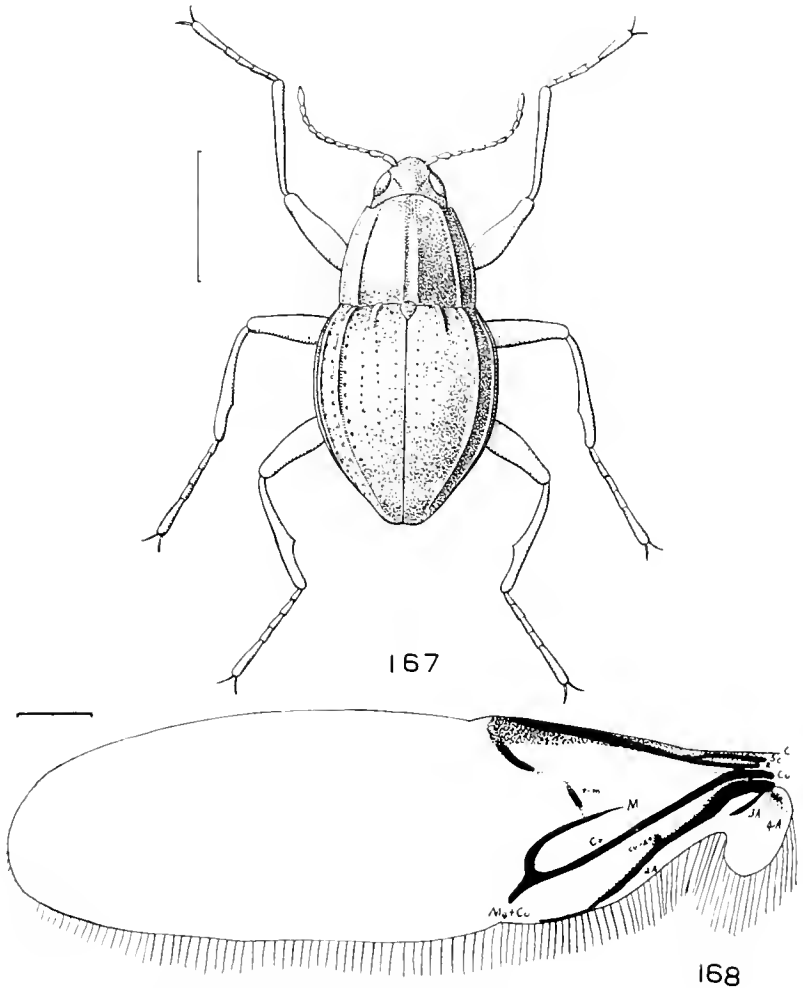
TEXT-FIGS. 164-166.—*Austrolimnius tarsalis* Hinton. (164) Male reproductive system, (165) Central nervous system. (166) Female reproductive system

sternum. Claws without teeth. *Alimentary canal* with five caeca on the anterior margin of the mid-gut. Hind gut with six Malpighian tubules which end near the rectum freely or embedded in fatty tissue. *Male reproductive system* (text-fig. 164) with the lateral accessory glands with several lobes. Each testis with only one sperm tube. *Female reproductive system* (text-fig. 166) with two egg tubes to each ovary. Spermathecal duct opening posteriorly to bursa copulatrix. *Central nervous system* (text-fig. 165) with three thoracic discrete ganglia. First abdominal ganglion fused to third thoracic, two and three free, and four to eight fused into a single large ganglion.

GENOTYPE: *Elmis politus* King.

The internal anatomy of only one species, *A. tarsalis* Hinton, has been examined.

This genus is close to *Limnius* Erichson, but may be distinguished as follows : the middle region of the head is without tomentum ; Carter and Zeck (1929 : 61) claim that there is no tomentum on the head in *Austrolimnius*, but the genae are clearly tomentose in their genotype and in seven other species I have been able to examine for this character ; (2) there is no tomentum on the pronotum



TEXT-FIGS. 167, 168.—*Austrolimnius sulcicollis* Sharp. (167) Adult to show general appearance. (168) Hind wing. Venation after Forbes.

between the lateral margin and the sublateral carina, whereas in *Limnius* tomentum, at least anteriorly, is usually present here ; (3) the elytron between the first and second sublateral carinae is never tomentose, whereas in *Limnius* it is usually at least partly tomentose ; (4) the hind wing has a very well-developed anal lobe, whereas in *Limnius* the anal lobe is at most only very feebly developed ; (5) the second anal extends to inner margin of wing opposite junction of cubitus and media, whereas in *Limnius* the second anal is present only basally ; (6) in

Austrolimnius there is an incomplete cubito-anal cross vein, while in *Limnius* there is no trace of such a vein; (7) the male reproductive system has only one sperm tube to each testis, whereas in *Limnius* it has two sperm tubes; and (8) the central nervous system has only the second and third abdominal ganglia free, whereas in *Limnius*, the second, third, and fourth are free.

The specific characters of most importance in separating the species of *Austrolimnius* seem to be the following:

- (1) General proportions, length and breadth.
- (2) Colour. In some species, e.g. *luridus*, *suffusus*, etc., the elytra are maculate.
- (3) Density of the asperate microsculpture on the various sclerites.
- (4) Size and distribution of punctures and tubercles on the various sclerites.
- (5) Condition of fronto-clypeal suture.
- (6) Anterior margin of clypeus, whether rounded, truncate, emarginate, or sinuate; and also angle on each side.
- (7) Condition of anterior margin of labrum and the angle on each side.
- (8) Outline of pronotum. Shape and extent of sublateral carina. Extent and depth of median longitudinal impression if one is present.
- (9) Shape of elytral apices.
- (10) Condition of lateral margin of elytra (inner margin of epipleura), whether crenate or smooth.
- (11) Number and extent, if any, of carinate intervals.
- (12) Condition of epipleura. Form and extent of carina parallel to inner margin if one is present.
- (13) Shape of scutellum.
- (14) Condition of prosternal carinae.
- (15) Condition of anterior portion of prosternum, whether straight or lobed when viewed laterally.
- (16) Extent and depth of mesosternal groove.
- (17) Disk of metasternum, whether flat or not and extent and depth of the various impressions.
- (18) Extent and prominence of carina on each side of metasternal disk.
- (19) Length and prominence, if present, of carina of first abdominal sternite.
- (20) Shape of fifth abdominal sternite.
- (21) Secondary sexual characters.
- (22) Structure of male genitalia. No case is known where these structures are the same for two or more species.

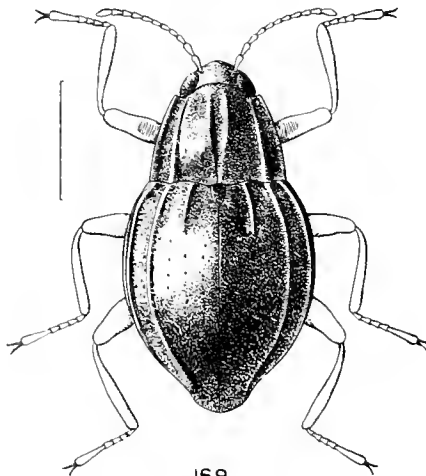
The following are the secondary sexual characters that have been noted by previous authors and those noted by the writer for the first time:

- (1) Male with numerous very long, fine, recumbent, golden hairs on each side of clypeus (*formosus*).
- (2) Male with a dense tuft of long, fine, recumbent, golden hairs on anterior side of metasternal disk (*formosus*).
- (3) Male with the inner apical fifth of the front tibia swollen (*montanus*).
- (4) Male with the front tarsi dilated (*oblongus*).
- (5) Male with numerous very fine and long hairs on ventral surface of four basal segments of front tarsi (*tarsalis*).
- (6) Male with the inner apex of the middle tibia acutely produced (*oblongus*).
- (7) Male with the middle tibiae on inner apical two-fifths swollen and here also with a few fine teeth (*victoriensis*, *oblongus*, *sulcicollis*).

- (8) Male with a row of short and stout teeth on inner apical half of middle tibia (*diemenensis*, *oblongus*).
- (9) Male with the inner apical spur of middle tibia strongly curved inwards (*diemenensis*).
- (10) Male with a few large and acute teeth on inner margin of hind trochanter (*sulcicollis*).
- (11) Male with, on outer apical fourth of hind tibia, a row of long, fine teeth and posterior to these with a few short and stout teeth (*diemenensis*).
- (12) Male with a long and acute tooth on inner apical two-fifths of hind tibia (*sulcicollis*).
- (13) Male with the inner part of apical two-fifths of hind tibia swollen (*tarsalis*).
- (14) Male with the shape of the fifth abdominal sternite different to that of female (*formosus*).
- (15) Male with the surface of the fifth abdominal sternite less strongly granulate than that of female (*formosus*).
- (16) Male with the sixth abdominal sternite differently shaped to that of female (all species).
- (17) Male with the last dorsal abdominal tergite differently shaped to that of female (*formosus*).

A KEY TO THE NORTH AMERICAN SPECIES OF *Austrolimnius*.

1. Elytra without carinate discal intervals. GUATEMALA. MEXICO.
A. formosus (Sharp) (1882).
- Elytra with the third discal interval strongly carinate at base 2.
2. Pronotum with the median longitudinal channel about as broad at apex
as at base. PANAMA, MEXICO *A. sulcicollis* (Sharp) (1882).
- Pronotum with the median longitudinal channel twice as broad on
apical three-fifths as at base (text-fig. 169). PANAMA
A. curtulus (Sharp) (1882).



169

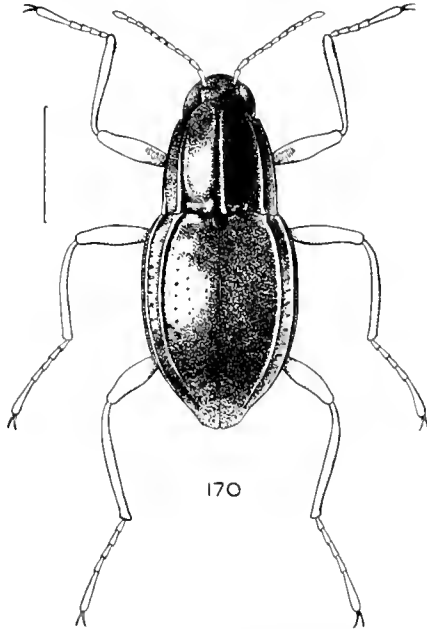
TEXT-FIG. 169.—*Austrolimnius curtulus* Sharp.

***Austrolimnius formosus* (Sharp).**

(Text-figs. 170-180.)

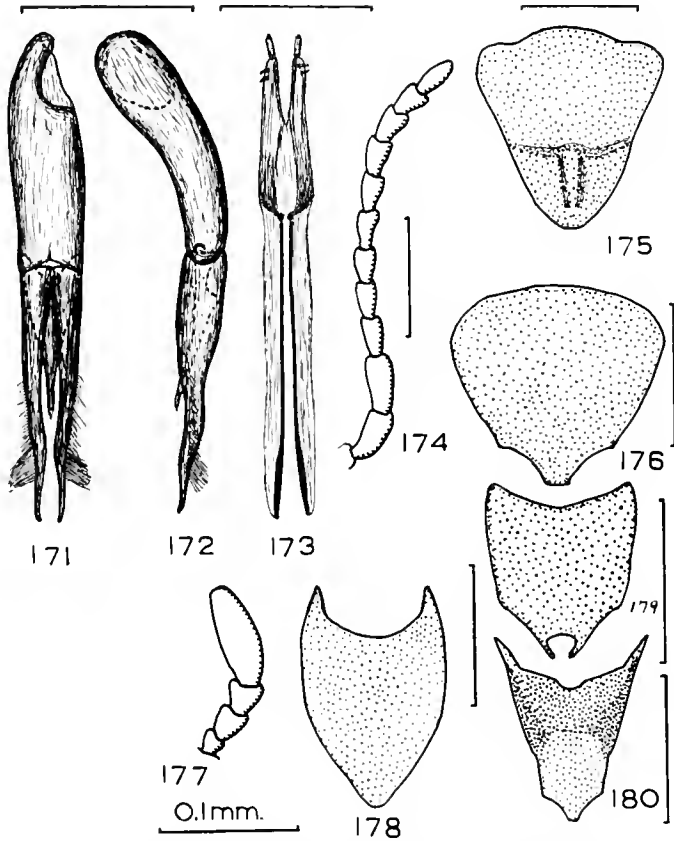
1882. *Elmis formosus* Sharp, *Biol. Centr.-Amer. Col.*, **1** (2) : 140.1939. *Austrolimnius formosus* Hinton, *Trans. R. Ent. Soc. Lond.*, **85** (18) : 120.

Male: Length, 1.3 mm.-1.5 mm.; breadth, 0.62 mm.-0.75 mm. Cuticle moderately strongly shining and black; antennae, mouth-parts, and legs rufopiceous. *Head* without distinct impressions; surface densely and finely asperate and without distinct granules or punctures. Clypeus with the fronto-clypeal suture straight and rather indistinct at middle; anterior margin truncate to very feebly rounded for its entire breadth and angle on each side very broadly

TEXT-FIG. 170.—*Austrolimnius formosus* Sharp.

rounded; surface asperate as on head and on each side with a dense tuft of fine, golden-testaceous, recumbent hairs which are about 0.10 mm. long. Labrum with the anterior margin broadly, arcuately, and moderately deeply emarginate at middle, and with the angle on each side prominent but obtusely rounded; surface slightly more sparsely asperate than that of clypeus; at sides with numerous fine hairs which are similar but generally shorter than those of clypeus. *Pronotum* across broadest point, which is at basal third, not quite as broad as long (0.53 mm. : 0.55 mm.) and base broader than apex (0.52 mm. : 0.32 mm.). Pronotum with the carina and impressions as figured (text-fig. 170). Surface asperate as head but more evenly so. *Elytra* nearly twice as long as pronotum (1.02 mm. : 0.55 mm.) and broadest point which is across middle (0.68 mm.) and very slightly broader than broadest point across humeri. Lateral margins (*i.e.* inner margins of epipleura) nearly smooth. Apices conjointly produced and rounded. Surface without striae; with three discal rows of seriate punctures of which the outer two extend from basal fourth to apical fifth and basally are round, about

0.024 mm. broad, and separated longitudinally by two to three times their diameters; towards apex these punctures become slightly denser and coarser; inner row of punctures similar to outer rows but not beginning until basal two-fifths and extending slightly nearer to apex. Surface between punctures more finely and much more sparsely asperate than that of pronotum. Inner side of inner sublateral carina with a complete row of coarse, less distinct,



TEXT-FIGS. 171-180.—*Austrolimnius formosus* Sharp. (171) Dorsal view of male genitalia. (172) Left lateral view of same. (173) Female genitalia. (174) Antenna. (175) Ventral view of fifth abdominal sternite of male. (176) Ventral view of fifth abdominal sternite of female. (177) Maxillary palp. (178) Apical abdominal tergite of male. (179) Apical abdominal tergite of female. (180) Sixth abdominal sternite of male.

and sparser punctures; between sublateral carinae and between inner margin of epipleura and outer sublateral carina with punctures which are indistinct about two to three times as coarse as those of disk, and are separated by once to twice their diameters. Epipleura from humeri to apical sixth with a row of fine (about as coarse as facets of eye) close granules parallel and close to inner margin of epipleura. *Scutellum* flat, subovate, longer than broad (0.10 mm. : 0.75 mm.), base broadly rounded, and narrowed to apex and at apex feebly rounded; surface asperate as adjacent parts of elytra. *Prosternum* with the carinae prominent

and extending nearly to anterior margin; when viewed laterally the anterior half (not including process) is moderately but not sharply bent ventrally; surface of middle and of process asperate as pronotum, while the surface of the sides and hypomera is asperate as that of head. Mesosternum with the groove for the reception of the prosternal process broad and deep but not extending beyond posterior third; surface asperate on each side as that of prosternal process. Metasternum with the median longitudinal line feebly impressed and extending nearly to anterior fourth; disk anteriorly nearly flat and with the posterior third moderately strongly convex; disk on each side with a prominent carina which extends posteriorly and slightly outwards from middle coxa nearly to hind coxa; surface asperate as disk of elytra and on each side near anterior fourth of discal carina with a dense tuft of fine, recumbent, golden testaceous hairs which are about 0.05 mm. long; sides of metasternum asperate as pronotal disk. Abdomen with the first sternite without carinae; surface of sternites one to four asperate as metasternal disk; fifth sternite (text-fig. 175) more densely asperate and also with a few obscure granules. *Genitalia* as figured (text-figs. 171, 172).

Female: Externally similar to male except as follows: (1) there is no dense tuft of fine and long hairs on each side of the clypeus; (2) there is no dense tuft of fine and long hairs on each side of the metasternal disk near anterior fourth of discal carina; (3) the fifth abdominal sternite is shaped differently (cf. text-figs. 176 and 175); (4) the surface of the fifth abdominal sternite is more densely and distinctly granulate than that of the male, the granules being here about as coarse as facets of eyes and separated by two to three times their diameters; and (5) the last dorsal abdominal segment is differently shaped (cf. text-figs. 179 and 178).

Type: In the British Museum (Nat. Hist.). GUATEMALA: Vera Paz, San Joaquín (*Champion*).

Specimens examined: 1, with same data as type. 18, MEXICO: Dist. de Temascaltepec, Tejupilco, alt. about 4000 ft., vi. 1933 (*H. E. Hinton, R. L. Usinger*); 1, in the same district, Real de Arriba, alt. about 7000 ft., 28.v. 1933 (*H. E. Hinton, R. L. Usinger*); and 21, MEXICO: Estado de Morelos, Cuernavaca, vi. 1934 (*H. E. Hinton*).

Variations: No variations, apart from absolute size, have been noted.

Comparative notes: This species may be easily distinguished from its only Mexican congener and the only other North American species of the genus by the absence of a basal carina on the third discal elytral interval.

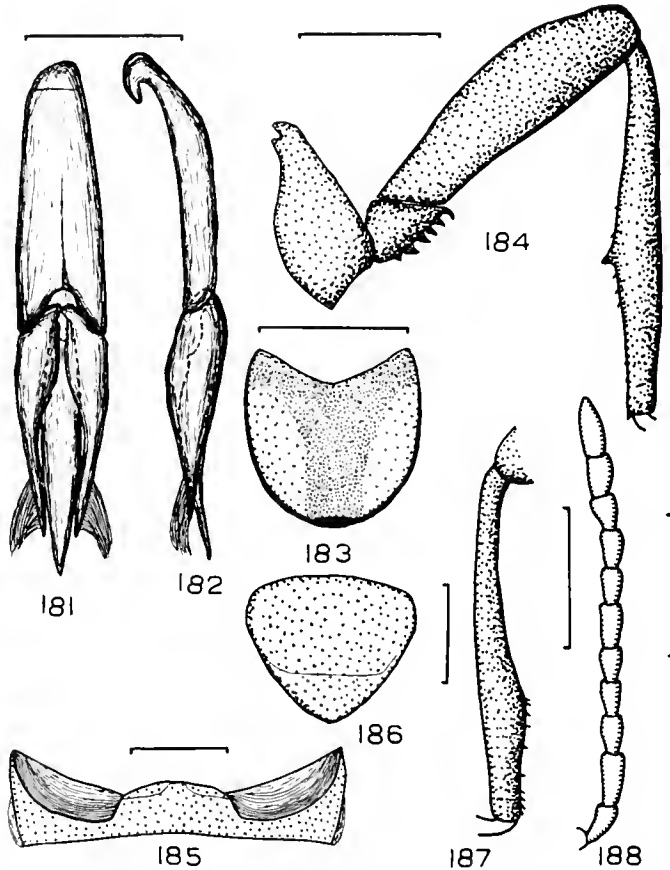
***Austrolimnius sulcicollis* (Sharp).**

(Text-figs. 167, 168, 181-188.)

1882. *Elm. sulcicollis* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2): 139, t. 4, f. 10.

Male: Length, 1.3 mm.-1.4 mm.; breadth, 0.70 mm. 0.77 mm. Cuticle moderately shining and rufo-piceous to black; antennae, mouth-parts, and legs paler rufo-piceous. Head without distinct impressions; surface densely and very finely asperate and without granules or punctures. Clypeus with the fronto-clypeal suture straight and rather indistinct at middle; anterior margin truncate and angle on each side broadly rounded; surface asperate as head and on each side with a few fine, recumbent, golden-testaceous hairs which are about 0.05 mm. long. Labrum with the anterior margin broadly and very feebly rounded and with the angle on each side broadly rounded; surface slightly more sparsely

asperate that that of clypeus and on each side with a dense tuft of hairs each of which is similar to those of clypeus. *Pronotum* with the broadest point, which is across base and equally across basal third, slightly broader than long (0.55 mm. : 0.50 mm.) and base broader than apex (0.55 mm. : 0.33 mm.). *Pronotum* with the carinae and impressions as figured (text-fig. 167). Surface asperate as head but, particularly on disk, more sparsely and evenly so. *Elytra* twice as long as



TEXT-FIGS. 181-188.—*Austrolimnius sulcicollis* (Sharp). (181) Dorsal view of male genitalia. (182) Left lateral view of same. (183) Last dorsal abdominal segment of male. (184) Hind leg of male. (185) First abdominal sternite. (186) Fifth abdominal sternite of male. (187) Middle tibia of male. (188) Antenna.

pronotum (1.00 mm. : 0.50 mm.) and broadest point which is across middle only slightly broader than broadest point across humeri (0.70 mm. : 0.72 mm.). Lateral margins nearly smooth. Apices broadly produced and conjointly rounded. Surface without striae but with three discal rows of seriate punctures of which the two outer begin on about basal third and extend to apical sixth, while the inner row begins at about basal half and extends nearly to apex ; on disk these punctures are two-thirds as coarse to a third coarser than facets of eyes and are usually separated by two to three times their diameters ; anterior

half of inner row with the punctures distinctly finer than corresponding punctures of outer rows; surface between punctures finely, indistinctly, and much more sparsely asperate than those of pronotal disk. Inner side of inner sublateral carina with a complete row of coarse, less distinct, and more irregularly distributed punctures; area between sublateral carinae with punctures about two to three times as coarse as discal ones, often indistinct, separated by once to twice their diameters, and near apex partly arranged in two rows. Third discal interval carinate on basal fifth. Epipleura from basal fourth to apical fifth with a feeble ridge parallel and very close to inner margin. *Scutellum* flat, subovate, longer than broad (0.10 mm. : 0.07 mm.), base broadly rounded, and narrowed to and feebly rounded at apex; surface asperate as adjacent parts of elytra. *Prosternum* with the carinae prominent and extending nearly to anterior margin; when viewed laterally the anterior half (not including process) is only feebly and gradually bent ventrally; surface of middle and of process asperate as disk of elytra but slightly more densely so, while the surface of sides and hypomera is about as densely asperate as head. *Mesosternum* with the groove for the reception of the prosternal process broad and very deep and not extending to posterior fourth; surface asperate as hypomera. *Metasternum* with the median longitudinal line feebly impressed and extending nearly to anterior fourth; disk only very feebly convex at sides on posterior half; disk on each side with a fine and feebly raised carina which extends posteriorly and slightly outwards from middle coxa nearly to posterior coxa; surface of disk asperate as disk of elytra; sides of metasternum asperate as densely as sides of prosternum. Abdomen without carinae on the first sternite; sternites one to four asperate as metasternal disk; fifth sternite asperate as hypomera. *Legs* with middle tibia near apical fourth swollen on inner side and with a row of fine short teeth (text-fig. 187). Hind trochanter with an inner row of six stout, short, and acute teeth (text-fig. 184); hind tibia on inner apical two-fifths with a large but short acute tooth. *Genitalia* as figured (text-figs. 181, 182).

Female: Externally similar to male except as follows: (1) the inner apical fourth of the middle tibia is not swollen and there is here no row of short and stout teeth; (2) the hind trochanter is smooth and not toothed along its inner margin; and (3) there is no tooth on the inner apical two-fifths of the hind tibia.

Type: ♂ in the British Museum (Nat. Hist.). PANAMA: Volcan de Chiriqui, alt. 2000–3000 ft. (*Champion*).

Specimens examined: 5, with same data as type but collected between 4000 and 6000 ft.; 1, MEXICO: Dist. de Temascaltepec, Tejupileco, alt. about 4000 ft., 15.vi.1933 (*H. E. Hinton, R. L. Usinger*); and 8, at same locality as above but collected in vii.1934 (*H. E. Hinton*).

Variations: No variations worthy of mention have been noted in the small series before me.

Comparative notes: This species can be compared only with *A. curtulus* (Sharp) of Panama but may easily be distinguished by having the pronotal channel as broad at apex as at base, whereas in *curtulus* this channel is twice as broad at apex as at base.

XENELMIS Hinton.

1936. *Xenelmis* Hinton, *Trans. R. Ent. Soc. Lond.*, **85** (18): 127.

The following species should be referred to *Xenelmis*: *X. granata* (Grouv.) (*Elmis*) and *X. micros* (Grouv.) (*Elmis*). Five species of this genus are now

known, one from Mexico and four from Brazil. A redescription of the genus follows :

Body broadly oval. Non-tomentose areas clothed with sparse and short recumbent hairs ; fine scale-like or hairy tomentum confined to the following areas : (1) pronotum ; (2) epipleura ; (3) hypomera ; (4) sides of prosternum, mesosternum, metasternum, and abdominal sternites, but occasionally the entire sternum of the abdomen is clothed with scale-like tomentum ; and (5) part of all of legs except tarsi. *Head* when seen from below capable of being retracted so that none of the mouth-parts are visible. Antennae 11-segmented. Mandibles with three apical blunt teeth ; prosthema entirely membranous and with a few fine spines or hairs apically. Maxilla with the palp 4-segmented and stipes with a well-developed palpifer ; galea and lacinia separate and apex of each with spines. Labium with the palp 3-segmented and prementum with a well-developed palpiger. Mentum transverse and as broad as but only half as long as submentum. Gula about as broad as submentum, nearly a fourth longer, and with the sides parallel. *Pronotum* with the anterior margin strongly arcuate at middle and on each side behind eye before apical angle deeply and broadly sinuate. Pronotum without sublateral carinae and disk without a median longitudinal channel ; base trisinate, broadly and moderately deeply so on each side and more narrowly and shallowly so in front of scutellum. *Elytra* punctate and striate ; each elytron with two sublateral carinae each of which is formed by a row of close granules. Hind wing (text-fig. 192) without a radial cross vein or an anal cell ; first anal absent ; second anal without branches ; third anal only present basally and at its apex joined to second anal at about apical two-fifths of the latter's length ; fourth anal well-developed ; and cubito-anal cross vein absent. *Prosternum* moderately short in front of anterior coxae ; prosternal process long and very broad and with the posterior margin broadly rounded. Mesosternum with a deep and very broad groove for the reception of the prosternal process. Abdomen with the middle posterior margin of the first sternite very broad and nearly truncate. Metasternum with a median longitudinal impressed line. *Legs* with the visible portion of the front coxae rounded and trochantin completely concealed by the hypomera and sternum. Claws without teeth. *Alimentary canal* (text-fig. 191) without caeca on the anterior margin of the mid-gut. Hind gut with six Malpighian tubules which end freely near the rectum. *Male reproductive system* with the lateral accessory glands simple and not lobed. Each testis with two sperm tubes. Female reproductive system (text-fig. 189) with at least four egg tubes to each ovary. Spermathecal duct opening into apex of bursa copulatrix (the duct then continuing in wall of bursa copulatrix so that it appears actually to open near the uterus). *Central nervous system* with three discrete thoracic ganglia. First abdominal ganglion partly fused at base to third thoracic, second free, third partly fused at apex to terminal ganglion, and four to eight fused into a single large terminal ganglion.

GENOTYPE : *Elmis bufo* Sharp (1882).

Only one species, *X. tarsalis* Hinton, has been available for an examination of the internal anatomy.

This genus seems to be most closely related to *Limnius* Erichson, but may be distinguished as follows : (1) the head is without tomentum ; (2) the disk of the pronotum is tomentose whereas in *Limnius* the pronotal tomentum is confined to the sides between lateral margin and sublateral carina ; (3) the elytra are without tomentum, whereas in *Limnius* they are often tomentose to inner sublateral carina ; (4) there are no sublateral carinae on the pronotum ; (5) the hind wing has the

second anal extending to inner margin of hind wing opposite junction of cubitus and media, whereas in *Limnius* the second anal is present only basally; (6) the alimentary canal has no caeca on anterior margin, whereas in *Limnius* caeca are here present; and (7) the central nervous system has the fourth abdominal ganglion fused to the terminal mass, whereas in *Limnius* the fourth is free. It may be distinguished from *Xenelmoides* Hinton by its broadly oval instead of subparallel body, the absence of tomentum on the genae, and the much broader and nearly truncate middle posterior margin of first abdominal sternite.

The specific characters of greatest importance in separating the species of *Xenelmis* appear to be the following:

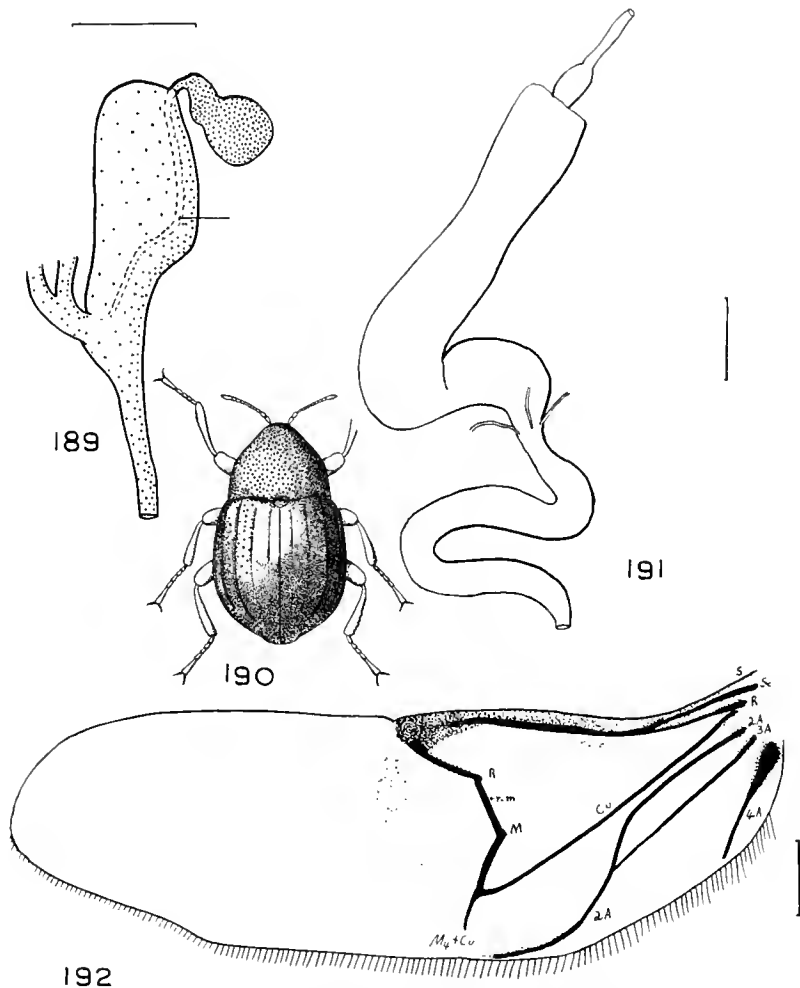
- (1) General proportions, length and breadth.
- (2) Colour. In some species the surface of the pronotum is a different colour to that of the elytra.
- (3) Density of the tubercles and punctures on the various sclerites.
- (4) Distribution of the alutaceous microsculpture.
- (5) Length and shape of carinae, if present, on head.
- (6) Condition of fronto-elypeal suture.
- (7) Anterior margin of clypeus, whether rounded, truncate, emarginate or sinuate; and also shape of angle on each side.
- (8) Shape and distribution of rows of granules, if present, on pronotal disk.
- (9) Shape of anterior margin of labrum and that of the angle on each side.
- (10) Condition of lateral margin of elytra (inner margin of epipleura), whether crenate or smooth.
- (11) Number and length of carinate discal intervals, if any.
- (12) Shape of scutellum.
- (13) Condition of prosternal carinae.
- (14) Condition of anterior portion of prosternum whether straight or lobed when viewed laterally.
- (15) Shape of prosternal process.
- (16) Extent and depth of mesosternal groove.
- (17) Disk of metasternum, whether flat or not and the extent and depth of the various impressions.
- (18) Secondary sexual characters.
- (19) Structure of the male genitalia. No case is known where these structures are the same for two or more species.

The following are the secondary sexual characters that have been observed in the species before me:

- (1) Male with a prominent and short longitudinal carina on middle of first abdominal sternite near base (*micros*).
- (2) Male with the inner apex of the front tibia with a short and prominent carina (*micros*).
- (3) Male with the inner apical fourth of the hind tibia moderately strongly excavated and distal margin of this concave portion with a small but prominent carina (*micros*).
- (4) Male with numerous erect, fine, long, and pale hairs on ventral surface of four basal segments of middle and hind tarsi (*micros*).
- (5) Male with the last segment of the hind tarsus strongly dilated and ventral surface of dilated part densely pubescent (*tarsalis*).

Xenelmis bufo (Sharp).

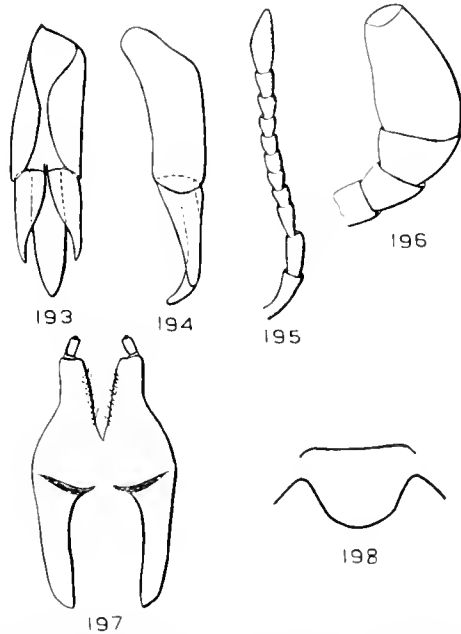
(Text-figs. 189-198.)

1882. *Elmus bufo* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2) : 140.1936. *Xenelmis bufo* Hinton, *Ent. mon. Mag.*, 72 : 4, fig. 7.1936. *Xenelmis bufo* Hinton, *Trans. R. Ent. Soc. Lond.*, 85 (18) : 427, figs. 23, 24, pl. 1, fig. 3.

TEXT-FIGS. 189-192.—(189) Female reproductive system of *Xenelmis tarsalis* Hinton. (190) Adult of *Xenelmis bufo* (Sharp). (191) Alimentary canal of *Xenelmis tarsalis* Hinton. (192) Hind wing of *X. bufo* (Sharp). Venation after Forbes.

Male : Length, 1.42 mm.-1.62 mm. ; breadth, 0.87 mm.-0.95 mm. Cuticle feebly shining and rufo-piceous to black. *Head* on each side with a fine, low carina which extends from a point which is about a third of the way across between eyes, and is opposite posterior fourth of eyes, to posterior seventh of head ; these carinae converge posteriorly but do not meet so that at posterior end they are separated by a distance equal to half that of anterior end. Surface of head with

round, high granules which are about as coarse as facets of eyes or about 0.010 mm. broad and are usually separated by one to three times their diameters; each of these granules gives rise to a fine recumbent seta which is about twice as long as its respective granule; surface between granules densely and microscopically alutaceous. Clypeus with the fronto-clypeal suture straight and deep; anterior margin very feebly rounded to nearly truncate and with the angle on each side broadly rounded; surface sculptured as head. Labrum with the anterior margin truncate and with the angle on each side broadly rounded; surface on basal half smooth, on apical half with a narrow transverse belt of obscure, dense punctures, and on each side with a few very fine, testaceous hairs which are often about



TEXT-FIGS. 193-198.—*Xenelmis bufo* (Sharp). (193) Dorsal view of male genitalia. (194) Left lateral view of same. (195) Antenna. (196) Maxillary palp. (197) Female genitalia. (198) Prosternum.

0.05 mm. long. *Pronotum* across broadest point, which is at base, broader than long (0.72 mm. : 0.55 mm.) and base broader than apex (0.72 mm. : 0.35 mm.); evenly convex and surface with granules similar to those of head but usually separated by two to three times their diameters; area between granules much more sparsely alutaceous; at base in front of scutellum for a short distance (about a seventh of the length of the pronotum) there are no granules. *Elytra* slightly more than twice as long as pronotum (1.12 mm. : 0.55 mm.) and broadest point, which is across middle, broader than broadest point across humeri (0.90 mm. : 0.82 mm.). Lateral margins finely and regularly crenate, these crenations being due to laterally placed granules. Apices broadly conjointly produced and rounded. Surface with the striae as broad as strial punctures and very feebly impressed; discal strial punctures round to subquadrate, about a third to two-thirds as coarse as intervals, and separated longitudinally by one to one and a half times their diameters; these punctures become finer and denser towards

apex and coarser and denser towards sides. Intervals flat and with the surface sculptured as that of head except that here the granules are slightly coarser, especially towards sides. Granules of sublateral carina about a fourth to a third coarser than those elsewhere on elytra. *Scutellum* flat, subovate, broader than long (0.15 mm. : 0.10 mm.), base very broadly and feebly rounded, and narrowed to and acutely rounded at apex; surface sculptured as adjacent parts of elytra. *Prosternum* without distinct carinae; when viewed laterally the anterior half (not including process) is very feebly bent ventrally and the remainder of the prosternum and its process is on the same plane; process shaped as figured (text-fig. 198); surface of all of prosternum and hypomera sculptured as disk of elytra but with the granules slightly more distinct. *Mesosternum* with the groove for the reception of the prosternal process a third broader posteriorly than anteriorly and extending to posterior fifth of mesosternum; surface at sides sculptured as disk of elytra but without distinct granules. *Metasternum* with the median longitudinal line feebly impressed and extending to anterior fifth or sixth; disk nearly flat but along anterior margin moderately depressed at middle and more strongly so at sides; surface of disk with irregular to round, large (0.03 mm. broad), frequently confluent punctures and with only an occasional granule; between punctures and granules the surface is moderately densely microscopically alutaceous; sides of metasternum with the granules similar in size and distribution to those of sides of elytra but otherwise sculptured as metasternal disk except that the punctures are not as dense. Abdomen with the surface of sternites one to four sculptured as disk of elytra and the surface of five similarly sculptured but with the granules distinctly denser. *Genitalia* as figured (text-figs. 193, 194).

Female: Externally similar to male.

Type: In the British Museum (Nat. Hist.). PANAMA: Volcan de Chiriqui, alt. 2600–3000 ft. (*Champion*).

Specimens examined: 1, PANAMA: San Miguel, Pearl Island (*Champion*). 30, MEXICO: Dist. de Temascaltepec, Tejupileco, alt. about 4000 ft., vi. 1933 (*H. E. Hinton, R. L. Usinger*); and 18, in the same locality in vii. 1934 (*H. E. Hinton*).

Variations: Except for the differences in absolute size as already noted, no variations worthy of mention have been observed.

Comparative notes: This species is apparently most closely related to the Brazilian *X. tarsalis* Hinton, but it may be distinguished from the latter by not having a row of close granules on the basal half of the third discal elytral interval.

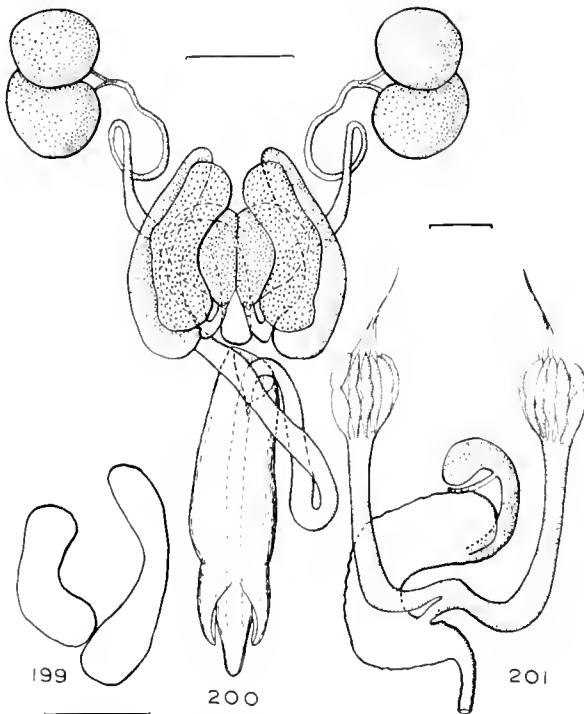
MICROCYLLOEPUS (Hinton).

1935. *Microcylloepus* Hinton, *Stylops*, 4 (8) : 178.

In addition to the species referred to this genus by Hinton (1935), the following belong here: *M. thermarum* (Darlington) (*Elmis*) and *M. longipes* (Grouvelle) (*Elmis*). At the time of writing seven species and three varieties have been described. In my collection there are 13 new species, and of these three are from Mexico and will be described here. The species of this genus occur from Canada to the south of Brazil and have been taken in the British West Indies on Trinidad and Tobago. A redescription of the genus follows:

Body subparallel. Non-tomentose areas glabrous or clothed with sparse and short recumbent hairs. Scale-like or hairy tomentum confined to the following areas: (1) genae; (2) epipleura—many species have non-tomentose epipleura; (3) sides of prosternum, mesosternum, metasternum, and abdominal

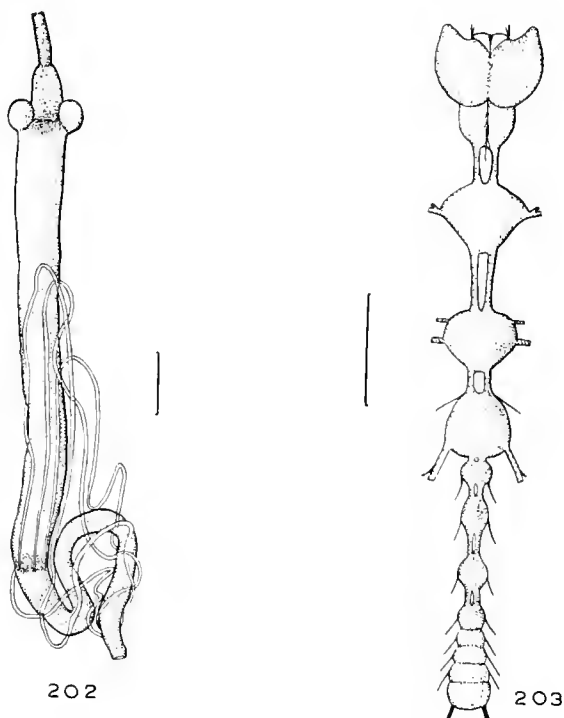
sternites, but in some species nearly the entire sternum of the abdomen is clothed with fine tomentum; and (4) part or all of legs except tarsi. *Head* when seen from below capable of being retracted so that none of the mouth-parts is visible. Antennae 11-segmented (text-fig. 218). Mandibles with three acute apical teeth; protheca long and entirely membranous with numerous fine spines or hairs apically. Maxilla with the palp (text-fig. 219) 4-segmented and stipes with a well-developed palpifer; galea and lacinia separate and apex of each spinose or hairy. Labium with the palp 3-segmented and prementum with a poorly developed



TEXT-FIGS. 199-201. —*Microcyllloepus carinatus* Hinton. (199) Lateral view of lateral accessory glands. (200) Male reproductive system. (201) Female reproductive system.

palpiger. Mentum as broad and three-fifths as long as submentum. Gula slightly longer than submentum, at anterior margin about two-thirds as broad as submentum, and with the sides feebly converging posteriorly. *Pronotum* with the anterior margin moderately arcuate at middle and on each side behind eye before apical angle broadly and moderately deeply sinuate. Base trisinate, broadly and moderately deeply so on each side and more narrowly and shallowly so in front of scutellum. Pronotum on each side with a sublateral carina which extends from base nearly to anterior margin; at apical two-fifths with a broad, moderately deep and complete or incomplete transverse impression which is always distinct at sides but in some species it is not evident on discal region; disk with or without a broad and deep median longitudinal impression; beginning either at base or at basal third on each side in front of scutellum is a

broad, deep or shallow impression which extends obliquely forwards, crosses sublateral carina at basal two-fifths, and joins apical transverse impression near lateral margin; sometimes this oblique impression is confined to sides; with or without a median longitudinal, feebly convex to carinate line extending from base in front of scutellum to posterior margin of longitudinal discal impression. *Elytra* punctate and striate; each elytron with a sublateral carina on eighth interval and one on sixth, though in a few species the carina of the sixth interval is absent or very indistinct. Hind wing without an anal lobe; without a radial cross vein



TEXT-FIGS. 202, 203.—*Microcylloepus carinatus* Hinton. (202) Alimentary canal.
(203) Dorsal view of central nervous system.

or an anal cell; first anal absent; second anal with the first branch present; second branch of second anal absent; third anal with the second branch absent; fourth anal well-developed; and cubito-anal cross vein present but incomplete and joining cubitus to second anal. *Prosternum* very long in front of anterior coxae; prosternal process long, narrow to moderately narrow, and with the posterior margin broadly rounded to nearly truncate. *Mesosternum* with a broad and deep groove for the reception of the prosternal process. *Metasternum* with a median longitudinal impressed line. *Legs* with the visible portion of the front coxae rounded and trochantin completely concealed by the hypomera and sternum. Claws without teeth. *Alimentary canal* (text-fig. 202) with two caeca on the anterior margin of the mid-gut. Hind gut with six Malpighian tubules which end freely near the rectum. *Male reproductive system* (text-fig. 200) with the lateral accessory glands lobed. Each testis with two sperm tubes. Female

reproductive system (text-fig. 201) with six egg tubes to each ovary. Spermathecal duct opening into apex of bursa copulatrix. *Central nervous system* (text-fig. 203) with three thoracic discrete ganglia; first three abdominal ganglia discrete, and four to eight partly fused together, though the limits of each are distinguishable.

GENOTYPE: *Elmis pusilla* Leconte (1852).

The internal anatomy of three species has been examined and found to agree in essential details. That of *M. carinatus* Hinton is figured.

The species of *Microcylloepus* frequently bear a close resemblance to those of *Cylloepus* Erichson (*sensu stricto*), but may be distinguished as follows: (1) the pronotum has, at least at sides, a distinct apical transverse impression on apical two-fifths, whereas in *Cylloepus* no such impression is present; (2) the hind wing has the second branch of the third anal absent, whereas in *Cylloepus* it is present; (3) the alimentary canal has two instead of eight caeca on the anterior margin of the mid-gut; (4) each ovary has six instead of about 18 egg tubes; (5) the spermathecal duct opens into the apex of the bursa copulatrix instead of into the base; and (6) the central nervous system has the first three abdominal ganglia discrete, whereas in *Cylloepus* two to five are discrete.

A list of the characters which have been found useful in distinguishing the species is as follows:

- (1) General proportions, length and breadth.
- (2) Colour.
- (3) Size and distribution of the punctures and tubercles on the various sclerites and the density and type of microsculpture between them.
- (4) Condition of the fronto-clypeal suture.
- (5) Condition of anterior margin of clypeus, whether rounded, truncate, emarginate, or sinuate; and also the condition of the angle on each side.
- (6) Condition of the anterior margin of the labrum and the angle on each side.
- (7) Outline of pronotum and general proportions.
- (8) Extent and depth of the various pronotal impressions.
- (9) Shape of elytral apices.
- (10) Absence or presence of tomentum on epipleura.
- (11) Prominence and extent of the inner sublateral carina of the elytra.
- (12) If third discal interval is carinate at base the prominence and extent of the carina should be given.
- (13) Condition of other elytral intervals, whether flat, gibbous, or carinate.
- (14) Shape of scutellum and whether convex or flat.
- (15) Condition of anterior portion of prosternum, whether straight or bent ventrally when seen from the side.
- (16) Extent of prosternal carinae.
- (17) Shape of prosternal process.
- (18) Extent and depth of mesosternal groove.
- (19) Condition of disk of metasternum, whether flat or not, and the extent and depth of the various impressions.
- (20) Length, shape, and prominence of carina on each side of metasternal disk.
- (21) Length, shape, and prominence of carina on each side of middle of first abdominal sternite.
- (22) Secondary sexual characters.

- (23) Structure of the male genitalia. This is one of the very few genera in the family in which a number of species may have the structure of the male genitalia identical.

The following secondary sexual characters have been observed in the species before me :

- (1) Female with the sutural elytral interval strongly convex on apical third, while that of the male is only feebly convex (*carinatus*).
- (2) Female with the apex of each elytron produced to form an acute tooth, while in the male the apices are broadly and conjointly rounded (*carinatus*).
- (3) Male with the sides of the mesosternum between coxae densely clothed with fine testaceous hairs, while in the female this part is glabrous or very nearly so (*spinipes*).
- (4) Male with the disk of the metasternum more deeply and extensively concave than that of female (*carinatus*, *obesus*, *spinipes*).
- (5) Female with the metasternal disk more densely punctate than that of male (*obesus*).
- (6) Male with the carina on each side of metasternal disk more prominent than that of female (*obesus*).
- (7) Female with the region near the apex of the fifth abdominal sternite moderately gibbous (*carinatus*, *spinipes*).
- (8) Male with the outer edge of the front and middle tibiae gibbous on basal two-fifths (*blaumani*).
- (9) Male with an acute tooth concealed in a tuft of erect, testaceous hairs on inner apex of all tibiae (*carinatus*).
- (10) Male with the ventral apex of the basal segment of front tarsi strongly and acutely produced and at apex of produced portion with a long and acute spine (*spinipes*).
- (11) Male with the ventral mesal surface of the hind coxae with numerous recumbent, testaceous hairs which are here much sparser or absent in the female (*spinipes*).
- (12) Male with the inner apical spur of the hind tibiae very long, slender, and slightly curved forwards (*spinipes*).

A KEY TO THE MEXICAN SPECIES OF *Microcylloepus*.

1. Scutellum strongly convex. MEXICO *M. obesus*, sp. n.
Scutellum flat, rarely very feebly convex 2.
2. Humeri narrow, greatest breadth across humeri less or only very little more than greatest breadth across pronotum. Elytra with the punctures of the first and second striae on basal third broader than intervals. MEXICO *M. angustus*, sp. n.
Humeri broad, always distinctly broader than greatest breadth across pronotum. Elytra with the punctures of the first and second striae on basal third seldom as broad as intervals 3.
3. Small species with the mean length from apex of elytra to middle anterior margin of pronotum 1.772 mm. (altitude, 5600-7500 ft.). Elytra with the third discal interval strongly convex to carinate on basal fifth or sixth; inner sublateral carinae usually as prominent as outer. GUATEMALA, MEXICO *M. inaequalis* (Sharp) (1882).

Large species with the mean length from apex of elytra to middle anterior margin of pronotum 2.003 mm. (altitude, 5600-7500 ft.).

Elytra with the third discal interval at most only very feebly convex on basal seventh; inner sublateral carinae never as prominent as outer and frequently so flat that they are scarcely noticeable.

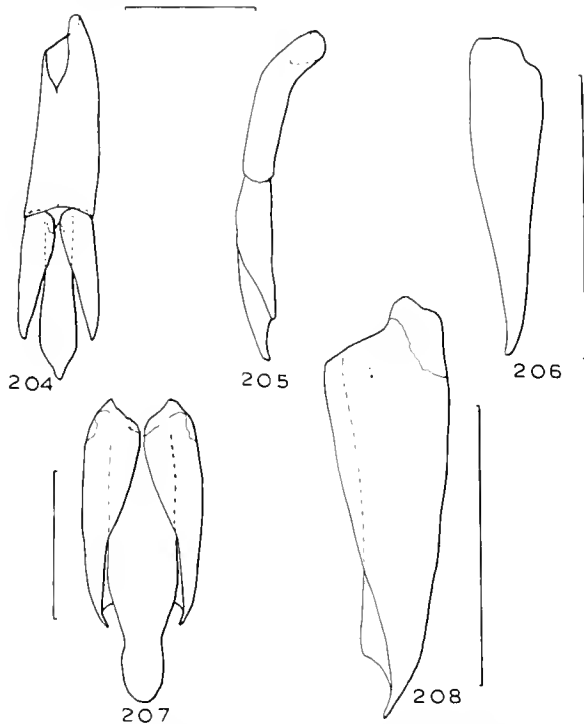
MEXICO *M. troilus*, sp. n.

***Microcylloepus obesus* sp. n.**

(Text-figs. 207-208.)

Male: Length, 2.215 mm.-2.415 mm.; breadth 1.00 mm.-1.10 mm. Cuticle shining and rufo-piceous to black; antennae, mouth-parts and legs paler rufo-piceous. *Head* without distinct impressions; surface with round granules which are about 0.017 mm. broad and are usually separated by one to three times their diameters; surface between granules with round to irregularly shaped microscopic punctures (about 0.001 mm. broad) which are confluent to separated by twice their diameters—under low magnifications ($\times 70$) the surface does not appear punctate but densely and microscopically alutaceous. Clypeus with the fronto-clypeal suture well impressed and nearly straight; anterior margin when seen from in front shallowly and arcuately emarginate for its entire breadth; angle on each side broadly rounded; surface sculptured as head. Labrum with the anterior margin feebly rounded and the angle on each side broadly rounded; surface without granules, basally and at sides with fine punctures similar in size and distribution to those of clypeus, apical half at middle with the punctures usually twice as large and half as dense and apical sides with numerous fine, testaceous hairs which are about 0.05 mm. long. *Pronotum* across broadest point, which is at basal third, as broad as long (0.70 mm.) and base broader than apex (0.63 mm. : 0.48 mm.). Sides deeply and broadly sinuate opposite apical transverse impression and very feebly sinuate to nearly straight before basal angles. Sublateral carina extending from base very nearly to apex. Impressions as figured for *inaequalis* (text-fig. 209) but without a longitudinal ridge from base to posterior margin of longitudinal discal impression. Disk of pronotum very densely, frequently confluent punctate with punctures which are from 0.006 mm. to 0.02 mm. broad except as follows: on the middle portion of the anterior third the punctures are usually separated by three to five times their diameters; and at sides near sublateral carinae on basal fourth the punctures are separated by one to three times their diameters. Sides between sublateral carinae and lateral margins sculptured as head. *Elytra* more than twice as long as pronotum (1.72 mm. : 0.70 mm.) and at broadest point, which is across apical third, broader than broadest point across humeri (1.07 mm. : 1.05 mm.). Epipleura without tomentum. Lateral margins moderately feebly and irregularly crenate. Apices broadly and strongly produced and conjointly feebly rounded. Surface with the striae moderately strongly impressed basally and feebly impressed on apical third; strial punctures on basal third of disk are round to feebly subquadrate, deep, about as broad as intervals and separated longitudinally by less than to once their diameters; from basal third to apex these punctures gradually become finer so that near apex they are half as coarse as at base, half to two-thirds as broad as intervals, and separated longitudinally by two to three times their diameters. Intervals flat except for third which is very feebly convex for a short distance behind level of scutellum; surface with an occasional microscopic puncture and sparsely transversely alutaceous but on base at sides and on basal

third between lateral margins and sublateral carinae with round granules similar to those of sides of pronotum, and which on gibbous portion of humeri are separated by about their diameters, while elsewhere they are sparser. Inner sublateral carinae less prominent than outer. *Scutellum* moderately strongly convex, subovate, longer than broad (0.12 mm. : 0.10 mm.), base feebly rounded, and apex more strongly and narrowly rounded; surface sculptured as adjacent elytral intervals. *Prosternum* when seen from the side with the anterior four-fifths (not including process) gradually to moderately sharply and moderately strongly



TEXT-FIGS. 204-208.—(204) Dorsal view of male genitalia of *Microcylloepus angustus* Hinton. (205) Right lateral view of same. (206) Left paramere of same species. (207) Dorsal view of male genitalia of *M. obesus* Hinton. (208) Left paramere of same.

bent ventrally; prosternal carinae prominent, present on basal fourth, feebly diverging anteriorly, and posteriorly as broad as process at base; process moderately narrow, with the sides converging to apex and with the apex broadly rounded; surface for the most part densely asperate. Hypomera with the surface densely asperate and with an occasional granule. Mesosternum with the anterior two-fifths of the groove for the reception of the prosternal process broad, deep, and smooth-bottomed; on posterior three-fifths it is deeper but only half as broad, extends nearly to metasternum, and the bottom is densely asperate; mesosternum between coxae moderately depressed and surface densely microscopically punctate to asperate. Metasternum with the median longitudinal line complete; disk with the posterior four-fifths very broadly and deeply depressed; surface with punctures about 0.017 mm. broad which are separated

by one to four times their diameters, and at posterior third on each side near discal carina with a broadly oval (0.07 mm.), moderately deep depression; discal carinae prominent, strongly diverging posteriorly, and extending to posterior fifth of metasternum. Abdomen with the carina of the first sternite prominent, feebly diverging posteriorly, and extending to posterior margin of the segment; middle area of first sternite between carinae only feebly depressed anteriorly; surface of middle of sternites one to four with punctures which are usually separated by once to twice their diameters; surface of sides of first four sternites and all of anterior half of fifth very densely and microscopically punctate; apical half of fifth similarly punctate but also with round granules about 0.015 mm. broad which are separated by less than to twice or more times their diameters. *Genitalia* as figured (text-figs. 207, 208).

Female: Externally similar to male except as follows: (1) the metasternal disk is not as deeply and only about three-fifths as broadly depressed; (2) the metasternal disk has the punctures much denser, being seldom separated by more than their diameters and frequently confluent; and (3) the metasternal discal carina are less prominent.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Rio Verde, alt. 8000 ft., 14. vi. 1934 (H. E. Hinton).

Paratypes: 3, with same data as type.

Variations: One of the two females before me has the metasternal discal impression nearly as broad and deep as that of male but confined to posterior half of disk, and the sides of disk near impression are feebly but distinctly convex, whereas those of the female mentioned above are flat.

Comparative notes: This is the largest known species of *Microcylloepus*. From all others it may be immediately distinguished by its moderately strongly convex instead of flat scutellum and by the structure of the male genitalia.

***Microcylloepus angustus*, sp. n.**

(Text-figs. 204-206.)

Male: Length, 1.42 mm.-1.67 mm.; breadth, 0.55 mm.-0.67 mm. Cuticle shining and rufo-piceous to black; antennae, mouth-parts, and legs paler rufo-piceous. *Head* without distinct impressions; surface, particularly at sides, with an occasional round granule which is about 0.012 mm. broad or slightly finer than an eye facet; surface everywhere densely microscopically alutaceous, this microsculpture sometimes appearing asperate. Clypeus with the fronto-clypeal suture deeply impressed and straight; anterior margin when seen from in front shallowly and arcuately emarginate for its entire breadth; angle on each side broadly rounded; surface sculptured similarly to head and at sides also with an occasional obscure granule. Labrum with the anterior margin feebly rounded and the angle on each side broadly rounded; surface without granules, only sparsely and very finely alutaceous, with numerous very fine (about 0.004 mm. broad) punctures, and at anterior sides with numerous fine, testaceous hairs which are about 0.05 mm. long. *Pronotum* across broadest point, which is at about basal half, broader than long (0.61 mm. : 0.57 mm.) and base broader than apex (0.50 mm. : 0.42 mm.). Sides moderately deeply and broadly sinuate opposite apical transverse impression and scarcely noticeably sinuate before basal angles. Sublateral carina extending from base very nearly to apex. The impressions are similar to those figured for *inaequalis* (text-fig. 209). Disk of pronotum very densely, frequently confluent, punctate with punctures which vary from 0.006

mm. to 0.012 mm., except as follows : on the middle portion of anterior third the punctures are often separated by as much as three times their diameters ; and on basal fourth on each side of median ridge the punctures are separated by once to twice their diameters. Sides between sublateral carinae and lateral margins as densely punctate as middle of disk and also with round, obscure granules which are as coarse as facets of eyes and are separated by one to three times their diameters. *Elytra* twice as long as pronotum (1.12 mm. : 0.57 mm.) and at broadest point, which is across apical two-fifths, broader than broadest point across humeri (0.675 mm. : 0.60 mm.). Epipleura without tomentum. Lateral margins regularly and moderately strongly crenate. Apices broadly, strongly produced and conjointly feebly rounded. Surface with the striae moderately impressed basally and more feebly impressed towards apex ; strial punctures on basal third of disk round to nearly subquadrate, moderately deep, usually about a third broader than intervals, and separated longitudinally by less than their diameters ; from about basal third to apex these punctures gradually become finer and sparser so that at apex they are two-thirds to half as coarse and dense as at base. Intervals flat except for third which is prominently carinate on basal sixth ; surface microscopically punctate and sparsely, transversely alutaceous but on base and on sides on basal third between lateral margins and inner sublateral carinae with round granules similar to those of sides of pronotum but somewhat sparser. Inner sublateral carina prominent and extending slightly beyond basal half. *Scutellum* at most very feebly convex, subovate, longer than broad (0.08 mm. : 0.06 mm.), base very feebly rounded, and apex more strongly and much more narrowly rounded ; surface sculptured like adjacent elytral intervals. *Prosternum* when seen from the side with the anterior half (not including process) gradually and moderately strongly bent ventrally ; prosternal carinae prominent, present on basal three-fifths, diverging anteriorly, and posteriorly slightly broader than process at base ; process moderately narrow with the sides nearly parallel and the apex broadly rounded ; lateral margins of process strongly gibbous ; surface as densely punctate as disk of pronotum, but on posterior sides and on process frequently asperate. Hypomera with the surface densely asperate and with occasional granules similar to those of sides of head. Mesosternum with the anterior two-fifths of the groove for the reception of the prosternal process broad, deep, and with the bottom smooth, while posterior three-fifths is deeper, only a third as broad, extends nearly to metasternum, and the bottom is asperate ; mesosternum between coxae moderately depressed and surface densely asperate. Metasternum with the median longitudinal line complete ; disk on anterior third moderately gibbous, but on posterior half broadly (0.07 mm.) and deeply depressed on middle and with a deep pit at posterior margin ; on posterior third on each side adjacent to discal carina is a broad (about 0.06 mm.), oval, moderately shallow depression ; surface on middle of disk (except for bottom of posterior depression which is microscopically asperate) with only an occasional microscopic puncture and sparsely transversely alutaceous, while the surface elsewhere is densely asperate as are sides of metasternum ; discal carinae prominent, feebly diverging posteriorly, and extending to posterior third. Abdomen with the carinae of the first sternite prominent, moderately diverging posteriorly, and extending to the posterior margin of the segment ; middle area of first sternite between carinae scarcely depressed anteriorly ; surface of middle of sternites one to four and extreme basal middle of fifth non-tomentose and with microscopic punctures which are usually separated by two to four times their diameters ; surface of sides of first four and most of fifth finely asperate when

the tomentum is rubbed off; apical third of fifth sternite with round granules about 0.010 mm. broad which are separated by once to twice their diameters. *Genitalia* as figured (text-figs. 204-206).

Female: Externally similar to male.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Temascaltepec, alt. 5600 ft., vii. 1934 (*H. E. Hinton*).

Paratypes: 16, with same data as type; and 1, also with same data but collected on 15. vii. 1933 (*H. E. Hinton, R. L. Usinger*).

Variations: In some specimens the middle raised portions of the pronotal disk are not confluent punctate, the punctures here being separated by twice their diameters. A few have the surface of the ridge, which extends from base in front of scutellum to posterior margin of median longitudinal impression, with a few obscure granules. In many specimens the striae punctures on basal third of disk of elytra are occasionally longitudinally and laterally confluent. In some specimens the frontal region of the head as well as the sides has a number of round granules. In a few the middle portion of the metasternal disk has the microscopic punctures separated by once to twice their diameters, but they are here never dense enough to give the surface an asperate appearance.

Four specimens have been examined for the condition of the hind wings and all found to have them greatly reduced, the apex barely extending to a point opposite the posterior margin of the first abdominal sternite. As is the case with most beetles having the hind wings reduced, the humeri of this species are greatly narrowed.

Comparative notes: This species most nearly resembles *M. thermarum* (Darlington) of Oregon, but may be distinguished by having the inner sublateral carinae of the elytra moderately prominent and extending to apical half, whereas in *thermarum* the inner sublateral carinae are absent or scarcely visible. Of the Mexican species it can only be compared with *M. inaequalis* (Sharp), and from this may be distinguished by the structure of the male genitalia (*cf.* text-figs.), the narrow instead of broad humeri and the discal striae punctures on basal third of elytra which in *angustus* are generally broader than intervals, whereas in *inaequalis* they are seldom as broad as intervals. *M. angustus* is also a much shorter species (*vide* Table I). The means of the lengths of these two species were found to be significantly different. Using the formula $t = \frac{M_1 - M_2}{\sqrt{(S.E.M._1)^2 + (S.E.M._2)^2}}$, where M is the mean and S.E.M. is the standard error of the mean, $t = 10$. As may be seen from Fisher's (1936) table of t, the probability, P, of these two samples being got from the same populations is $P < .01$. Or using Fisher's table of x, which is in effect a continuation of t for numbers over 30, a better idea is got of the improbability of the two populations being homogeneous for length, as the probability here is $P < 10^{-9}$.

TABLE I.

Species	Mean	Max	Min	S.D.	S.E.D.	S.E.M.	Numbers
<i>angustus</i> , 5600 ft.	1.4904	1.925	1.375	0.0740	0.0145	0.0214	13
<i>inaequalis</i> , 5600-7500 ft.	1.772	1.925	1.575	0.0782	0.0123	0.0170	20

Lengths are given in mm., and are taken from the apex of the elytra to the middle anterior margin of the pronotum. S.D. equals standard deviation, S.E.D. equals standard error of the deviation, and S.E.M. equals standard error of the mean.

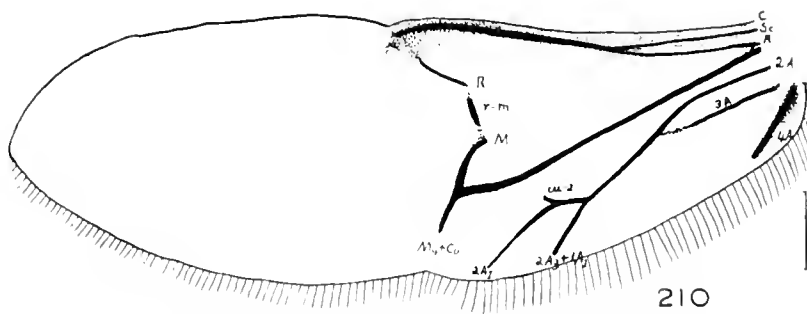
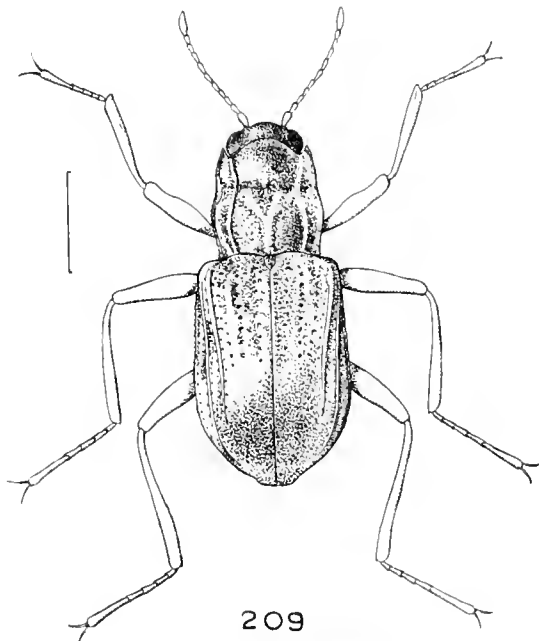
Microcylloepus inaequalis (Sharp).

(Figs. 209-213.)

1882. *Elmis inaequalis* Sharp, *Biol. Centr.-Amer. Col.*, **1** (2) : 137.
 1888. *Elmis inaequalis* Grouvelle, *Ann. Soc. Ent. Fr.*, **8** (6) : 408, t. 8, f. 11.
 1934. *Limnius mexicanus* Hinton, *Rev. Ent., Rio de J.*, **4** (2) : 199 (syn. n.).
 1935. *Microcylloepus inaequalis* Hinton, *Stylops*, **4** (8) : 179.
 1935. *Microcylloepus mexicanus* Hinton, *Stylops*, **4** (8) : 179.

Male : Length, 1.47 mm.-1.99 mm. ; breadth, 0.92 mm.-0.60 mm. Cuticle shining and rufo-piceous to black ; antennae, mouth-parts and legs usually paler rufo-piceous. *Head* without distinct impressions ; surface with an occasional round granule which is about 0.012 mm. broad or slightly coarser than a facet of an eye, these granules being more numerous at sides where they are separated by twice their diameters ; surface between granules densely, microscopically alutaceous, this microsculpture sometimes appearing asperate. Clypeus with the fronto-clypeal suture deeply impressed and straight ; anterior margin when seen from in front shallowly and arcuately emarginate for its entire breadth ; angle on each side broadly rounded ; surface sculptured similarly to head but even at middle with the granules separated by twice their diameters. Labrum with the anterior margin feebly rounded and the angle on each side broadly rounded ; surface moderately densely, microscopically alutaceous and also with a number of microscopic punctures, and at anterior sides with numerous fine, testaceous hairs which are about 0.075 mm. long. Pronotum across broadest point, which is at basal two-fifths, broader than long (0.60 mm. : 0.55 mm.) and base broader than apex (0.55 mm. : 0.42 mm.). Sides broadly and moderately deeply sinuate opposite apical transverse impression and scarcely noticeably sinuate before basal angles. Sublateral carina extending from base very nearly to apex. Impressions as figured (text-fig. 209). Disk of pronotum between sublateral carinae with an asperate type of alutaceous microsculpture like that of head on bottom of the impressions ; convex portions with microscopic (0.006 mm. broad) punctures which are usually separated by two to three times their diameters ; surface of median longitudinal ridge which extends from base to posterior margin of median impression very densely and microscopically punctate so that it nearly appears asperate. Sides between sublateral carinae and lateral margins sculptured as head but with the granules very slightly coarser and separated by one to four times their diameters. *Elytra* more than twice as long as pronotum (1.20 mm. : 0.55 mm.) and at broadest point, which is across apical third, broader than broadest point across humeri (0.82 mm. : 0.72 mm.). *Epi-pleura* without tomentum. Lateral margins regularly, moderately strongly crenate. Apices broadly, strongly produced and conjointly feebly rounded. Surface with the striae moderately impressed basally and more feebly impressed towards apex, so that on apical third of discal region the striae are practically absent ; strial punctures on basal third of disk round, deep, usually about one-half to two-thirds as broad as intervals, and separated longitudinally by one-half to one times their diameters ; from basal two-fifths to apex these punctures become finer and sparser so that near apex they are two-thirds as coarse and dense as those near base. Inner sublateral carinae prominent and extending to apical third of elytra. Intervals flat except for third which is strongly convex and diverging outwards on basal seventh ; surface of intervals microscopically punctate and sparsely, transversely alutaceous, but on base and on basal third at sides between lateral margins and inner sublateral carinae with round granules

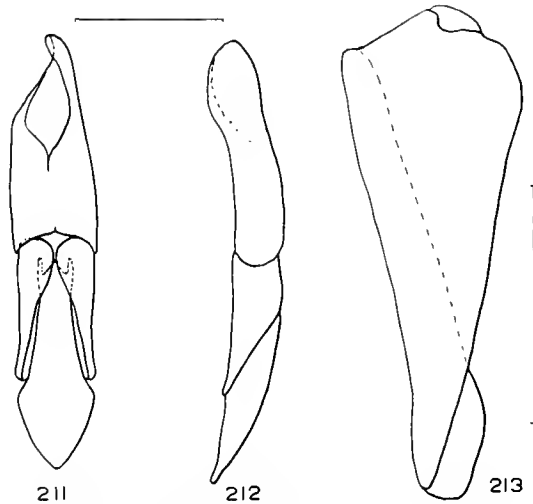
which are similar to those of sides of pronotum but are usually slightly sparser. *Scutellum* flat, subovate, longer than broad (0.10 mm. : 0.07 mm.), base very feebly rounded, and apex more strongly and much more narrowly rounded; surface sculptured as adjacent elytral intervals but with the granules slightly denser. *Prosternum* when seen from the side with the anterior three-fourths



TEXT-FIGS. 209, 210.—*Microcylloepus inaequalis* (Sharp). (209) Adult to show general appearance. (210) Hind wing. Venation after Forbes.

(not including process) gradually and moderately strongly flexed ventrally; prosternal carinae prominent, present on basal two-thirds, feebly diverging anteriorly, and posteriorly slightly broader than process at base; process moderately narrow and with the moderately strongly gibbous sides feebly converging to apex which is broadly rounded; surface for the most part sculptured similarly to that of head. Hypomera densely and distinctly asperate and with a few obscure granules similar in size to those of head. Mesosternum with the

groove for the reception of the prosternal process extending nearly to metasternum; with the anterior three-fifths of this groove broad, deep, and smooth bottomed, and with the posterior two-fifths only a third as broad, deeper, and with the bottom densely asperate; most of the mesosternum between coxae depressed and with the surface densely asperate. Metasternum with the median longitudinal line complete; disk on anterior third moderately convex but on posterior two-thirds moderately deeply and broadly depressed, and with a deep narrow pit on posterior margin; disk on posterior third or half adjacent to discal carina on each side with a broad (about 0.075 mm.), oval, moderately deep depression; surface on middle of disk (except bottom of median longitudinal line which is densely alutaceous) sparsely, transversely alutaceous and also with a few microscopic punctures; surface of



TEXT-FIGS. 211-213.—*Microcylocepus inaequalis* (Sharp). (211) Dorsal view of male genitalia. (212) Left lateral view of same. (213) Left lateral view of paramere.

disk elsewhere densely asperate as well as non-tomentose parts of sides of metasternum; discal carinae moderately prominent and diverging outwards and extending to posterior third. Abdomen with the carinae of the first sternite prominent, feebly diverging posteriorly, and extending to posterior margin of the segment; middle area of first sternite between carinae scarcely depressed anteriorly; surface of middle of sternites one to four and extreme basal middle of fifth with punctures which are about 0.010 mm. broad and are usually separated by once to twice their diameters; surface of sides of first four and most of fifth tomentose but if the tomentum is rubbed off the surface is densely, microscopically alutaceous; apical third or fourth of fifth with round granules about 0.012 mm. broad which are separated by less than to once their diameters. *Genitalia* as figured (text-figs. 211-213).

Female: Externally similar to male.

Type: In the British Museum (Nat. Hist.). GUATEMALA: Guatemala City, alt. 5000 ft. (*G. C. Champion*).

Specimens examined: 23, with same data as type; and 10, GUATEMALA: San Joaquin (*G. C. Champion*). The following 2926 specimens were collected in MEXICO: 4, Atlisco (*Flohr, F. D. Godman*); 1, Vera Cruz (*Koebele*); 2071, Estado

de Morelos, Cuernavaca, alt. 4800 ft., vi. 1934 (*H. E. Hinton*); and 850, Dist. de Temascaltepec, Tejupilco to Real de Arriba, alt. 3500-7500 ft., v-vii. 1933 and 1934 (1933, *H. E. Hinton*, *R. L. Usinger*) (1934, *H. E. Hinton*).

Variations: This species is the most variable member of the genus that has been examined. The most striking variations are those concerning the sculpture of various sclerites, particularly the pronotum and the disk of the elytra. The convex parts of the pronotal disk are typically as described above, but in some specimens all of the disk except anterior third, which is densely punctate, is confluent punctate with punctures which are usually about 0.007 mm. broad, and the intermediates between this extreme and the normal are numerous. In some the stria punctures on basal third of disk of elytra are broader than intervals, being in these individuals relatively as broad as in *M. angustus*. In many the alutaceous microsculpture of the surface of the prosternal process is distinctly asperate. A few specimens have the entire middle of abdominal sternites two to five densely tomentose.

Samples selected at random were taken from localities at three different altitudes and measured for length. The length was taken from the apex of the elytra to the anterior margin of the pronotum, and the head was never included. Table II shows that there is an increase in size (the length of this species shows a high positive correlation with breadth) with an increase in altitude, and, as may be seen from Table III, the differences between the means of the three samples may be regarded as significant.

TABLE II.

	Mean	Max	Min	S.D.	S.E.D.	S.E.M.	Numbers
Temascaltepec, 5000-7500 ft.	1.772	1.925	1.575	0.0782	0.0123	0.0179	20
Cuernavaca, 4800 ft.	1.726	1.900	1.425	0.1100	0.0142	0.0204	30
Tejupilco, 3500-4000 ft.	1.620	1.850	1.100	0.1152	0.0135	0.0194	38

Lengths are given in mm. S.D. equals standard deviation; S.E.D. equals standard error of the deviation, and S.E.M. equals standard error of the mean.

TABLE III.

	t	P	x	P
Temascaltepec and Tejupilco	5.77	.01	5.77	.10 ⁻⁸
Tejupilco and Cuernavaca	3.7	.01	3.7	.10 ⁻⁴
Cuernavaca and Temascaltepec	1.71	.10	1.71	.08

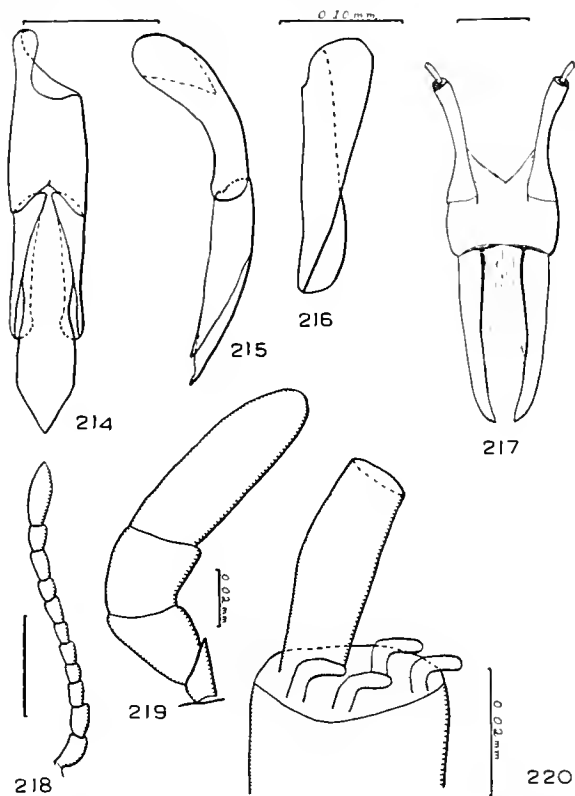
The significance of the difference between the means for length of the samples from the three different altitudes has been found by using the formula $t = \frac{M_1 - M_2}{\sqrt{(S.E.M._1)^2 + (S.E.M._2)^2}}$ where M is the mean and S.E.M. the standard error of the mean. Since in all cases the sum of the samples is over 30, the probabilities have also been given for values of x (Fisher, 1930), as these probabilities of the homogeneity of the population are more accurate.

Comparative notes: Of those species already described, this can only be confused with *M. angustus*, but may be readily distinguished as has been pointed out above under the description of *angustus*.

Microcylloepus troilus sp. n.

(Text-figs. 214-220.)

Male: Length, 1.85 mm.-2.201 mm.; breadth, 0.82 mm.-0.97 mm. Externally similar to *inaequalis* except as follows: (1) the elytra has the third discal interval at most only very feebly convex on basal seventh, whereas in *inaequalis* it is strongly convex to carinate on basal fifth or sixth; (2) the inner sublateral carinae of the elytra are never as prominent as the outer and are frequently so



TEXT-FIGS. 214-220.—*Microcylloepus troilus* Hinton. (214) Dorsal view of male genitalia. (215) Left lateral view of same. (216) Lateral view of left paramere of same. (217) Female genitalia. (218) Antenna. (219) Maxillary palp. (220) Apex of left coxite of female genitalia.

feebly convex that they are scarcely visible, whereas in *inaequalis* they are always prominent and generally as prominent as outer carinae; (3) *troilus* is nearly always much larger and though there is some overlap the means for absolute length are very different (*vide* Table VI); and (4) the male genitalia are different (*cf.* text-figs. 214-216).

Female: Externally similar to male.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Real de Arriba, alt. about 7000 ft., vi. 1933 (H. E. Hinton, R. L. Usinger).

Paratypes: 163, collected in the same district from Temascaltepec to Real de Arriba, alt. 5600-7500 ft., v-vii. 1933 (H. E. Hinton, R. L. Usinger); 866, with

data as above but collected in 1934 (*H. E. Hinton*); and 260, in the same district at Rio Verde, alt. about 8000 ft., 14. vi. 1934 (*H. E. Hinton*).

Variations: There is very little variation in the density of the punctures on the various sclerites. In no case are the inner sublateral carinae of the elytra as prominent as the outer, being one-half to two-thirds as high in 64 per cent., while in about 36 per cent. they are so feebly convex that they are scarcely noticeable. When viewed from the side the prosternum has the anterior three-fifths (not including process) bent ventrally in about half the cases, while in the other half the anterior three-fourths is bent. The prosternal carinae are usually present on basal half of prosternum, in a few cases they are on basal three-fifths or two-fifths, while in a very few they are confined to basal third. In a few cases the carinae of the first abdominal sternite extend only to posterior third of segment, but in the great majority they are complete or very nearly so.

A sample was selected at random from each of two altitudes. The specimens were measured for length from the apex of the elytra to the anterior middle margin of the pronotum. Table IV shows a slight increase in size with an increase in altitude. But, using the formula $t = \frac{M_1 - M_2}{\sqrt{(S.E.M._1)^2 + (S.E.M._2)^2}}$, where *M* is the mean and S.E.M. the standard error of the mean, $t = 0.6$ and the probability of the two samples representing populations homogeneous for length is 50 per cent., so that the difference in size recorded in Table IV should be considered to be of no significance.

TABLE IV.

Altitude.	Mean.	Max.	Min.	S.D.	S.E.D.	S.E.M.	Numbers.
8000 ft.	2.0130	2.150	1.850	0.0901	0.0073	0.0105	14
5000-7500 ft.	2.0034	2.125	1.825	0.0950	0.0070	0.0101	13

Lengths are given in mm. S.D. equals standard deviation; S.E.D. equals standard error of the deviation; and S.E.M. equals standard error of the mean.

Comparative notes: This species appears to be very close to *M. obesus*, but may be distinguished by such qualitative characters as the flat instead of convex scutellum and the differently formed male genitalia (*cf.* text-figs.). *M. troilus* is a distinctly smaller species as may be seen from Table V, being intermediate in size between *obesus* and *inaequalis*.

TABLE V.

Species.	Mean.	Max.	Min.	S.D.	S.E.D.	S.E.M.	Numbers
<i>obesus</i> , 8000 ft.	2.300	2.375	2.175	0.0800	0.0300	0.0500	4
<i>troilus</i> , 8000 ft.	2.0130	2.150	1.850	0.0901	0.0073	0.0105	14

Lengths are given in mm. and are taken from the apex of the elytra to the anterior middle margin of the pronotum. S.D. equals standard deviation; S.E.D. equals standard error of the deviation; and S.E.M. equals the standard error of the mean. The two means

were compared using the formula $x = \frac{M_1 - M_2}{\sqrt{(S.E.M._1)^2 + (S.E.M._2)^2}}$, $x = 5.6$ so that $P < 10^{-5}$ and the difference between the means may be regarded as being very significant.

TABLE VI.

Species.	Mean.	Max.	Min.	S.D.	S.E.D.	S.E.M.	Numbers
<i>troilus</i> , 5600-7500 ft.	2.0034	2.125	1.825	0.0656	0.0070	0.0101	43
<i>inaequalis</i> , 5600-7500 ft.	1.772	1.925	1.575	0.0782	0.0123	0.0170	20

Lengths are given in mm. and are taken from the apex of the elytra to the anterior middle margin of the pronotum. S.D. equals standard deviation; S.E.D. equals standard error of the deviation; and S.E.M. equals standard error of the mean. The two means were compared, using the formula $x = \frac{M_1 - M_2}{\sqrt{(S.E.M._1)^2 + (S.E.M._2)^2}}$, $x = 11$ and $P = 10^{-2}$, so that the difference between these two means may be regarded as being very significant.

LARVAE.

The larvae of *Microcylloepus* have been determined by elimination and according to locality, e.g. this is the only genus of the family found in both California and Trinidad, B.W.I., and larvae have been collected by the writer in California which are difficult to separate from those taken in Trinidad. Four species of larvae are available, and from a study of these the following generic diagnosis has been made.

Generic Characters of Larvae of Microcylloepus.

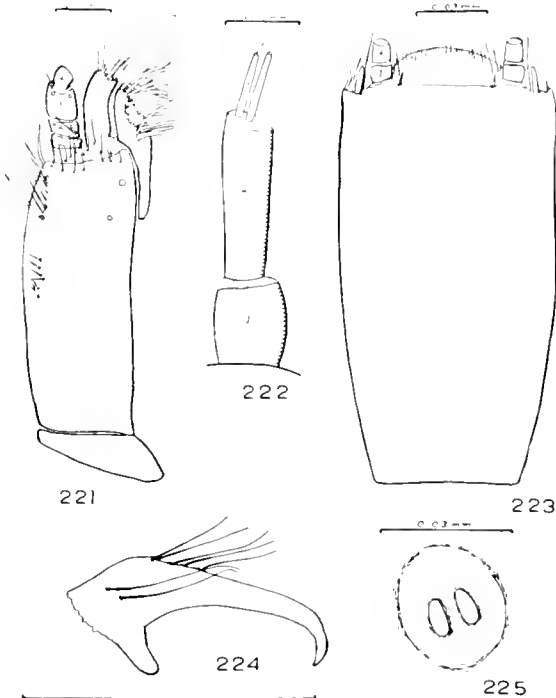
Body parallel, cylindrical, and evenly convex above. Tubercles of middle region of first eight abdominal tergites for the most part arranged in parallel, longitudinal rows. Head when viewed dorsally exposed and not at all concealed by the pronotum; anterior margin on each side between base of antenna and clypeus without a distinct tooth. With one ocellus on each side. Antennae (text-fig. 222) 3-segmented and not or only very feebly retractile. Clypeus not separated from the front of the head by a visible suture. Mandible (text-fig. 230) of both sides similar and with three obtuse apical teeth; prostheca long, slender, and densely spinose. Maxilla (text-fig. 221) with the palp 4-segmented and the stipes showing no differentiation into a palpifer; galea and lacinia separate and apex of each densely spinose. Labium (text-fig. 223) with the palp 2-segmented and prementum without a palpiger; post-mentum undivided. Hypopharynx with a sclerotized rod on each side. Gula not developed. Ventral sutures well-developed. *Prothoracic pleura* (text-fig. 226) divided into two parts and anterior part meeting on middle line of body so that sternum is here completely suppressed. Meso- and metapleura (text-fig. 226) divided into two parts. Abdominal segments one to seven with the pleura bounded by tergo- and sterno-pleural sutures and these two sutures converge on seventh segment and meet at its apex; segments one to seven with a pale dorsal line or suture parallel to tergo-pleural suture; segment eight forming a complete sclerotized ring; apex of ninth segment shallowly and broadly, arcuately emarginate. Operculum with two strongly sclerotized claws attached to its dorsal membrane. *Spiracles* present on mesothorax and first eight abdominal segments and opening at the apices of small tubercles. Tracheae without air sacs; with three tufts of retractile anal gills. *Alimentary canal* with an oesophageal sclerite on posterior dorsal margin of the oesophagus. Hind gut with six Malpighian tubules which end freely near the rectum. *Central nervous system* with three thoracic and eight abdominal discrete ganglia.

The larvae of this genus are very close to those of *Elsianus* and *Neoelmis*, but from the former may be distinguished by the absence of a fronto-clypeal suture and the absence of a tooth on anterior margin of head between the base of antenna and clypeus. From *Neoelmis* they may be distinguished by having six instead of four Malpighian tubules, and by having the tubercles on the dorsal surface arranged in rows.

Description of Mature Larva of M. inaequalis (Sharp).

(Text-figs. 221-231.)

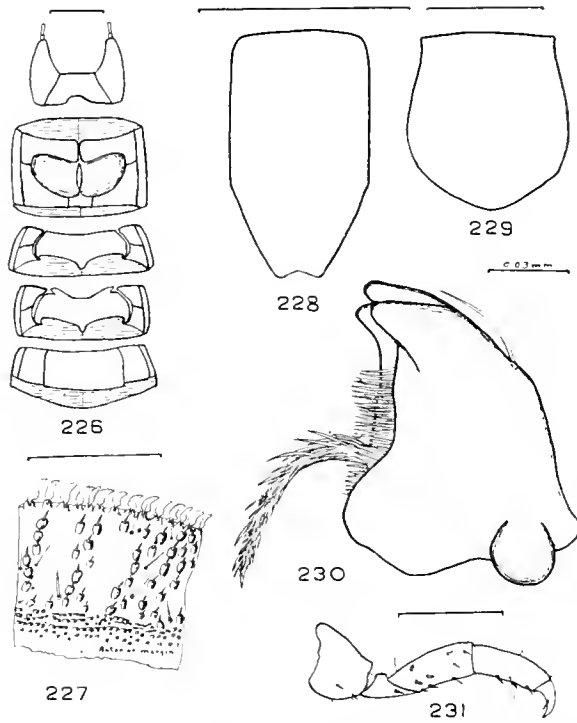
Length 4.0 mm.; breadth (across broadest point which is near base of metathorax), 0.55 mm. Elongate, subparallel, and cylindrical to subtriangular in



TEXT-FIGS. 221-225. —Larva of *Microcyllloepus inaequalis* (Sharp). (221) Ventral view of right maxilla. (222) Dorsal view of left antenna. (223) Ventral view of labium. Setae of prementum are only approximately correct. (224) Dorsal view of right opercular claw. (225) Mesothoracic spiracle.

cross section. Cuticle moderately shining and moderately dark brown to brownish testaceous. Head at broadest point, which is at basal third, about as broad as long (0.30 mm.); posterior dorsal margin (text-fig. 226) broadly, deeply, and arcuately emarginate; epicranial suture 0.012 mm. long; frontal suture on each side extending in a nearly straight line to anterior margin of head near inner base of antenna; anterior margin between base of antenna and clypeus without a tooth; surface sparsely pubescent with fine and erect hairs which are usually about 0.03 mm. long; surface on a basal belt which extends as far as beginning of frontal sutures with round, microscopic (about 0.004 mm. broad) granules

which are usually separated by once their diameters; surface elsewhere with moderately convex, oval granules which are about 0.012 mm. broad and are usually separated by less than to one and a half times their diameters; anterior dorsal margin with a single row of these granules which are about a fourth coarser and slightly denser; all granules except fine ones of basal belt have a fine seta which is about three-fourths as long as its respective granule on apical anterior margin. *Terga* of thoracic and abdominal segments with the granules for the most part similar to those of head but usually as coarse as those of anterior row.



TEXT-FIGS. 226-231.—Larva of *Microcyllopus inaequalis* (Sharp). (226) Ventral view of thorax and first abdominal segment to show sclerotization. (227) A section of the fifth abdominal tergite to show arrangement of tubercles. (228) Dorsal view of ninth abdominal segment. (229) Operenulum. (230) Mandible. (231) Inner face of front leg.

Pronotum with the granules of posterior half partly arranged in a series of irregular, parallel, longitudinal rows; all of tergites of last two thoracic and first eight abdominal segments with the granules arranged in similar rows (text-fig. 227); posterior margin of all segments except ninth and anterior margin of pronotum with a row of dense tubercles from which arise large, flat setae (text-fig. 227); anterior seventh or eighth of all segments except pronotum with a belt of fine (similar to those of basal belt of head), flat-topped, subquadrate to round tubercles; ninth tergite with a median longitudinal, strongly convex ridge extending from anterior eighth to posterior fifth and at middle about 0.07 mm. broad and 0.05 mm. high; apex of this segment (text-fig. 228) broadly and shallowly, arcuately emarginate. Sternites with the tubercles usually only two-thirds as coarse as

those of tergites, separated by two to three times their diameters, and not arranged in rows but otherwise similarly sculptured; sternites of last four abdominal segments with the tubercles coarser and usually separated by only twice their diameters; first abdominal sternite at middle anterior margin with a large (0.03 mm. broad) and high tubercle. Operculum (text-fig. 226) with the claws (text-fig. 224) not toothed. *Pleurites* tuberculate as their respective sternites except for those of prothorax which are about twice as densely tuberculate. *Legs* all fairly similar in chaetotaxy to front leg (text-fig. 231) and with the front pair shortest and the hind pair longest. *Spiracles* opening on apices of small tubercles and all similar to those of mesothorax (text-fig. 225).

Specimens examined: 22, MEXICO: Estado de Morelos, Cuernavaca, alt. 4800 ft., vi. 1934 (*H. E. Hinton*).

Among the series before me are a few specimens representing at least one earlier instar, but these apparently differ in no way but size from the mature larvae.

NEOELMIS Musgrave.

1935. *Neoelmis* Musgrave, *Proc. Ent. Soc. Wash.*, **37** (2) : 34

1936. *Neoelmis* Hinton, *Ent. Mon. Mag.*, **72** : 5.

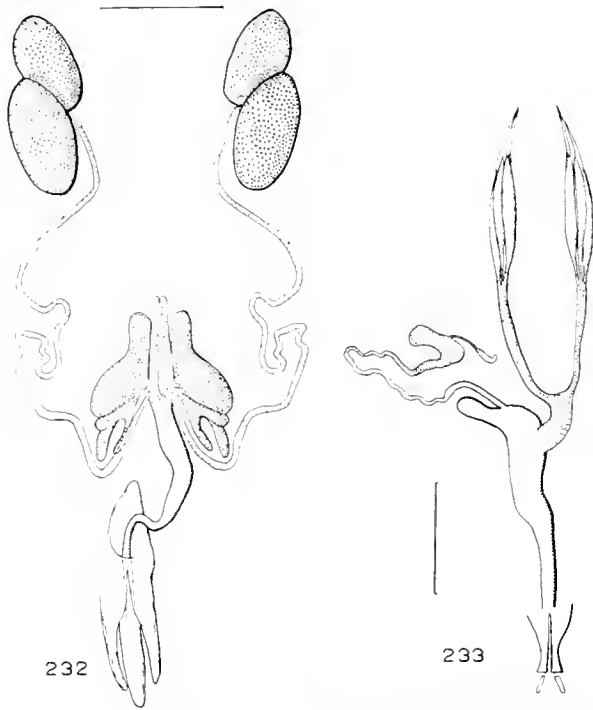
1936. *Elmis* Darlington, *Psyche*, **43** : 70.

This genus was erected by Musgrave to contain a new species from Puerto Rico, and to it he also referred *Elmis apicalis* Sharp, *E. caesa* Leconte, and *E. minima* Darlington. Hinton (1936) added a few generic characters omitted from the original description and referred *Elmis simoni* Grouvelle of Venezuela to the genus. Darlington (1936) sunk this genus as a synonym of *Elmis* Latreille, a genus very different from *Neoelmis* in the structure of the internal and external anatomy of both larvae and adults. If Darlington is correct and *Elmis* and *Neoelmis* should be united, then all the well-known genera of European Elmimi, with the possible exception of *Stenelmis* Dufour, must be sunk as synonyms of *Elmis*, for between these and *Elmis* there is less difference than between *Elmis* and *Neoelmis*. Such a course would invalidate the work of Erichson, Ganglbauer, Reitter, etc., on the adults and the work of Bertrand on the larvae. Perhaps it is needless to add that Darlington's conception of the generic limits of *Elmis* is followed by none of the present authorities on the family.

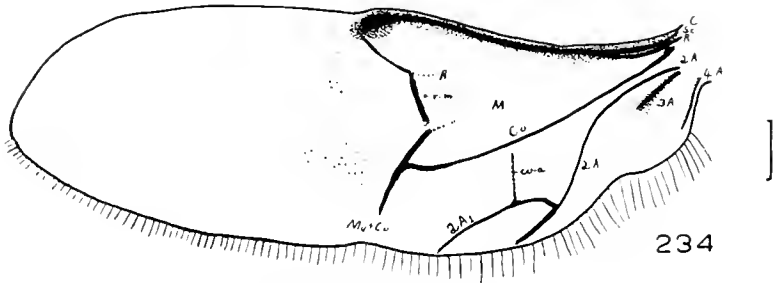
At the time of writing there are 21 species known. These occur from southern United States to south Brazil, and three species are known from the West Indies. A redescription of the genus follows:

Body subparallel and usually long and narrow. Non-tomentose areas glabrous or clothed with sparse and short recumbent hairs. Scale-like or hairy tomentum confined to the following areas: (1) genae; (2) epipleura; (3) sides of prosternum (in some species, e.g. *maculata*, there is no tomentum on the prosternum); (4) sides of mesosternum, metasternum and abdominal sternites, but in some species nearly the entire metasternum and the sternum of the abdomen is clothed with fine tomentum; and (5) part or all of legs except tarsi. *Head* when seen from below capable of being retracted so that none of the mouth-parts is visible. Antennae 11-segmented (text-fig. 246). Mandibles with three subacute, apical teeth; prostheca long and entirely membranous with numerous long spines or hairs apically. Maxilla with the palp (text-fig. 245) 4-segmented and stipes with a well-developed palpifer; galea and lacinia separate and apex of

each spinose or hairy. Labium with the palp 3-segmented and prementum without a distinct palpiger. Mentum about as broad and three-fourths as long as submentum. Gula slightly longer than submentum, at anterior margin about four-fifths as broad as submentum, and with the sides feebly converging, so that



TEXT-FIGS. 232, 233.—*Neelmis thoracica* (Grouvelle). (232) Male reproductive system. (233) Female reproductive system.



TEXT-FIG. 234.—Hind wing of *Neelmis longula* Hinton. Venation after Forbes.

at posterior margin it is only half as broad as submentum. *Pronotum* with the anterior margin moderately arcuate at middle and on each side behind eye before apical angle broadly and moderately deeply sinuate. Base trisinate, broadly and moderately so on each side and more narrowly and shallowly so in front of scutellum. *Pronotum* on each side with a sublateral carina which extends from base nearly to anterior margin; at apical two-fifths with a deep, broad, and

complete transverse impression; disk on either side of transverse impression evenly convex, though occasionally with a gibbosity in front of the scutellum. *Elytra* punctate and striate; each elytron with a sublateral carina on sixth interval. Hind wing (text-fig. 234) with a very feebly developed anal lobe; without a radial cross vein or an anal cell; first anal usually absent; second anal with the second branch absent; third anal only present basally and not joined to second anal; fourth anal well developed; and cubito-anal cross vein joining cubitus to second anal, though often incomplete. *Prosternum* very long in front of anterior coxae; prosternal process long, narrow or broad, and posterior margin of process nearly truncate to broadly rounded. Mesosternum with a broad and deep groove for the reception of the prosternal process. Metasternum with a median longitudinal impressed line. *Legs* with the visible portion of the front coxae rounded and trochantin completely concealed by the hypomera and sternum. Claws without teeth. *Alimentary canal* with three, two or no caeca on the anterior margin of the mid-gut. Hind gut with four Malpighian tubules which end freely near the rectum. *Male reproductive system* (text-fig. 232) with the lateral accessory glands lobed. Each testis with two sperm tubes. *Female reproductive system* (text-fig. 233) with four egg-tubes to each ovary. Spermathecal duct opening into middle of bursa copulatrix. *Central nervous system* with three thoracic discrete ganglia; abdominal ganglia one to six discrete; and seven and eight fused, but with the limits of each distinguishable.

GENOTYPE: *Neolmis gracilis* Musgrave (1935).

The internal anatomy of three species has been examined and found to agree in essential details, except that the number of caeca of the mid-gut varies. That of *N. thoracica* Grouvelle is figured.

This genus appears to be nearer to *Esolus* Mulsant and Rey than to any other described genus. From *Esolus* it may be distinguished as follows: (1) the hypomera are not clothed with tomentum as they are in *Esolus*; (2) the pronotum has a deep and complete transverse impression on apical two-fifths, whereas in *Esolus* it is more or less evenly convex; (3) the hind wing has the second anal branched and at least part of a cubito-anal cross vein is present, whereas in *Esolus* the second anal is not branched and there is no cubito-anal cross vein; (4) the anterior margin of the mid-gut has three, two, or no caeca, whereas in *Esolus* no caeca are here present; and (5) the central nervous system has only the seventh and eighth ganglia partly fused to form a terminal abdominal ganglion, whereas in *Esolus* the terminal abdominal ganglion consists of a fusion of ganglia four to eight.

A list of the specific characters which seem to be of most importance in distinguishing the species of *Neolmis* is as follows:

- (1) General proportions, length and breadth.
- (2) Colour. In some species, e.g. *maculata*, the elytra are maculate.
- (3) Size and distribution of the punctures on the various sclerites and the density and type of the micro-sculpture, if present, between the punctures.
- (4) Condition of fronto-clypeal suture.
- (5) Anterior margin of clypeus, whether rounded, truncate, emarginate, or sinuate; and also the condition of the angle on each side.
- (6) Condition of anterior margin of labrum and the angle on each side.
- (7) Outline of pronotum and its general proportions.
- (8) Condition of disk of pronotum, whether with gibbosities or evenly convex.

- (9) Shape of elytral apices.
- (10) Shape of scutellum.
- (11) Condition of anterior portion of prosternum, whether straight or bent ventrally when viewed from the side.
- (12) Extent of tomentum, if any, on sides of prosternum.
- (13) Condition of prosternal carinae. In some species they are absent, but when present may be parallel, diverging or converging anteriorly, or contiguous anteriorly. If they are parallel their breadth apart should be given.
- (14) Breadth of prosternal process.
- (15) Condition of sides of prosternal process. In some species they are strongly gibbous, while in others they are not at all thickened.
- (16) Extent and depth of mesosternal groove.
- (17) Disk of metasternum, whether flat or not and the extent and depth of the impressions.
- (18) Length, shape, and prominence of carinae, if present, on middle of first abdominal sternite.
- (19) Secondary sexual characters.
- (20) Structure of male genitalia. No case is known where these structures are the same for two or more species.

A list of the secondary sexual characters that have been observed in the species before me is as follows:

- (1) Male with a tooth on anterior margin of prosternum (*gigas*, *prosternalis*, *simoni*).
- (2) Male with the disk of the metasternum more strongly and extensively concave than that of the female (*gigas*, *lobata*, *musgravei*, *prosternalis*).
- (3) Each side of median impression of metasternal disk of male with numerous testaceous hairs, and also densely punctate, while in female this region is glabrous or nearly so and is also sparsely punctate (*musgravei*).
- (4) Male with carinae on the middle of the first abdominal sternite, while in the female they are absent (*prosternalis*).
- (5) Male with the carinae of the first abdominal sternite converging, while in the female they are straight (*gigas*).
- (6) Male with a tubercle on each side of middle of first abdominal sternite (*gigas*, *prosternalis*).
- (7) Male with the anterior middle of the second abdominal segment feebly depressed (*aspera*, *azteca*, *longula*).
- (8) Male with the inner apex of the front tibia gibbous (*gigas*).
- (9) Male with a row of short and stout spines on inner apex of middle tibiae (*gigas*, *prosternalis*).
- (10) Male with a row of short and stout spines on inner ventral side of apical three-fourths of middle and hind tibiae (*apicalis*, *aspera*).
- (11) Male with a row of small spines on ventral side of apical segment of middle and hind tarsi (*gigas*, *lobata*, *prosternalis*).

In the following key for the separation of the Mexican species *N. caesa* Leconte is included. This species is to-day recorded only from Texas, but will very likely be found to occur in the north-western parts of Mexico which are a continuation of the same Sonoran faunal region.

A KEY TO THE NORTH AMERICAN SPECIES OF *Neelmis*.

1. Hypomera with the middle area entirely smooth and without an asperate type of microsculpture. MEXICO *N. longula* Hinton (1936)
 Hypomera densely asperate throughout 2.
2. Disk of metasternum without a depression on each side. MEXICO
N. atлека, sp. n.
 Disk of metasternum with an oval depression on each side 3.
3. Prosternal carinae parallel and separated by a distance equal to breadth of process near base; prosternum with a distinct ridge on each side parallel to and between prosternal carina and sterno-notal suture. GUATEMALA, MEXICO *N. apicalis* (Sharp) (1882).
 Prosternal carinae converging in front so that while at base they are separated by a distance equal to the breadth of the process, at apex they are separated by only half or less of this distance; prosternum on each side without a distinct ridge between carina and sterno-notal suture 4.
4. Prosternal carinae at anterior end separated by a distance equal to about half of the breadth of the process at base. Surface of flat parts of metasternal disk without an asperate microsculpture between anterior seventh and basal fifth. MEXICO *N. aspera*, sp. n.
 Prosternal carinae at anterior end separated by a distance equal to about a third of the breadth of the process at base. Surface of flat parts of metasternal disk nearly entirely asperate. TEXAS
N. caesa (Leconte) (1874)

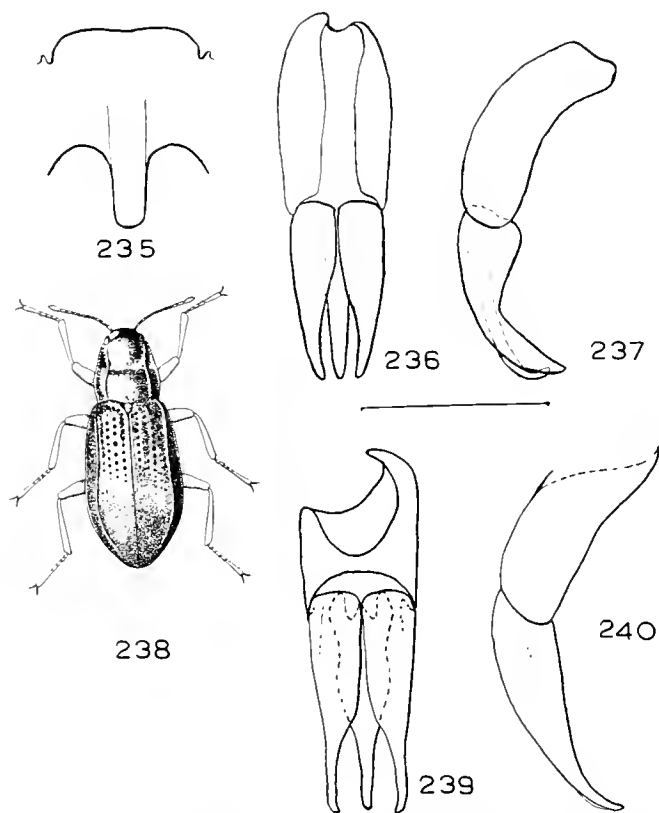
***Neelmis longula* Hinton.**

(Text-figs. 234-238.)

1936. *Neelmis longulus* Hinton, *Trans. R. Ent. Soc. Lond.*, **85** (18): 426, fig. 21, pl. 1, fig. 2.

Male: Length, 1.07 mm.-2.20 mm.; breadth, 0.82 mm.-0.90 mm. Cuticle shining and rufo-piceous; antennae, mouth-parts, and legs paler rufo-piceous. *Head* without distinct impressions; surface very densely and microscopically alutaceous. Clypeus with the fronto-clypeal suture straight and very feebly and indistinctly impressed; anterior margin when seen from in front broadly, arcuately, and very feebly emarginate; anterior angles broadly rounded; surface only sparsely alutaceous on most of the middle but at sides alutaceous as on head. Labrum with the anterior margin feebly and broadly rounded and the angle on each side broadly rounded; surface sparsely and transversely alutaceous basally, and anteriorly with fine punctures which are about 0.010 mm. broad and are separated by one to three times their diameters. *Pronotum* across broadest point, which is at basal third, not quite as broad as long (0.575 mm. : 0.587 mm.) and base broader than apex (0.52 mm. : 0.37 mm.). Sublateral carina extending from near base to apical eighth. Impressions as figured (text-fig. 238). Lateral margins nearly smooth. Surface on convex portions between sublateral carinae with fine (about 0.008 mm. broad) punctures which are usually separated by three to five times their diameters, and surface between punctures smooth; elsewhere similarly sculptured except as follows: bottom of transverse impression with a dense asperate type of microsculpture, and the middle of this belt extending slightly posteriorly; the basal and anterior sixth of area between sublateral

carina and lateral margin is irregularly alutaceous to asperate; and the outer dorsal side of the basal three-fifths of sublateral carina is also microscopically alutaceous. *Elytra* nearly twice as long as pronotum (1.47 mm. : 0.58 mm.) and at broadest point, which is across apical third, broader than broadest point across humeri (0.82 mm. : 0.76 mm.). Lateral margins nearly smooth (under magnification of more than $\times 150$ they appear very finely and irregularly crenate). Apices moderately strongly, broadly produced and conjointly feebly rounded.



TEXT-FIGS. 235-240. —(235) Prosternum of *Neocelmis longula* Hinton. (236) Dorsal view of male genitalia of same species. (237) Right lateral view of same. (238) Adult to show general appearance. (239) Dorsal view of male genitalia of *N. azteca* Hinton. (240) Right lateral view of same.

Surface with the striae feebly impressed on basal two-thirds, but absent on apical third; discal striae punctures deep, round to subquadrate, two-thirds to slightly broader than intervals, and separated longitudinally by a half to two thirds of their diameters; from apical half to apical third these punctures become rapidly finer so that at apical third they are about a third as coarse, only half as broad as intervals, and are separated longitudinally by twice their diameters; from apical third to apex they become slightly finer and sparser. Intervals flat; surface of intervals feebly, sparsely, very finely alutaceous and more finely punctate than pronotal disk; surface of intervals at extreme base and on basal fourth between lateral margins and sublateral carinae with round, low granules which are about

0.012 mm. broad and are usually separated by once to twice their diameters. *Scutellum* flat, subovate, longer than broad (0.10 mm. : 0.075 mm.), base feebly rounded, and apex more strongly rounded; surface sculptured as sutural interval. *Prosternum* when seen from the side with the anterior three-fifths (not including process) moderately strongly but not sharply bent ventrally; prosternal carinae present on posterior two-fifths, prominent, parallel, and separated by a distance equal to about four-fifths of the breadth of the process between coxae; between carina and sterno-notal suture there is no distinct ridge; process (text-fig. 235) moderately narrow, parallel, with the margins moderately strongly gibbous, and the posterior margin broadly rounded; fine hairy tomentum present on most of sides; surface sculptured similarly to discal elytral intervals but antero-lateral sides with a dense and asperate type of alutaceous microsculpture. Hypomera smooth and highly polished except for basal fifth, apical sixth, margins near sterno-notal suture, and bottom of depressions where it is mostly densely asperate. Mesosternum with the anterior portion of the groove for the reception of the prosternal process broad and deep, but at posterior half suddenly becoming twice as broad and slightly deeper so that all of the mesosternum between coxae except lateral and posterior margins is depressed. Metasternum with the median longitudinal line complete; disk deeply and broadly depressed on middle posterior three-fifths and the bottom of the depression is asperate; surface of disk elsewhere with irregularly-shaped punctures which are about 0.007 mm. broad and are separated by three to eight times their diameters, while the surface between the punctures is smooth; sides of metasternum densely, microscopically alutaceous and this sculpture is sometimes asperate. Abdomen with the carinae of the first sternite straight except posteriorly where they are feebly curved inwards, and extending to posterior fifth of sternite; the entire middle area of the first sternite between carinae is strongly depressed; second abdominal sternite feebly depressed on middle of anterior third; surface of basal half of middle of first sternite asperate, while apical half, middle region of sternites two to four, and basal third of fifth punctate similarly to metasternal disk; apical two-thirds of fifth, as well as lateral part, with punctures which are about 0.012 mm. broad and are separated by two to three times their diameters; sides of sternites one to four moderately densely, microscopically alutaceous. *Genitalia* as figured (text-figs. 236, 237).

Female: Externally similar to male except that middle third of the second abdominal sternite is not depressed.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Real de Arriba, alt. 6000-7000 ft., vii. 1933 (*H. E. Hinton, R. L. Usinger*).

Specimens examined: 10, with data as above but collected in v-vii; 192, as above but collected in v-vii. 1934 (*H. E. Hinton*); and 7, in the same district at Rio Verde, alt. about 8000 ft., 14. vi. 1934 (*H. E. Hinton*). 13, MEXICO: Estado de Morelos, Cuernavaca, alt. about 4800 ft., vi. 1934 (*H. E. Hinton*).

Teratology: One female from Real de Arriba has a deep oval pit on the right-hand side of the metasternal disk.

Variations: In some specimens the carinae of the first abdominal sternite only extend to posterior half. There is an increase in size with an increase in altitude. This could not be tested on the material collected in the district of Temascaltepec, as sufficiently accurate altitude data are not available. But the series collected at Cuernavaca, which is at a lower altitude approximately within the same latitude, has a smaller mean value for absolute length (Table VII, text-fig. 241). The significance of the difference between the means of the series

collected in Cuernavaca and that collected in the district of Temascaltepec was calculated from the formula $t = \frac{M_1 - M_2}{\sqrt{(S.E.M._1)^2 + (S.E.M._2)^2}}$, where M is the mean and S.E.M. is the standard error of the mean. In this case $t = 5.5$ and, as may be seen from Fisher's (1936) table of t , the probability, P , of these two series being got from the same population is considerably less than $P < .01$. This difference in absolute size of populations of the same species at different altitudes is probably due to a difference in temperature during the larval life of the species.

From the district of Temascaltepec there are 13 specimens collected between 5600 and 7500 ft. These are so similar to *longula* that I have been unable to separate them on any qualitative character. But, as may be seen from Table VII or text-fig. 24I, the absolute length of the longest is not even close to the absolute length of the smallest of typical *longula*; and they may be readily separated on size even by the unaided eye. This series of small individuals (hereafter called X) may be *longula* or another species.

TABLE VII.

Altitude.	Mean.	Max.	Min.	S.D.	S.E.D.	S.E.M.	Numbers.
5600-8000 ft.	2.0049	2.125	1.000	0.0907	0.0063	0.0090	46
4800 ft.	1.892	2.025	1.750	0.069	0.0139	0.0201	13
5600-7500 ft.	1.675	1.775	1.600	0.0445	0.0087	0.0127	13

The figures are given in mm. The lengths are taken from the apex of the elytra to the middle anterior margin of the pronotum, and the head was not included as to do so would have introduced a considerable error into the measurements, since the total length would vary in the order of 0.025 mm. : 0.100 mm. depending on how much the head happened to be retracted into the prothorax. S.D. equals standard deviation; S.E.D. equals standard error of the deviation, and S.E.M. equals standard error of the mean.

If X is *longula* it is obvious that some factor is playing the part of a sieve and sharply dividing the population into two size groups. This factor is not sex, as males and females occur in the proportion of about 1 : 1 in both groups. The population of *longula* may be infected by some protozoal or other disease the presence of which would make the size of any individual much larger or smaller. But even in this case lightly infected individuals intermediate in size would be expected to occur.

It seems much more probable that X is, in point of fact, a new species. If this is so, it should not be very surprising that these two species cannot be separated when the crudity of the available qualitative taxonomic methods is taken into account. X may differ from *longula* not only in one but in a great many genes which control the histological and biochemical structure of many different tissues. By the usual taxonomic methods applicable to dried specimens two or more related species can only be distinguished if there happens to be a difference in external characters. Even if the internal characters are alike, there may still be many biochemical differences of specific importance.

Comparative notes: X, *longula* may be distinguished from all its North American congeners by the smooth instead of asperate middle region of the hypomera and by the structure of the male genitalia.

***Neoelmis azteca*, sp. n.**

(Text-figs. 239, 240.)

Male: Length, 1.92 mm.; breadth, 0.75 mm. Similar to *longula* except as follows: (1) the round granules at the base and sides of elytra are much less numerous and distinct; (2) the prosternal carinae distinctly converge so that anteriorly they are only half as far apart as at base; (3) the asperate type of alutaceous microsculpture completely covers the hypomera, and there are no smooth and polished areas; (4) the asperate microsculpture of the depressed portion of the middle of the first abdominal sternite extends over the basal two-thirds, whereas in *longula* it is confined to the basal half; and (5) the male genitalia are different (text-figs. 239, 240).

Female: Unknown.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Real de Arriba, alt. about 7000 ft., vii. 1934 (*H. E. Hinton*).

Paratype: A male with the same data as above.

***Neoelmis apicalis* (Sharp).**

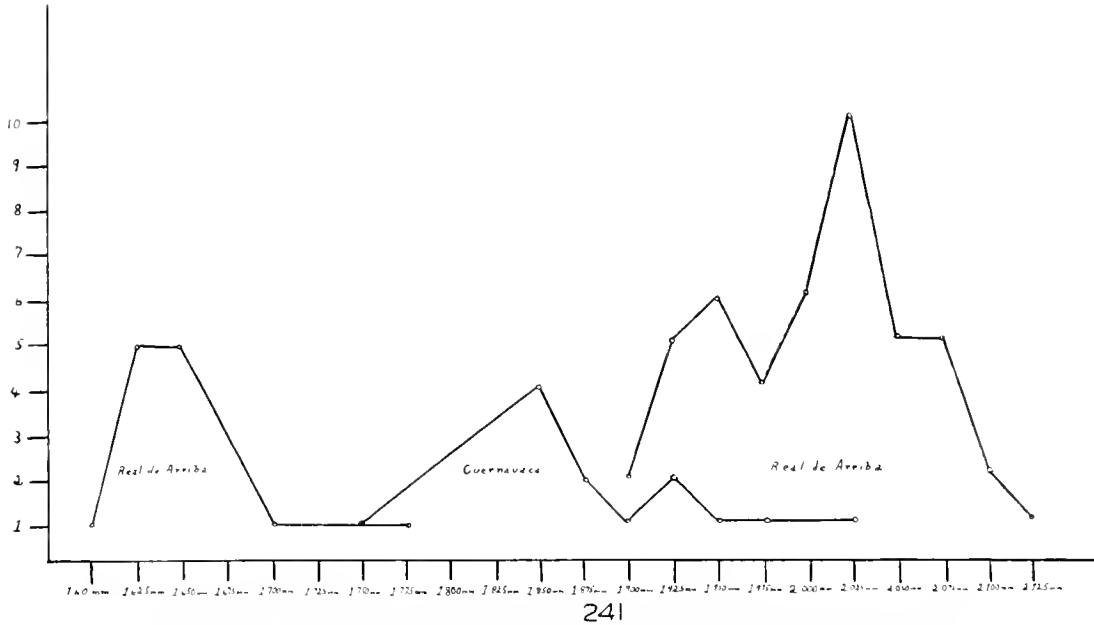
(Text-figs. 242-245.)

1882. *Elmis apicalis* Sharp, *Biol. Centri.-Amer. Col.*, **1** (2) : 136, t. 4, fig. 14.

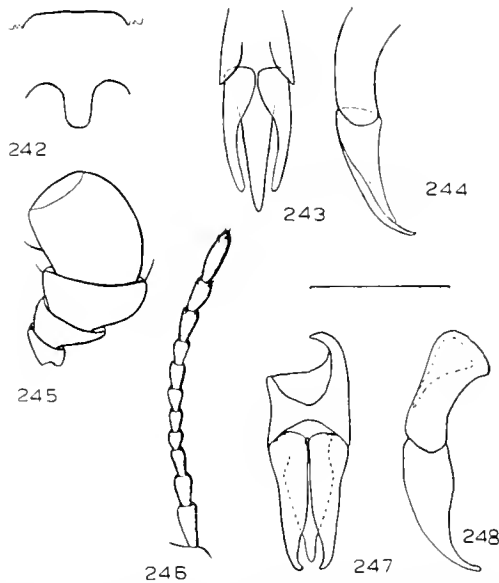
1935. *Neoelmis apicalis* Musgrave, *Proc. Ent. Soc. Wash.*, **37** (2) : 34, 35.

1939. *Neoelmis apicalis* Hinton, *Trans. R. Ent. Soc. Lond.*, **85** (18) : 420, fig. 22.

Male: Length, 1.57 mm.—1.75 mm.; breadth, 0.62 mm.—0.65 mm. Cuticle shining and rufo-piceous; antennae, mouth-parts, and legs paler rufo-piceous. *Head* without distinct impressions; surface very densely and microscopically, asperately alutaceous. Clypeus with the fronto-clypeal suture nearly straight and moderately feebly impressed; anterior margin when seen from in front truncate to very feebly rounded; anterior angles broadly rounded; surface at sides sculptured as head but elsewhere only occasionally alutaceous and with microscopic punctures (about 0.003 mm. broad) which are usually separated by two to five times their diameters. Labrum with the anterior margin feebly and broadly rounded and the angle on each side broadly rounded; surface punctate as middle region of clypeus but with the punctures denser and very slightly coarser. *Pronotum* across broadest point, which is at basal third, slightly broader than long (0.48 mm. : 0.46 mm.) and base broader than apex (0.42 mm. : 0.33 mm.). Sublateral carinae extending from base to very nearly apical margin. Impressions as in *longula*. Lateral margins feebly and regularly crenate. Surface on convex portions between sublateral carinae with fine (about 0.009 mm. broad) punctures which are usually separated by three to five times their diameters, and the surface between these punctures is smooth; elsewhere similarly sculptured except as follows: bottom of transverse impression with a very short belt (about a third as long as that of *longula*) of a dense asperate type of microsculpture; area between sublateral carinae with the basal fifth, anterior fifth, all of apical impression, and outer sides of sublateral carinae densely asperate. *Elytra* more than twice as long as pronotum (1.12 mm. : 0.46 mm.) and at broadest point, which is across apical third, broader than broadest point across humeri (0.62 mm. : 0.57 mm.). Lateral margins nearly smooth. Apices moderately strongly, broadly produced and conjointly feebly rounded. Surface with the striae feebly impressed on basal two-thirds but absent on apical third; discal strial punctures deep, usually round, as



TEXT-FIG. 241.—Frequency polygons of three populations of *N. longula* Hinton. The polygons are not adjusted to equal areas. The measurements are from the apex of the elytra to the anterior margin of the pronotum.



TEXT-FIGS. 242-248.—(242) Prothorax of *Neelmis apicalis* (Sharp). (243) Dorsal view of male genitalia. (244) Right lateral view of same. (245) Maxillary palp. (246) Antenna. (247) Dorsal view of male genitalia of *N. aspera* Hinton. (248) Right lateral view of same.

broad to half again as broad as intervals, and separated longitudinally by two-thirds to once their diameters; at apical two-fifths the discal punctures become only about a third as coarse and dense and from here to apex they gradually become finer so that at apex they are no more than a fourth as coarse and dense as those near base. Intervals flat, feebly, sparsely, microscopically alutaceous and also with punctures which are similar to those of pronotal disk but are more irregularly distributed; surface of intervals at extreme base with an occasional round, low granule which is about 0.012 mm. broad, and sides on basal fourth between lateral margins and sublateral carinae with similar granules which are frequently separated by no more than their diameters. *Scutellum* flat, subovate, slightly longer than broad (0.075 mm. : 0.070 mm.), base feebly, broadly rounded, and apex more strongly rounded. *Prosternum* when seen from the side with the anterior three-fifths (not including process) moderately strongly and sharply bent ventrally; prosternal carinae present on posterior two-fifths, prominent, parallel, and separated by a distance nearly equal to that of the process at base; on each side between carina and sterno-notal suture there is a prominent, thick ridge about 0.10 mm. long; process as figured (text-fig. 242) and with the lateral and apical margins moderately strongly gibbous; surface of prosternum and hypomera throughout densely asperate except for middle in front of process which is sculptured as disk of elytra. Mesosternum with the groove for the reception of the prosternal process broad and deep on anterior two-fifths, where the bottom of the groove is smooth, and suddenly becoming broader so that posterior three-fifths is nearly twice as broad and has the bottom densely asperate and at middle of this area there is a large (about 0.050 mm. long) oval, smooth-bottomed, deep pit; surface of sides of mesosternum asperate. Metasternum with the median longitudinal line complete, on basal five-sixths 0.50 mm. broad and deep, and on anterior sixth very narrow and feebly impressed; disk on each side on basal third with an irregularly round pit which is about 0.06 mm. broad; surface of disk and bottom of all impressions densely asperate except for a narrow smooth belt along sides of median line; sides of metasternum densely and obscurely asperately alutaceous. *Abdomen* with the carinae of the first sternite straight, prominent, and extending to posterior half of segment; middle of first sternite deeply depressed on anterior three-fourths; surface of sternites sculptured as follows: basal two-fifths of depressed portion of first sternite densely asperate; posterior three-fifths of middle of first sternite and all of middle of sternites two to four only sparsely microscopically alutaceous; and sides of first four sternites and all of fifth sculptured as sides of metasternum. *Legs* with the inner ventral side of apical four-fifths of middle and hind tibiae with a row of short and stout spines. *Genitalia* as figured, (text-figs. 243, 244).

Female: Externally similar to male except as follows: the middle and hind tibiae have no inner rows of short and stout spines.

Type: In the British Museum (Nat. Hist.). GUATEMALA: Vera Paz, San Joaquin (*Champion*).

Specimens examined: 1, with same data as type; and 2, in the same state at Rio Naranjo, 450 ft. (*Champion*). 200, MEXICO: Dist. de Temascaltepec, Tejunilco, alt. about 4000 ft., vi. 1933 (*H. E. Hinton, R. L. Usinger*); 69, with data as preceding but collected in vii. 1934 (*H. E. Hinton*); 2, MEXICO: Estado de Morelos, Cuernavaca, alt. about 4800 ft., vi. 1934 (*H. E. Hinton*).

Variations: Apart from the variation in absolute size already recorded, none worthy of mention have been observed.

Comparative notes: From *N. longula* this species may be distinguished by

its entirely instead of only partly asperate hypomera, from *azteca* by the presence of a pit on each side of the metasternal disk, and from *caesa* by having the prosternal carinae parallel instead of converging anteriorly.

***Neoelmis aspera*, sp. n.**

(Figs. 247, 248.)

Male : Length, 1.70 mm. ; breadth, 0.65 mm. Externally similar to *apicalis* except as follows : (1) the fronto-clypeal suture is not distinctly visible ; (2) the belt of asperate microsculpture on the bottom of the apical impression of the pronotal disk is broader (about as broad as in *longula*) ; (3) the extreme base of the pronotum is asperate as is apical part of disk ; (4) the prosternal carinae are indistinct and converge in front so that anteriorly they are separated by a distance equal to only half of breadth of process at base ; (5) prosternum without a distinct ridge on each side between carina and sterno-notal suture ; (6) nearly the entire non-impressed part of the metasternal disk is smooth ; (7) the second abdominal sternite is feebly depressed on middle anterior third ; and (8) the male genitalia are different (text-figs. 247, 248).

Female : Externally similar to male except as follows : the middle and hind tibiae have no short and stout teeth, and the basal third of middle of second abdominal sternite is not depressed.

Type : ♂ in the British Museum (Nat. Hist.). MEXICO : Estado de Morelos, Cuernavaca, alt. 4800 ft., vi. 1934 (*H. E. Hinton*).

Paratypes : 8, with data as above ; and 1, MEXICO : Dist. de Temascaltepec, Real de Arriba, alt. about 7000 ft., vii. 1934 (*H. E. Hinton*).

Teratology : One male specimen from Cuernavaca has no pit on the left-hand side of the metasternal disk, and the pit on the right-hand side is relatively only three-fourths as long as is normal for this species.

Variations : In some specimens the carinae of the first abdominal sternite extend to posterior fifth of segment, while in others it only extends to posterior half, as is usual in *apicalis*.

Comparative notes : *N. aspera* is also very close to *caesa*, but differs in having the prosternal carinae anteriorly separated by a distance equal to about half the breadth of the process at base, whereas in *caesa* they are here separated by a distance equal to only a third the breadth of the process at base ; and in having the flat parts of the metasternal disk mostly smooth, whereas in *caesa* the disk is here mostly asperate.

LARVAE.

No larvae of this genus were collected in Mexico. By elimination and according to locality the larvae of two Bolivian species of *Neoelmis* have been determined, and the following generic diagnosis is drawn up from a study of these.

Generic Characters of Larvae of Neoelmis.

Body subparallel and cylindrical to subtriangular in cross section ; dorsal surface evenly convex. *Head* when seen from above exposed and not concealed by the pronotum ; anterior margin on each side between base of antenna and clypeus with a short, indistinct, blunt tooth. Clypeus with the suture distinct. With one ocellus on each side. Antennae 3-segmented and not or only very feebly retractile. Mandibles of both sides similar and with three obtuse, apical

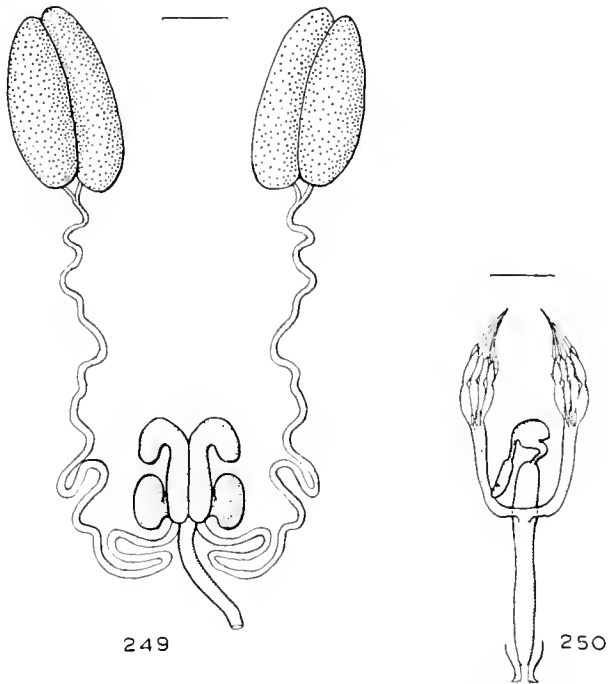
teeth; prostheca long, slender, and densely spinose. Maxilla with the palp 4-segmented and stipes showing no differentiation into a palpifer; galea and lacinia separate and apex of each densely spinose. Labium with the postmentum undivided; labial palp 2-segmented and prementum without a distinct palpiger. Gula well developed. *Prothoracic pleura* divided into two parts and anterior part meeting on middle line of body so that sternum is here completely suppressed. Meso- and metapleura each divided into two parts. Abdominal segments one to seven with pleura bounded by tergo- and sterno-pleural sutures and these two sutures converging and meeting at apex of seventh segment; segment eight forming a complete sclerotized ring. Operculum with two strongly sclerotized claws attached to its dorsal membrane. Apex of ninth segment broadly and arcuately emarginate. *Spiracles* present on mesothorax and first eight abdominal segments and opening at apices of small tubercles; trachea without air sacs; with three tufts of anal, retractile, tracheal gills. *Alimentary canal* with an oesophageal sclerite on the dorsal posterior margin of the oesophagus. Hind gut with four Malpighian tubules which end freely near the rectum. *Central nervous system* with three thoracic and eight abdominal discrete ganglia.

The larvae of this genus are very close to those of *Elsianus*, and may be distinguished from some species of *Elsianus* by the absence of a dorso-lateral suture parallel to tergo-pleural suture on segments two to seven. Some species which appear to belong to the genus *Elsianus* have no dorso-lateral suture on the abdomen, and from these *Neoelmis* can only be distinguished by the nearly toothless anterior margin of the head and by counting the Malpighian tubules. The adults of *Neoelmis* differ so greatly from those of *Elsianus* in the structure of both their internal and external anatomy, that I consider the similarity of the larvae of these two genera to be due to parallelism.

HEXACYLLOEPUS, gen. n.

Body elongate, subparallel. Dorsal surface clothed with short, sparse or dense, usually recumbent hairs. Hairy or scale-like tomentum confined to the following areas: (1) genae; (2) hypomera with a large area which begins opposite middle of front coxae and extends transversely or obliquely upwards to lateral margin of pronotum and forms next to this margin a belt which frequently extends to anterior margin; (3) epipleura; (4) sides of prosternum, mesosternum, metasternum, and abdominal sternites, but in a few species nearly the entire ventral surface may be clothed with tomentum; and (5) all of legs except tarsi, though in most species the tomentum is sparse or absent on many parts of the tibiae and femora. *Head* when seen from below capable of being retracted so that none of the mouth-parts are visible. Antenna 11-segmented. Mandible with three acute apical teeth; prostheca entirely membranous and with the apex spinose or hairy. Maxillary palp 4-segmented and stipes with a well-developed palpifer; galea and lacinia separate and apex of each densely spinose. Labial palp 3-segmented and prementum with a palpiger. Mentum transverse and about as broad and long as submentum. Gula anteriorly nearly as broad as submentum but posteriorly slightly narrowed. *Pronotum* with a sublateral longitudinal carina on each side which generally extends from base to apex, though in a few species it does not quite reach either base or apex; with a median longitudinal impression on disk. *Elytra* striate and punctate; without accessory striae; with two sublateral carinae on each elytron. Hind wing (text-fig. 252)

without a radial cross vein and without an anal cell ; with the first anal absent ; second anal with the first and second branches present ; third anal with a second branch ; cubito-anal cross vein complete and joining cubitus to second anal. *Prosternum* very long in front of anterior coxae ; prosternal process long and posterior margin usually broadly rounded. Mesosternum with a deep and moderately narrow groove for the reception of the prosternal process. Metasternum with a median longitudinal impressed line. *Legs* with the visible portion of the front coxae rounded and trochantin completely concealed by the hypomera. Claws without teeth. *Alimentary canal* with six caeca on the anterior margin of



TEXT-FIGS. 249, 250.—*Hexacylloepus smithi* (Grouvelle). (249) Male reproductive system. (250) Female reproductive system.

the mid-gut ; with the outer surface of the mid-gut smooth. Hind gut with four Malpighian tubules which end freely in the body cavity near the rectum. *Male reproductive system* (text-fig. 249) with the lateral accessory glands not divided. Each testis consisting of two sperm tubes. *Female reproductive system* (text-fig. 250) with seven egg tubes to each ovary. Spermathecal duct opening into apex of bursa copulatrix. *Central nervous system* with three thoracic discrete ganglia. First abdominal ganglion partly fused to third thoracic, two to five discrete, and six to eight partly fused together, though the limits of each are distinguishable.

GENOTYPE : *Elmis smithi* Grouvelle (1898).

H. smithi is the only member of this genus that has been available for an examination of the internal anatomy. The majority of the species are so close in external characters that they can be separated only on the structure of the

male genitalia which generally exhibit very striking specific differences. The larvae are still unknown.

The following species should be referred to *Hexacylloepus* Hinton: *H. abdominalis* (Hinton) (*Cylloepus*), *H. abditus* (Hinton) (*Cylloepus*), *H. aciculus* (Hinton) (*Cylloepus*), *H. ferruginea* (Horn) (*Cylloepus*), *H. flavipes* (Grouvelle) (*Cylloepus*), *H. granosus* (Grouvelle) (*Cylloepus*), *H. granulatus* (Sharp) (*Elmis*), *H. grouvellei* (Grouvelle) (*Cylloepus*), *H. horni* (Hinton) (*Cylloepus*), *H. indistinctus* (Hinton) (*Cylloepus*), *H. plaumanni* (Hinton) (*Cylloepus*), *H. subsulcatus* (Grouvelle) (*Cylloepus*), and *H. sulcatus* (Grouvelle) (*Cylloepus*).

On external characters this genus can be separated from *Cylloepus* only by having a complete transverse belt of tomentum on the hypomera. The internal anatomy, however, is not at all close to that of *Cylloepus*, differing as follows: (1) the anterior margin of the mid-gut has six instead of eight caeca; (2) the hind gut has only four instead of six Malpighian tubules; (3) the lateral accessory glands of the male are not divided into lobes; (4) each ovary has seven instead of about 18 egg tubes; and (5) the spermathecal duct opens into the apex instead of the base of the bursa copulatrix.

The species are confined to the Americas where they are found from the southern United States to south Brazil. They also occur in the West Indies.

The specific characters of most importance in separating the species are similar to those listed for *Cylloepus*. The following secondary sexual characters have been observed in the species before me.

- (1) Female with a broad depression on the apex of the fifth abdominal sternite (*abdominalis*).
- (2) Male with a long and acute tooth on the mesal margin of the hind coxa (sp. n., not yet described, BRAZIL).
- (3) Male with a row of close, stout, and short teeth on inner side of middle tibiae (*abditus*).

A KEY TO THE MEXICAN SPECIES OF *Hexacylloepus*.

1. Abdomen with an oval depression on the apex of the last sternite.

MEXICO	<i>H. apicalis</i> , sp. n.
Abdomen without a depression on the apex of the last sternite	2.
2. Median longitudinal impression of pronotum not present on basal fourth, or if present it is here very narrow and shallow so that it is scarcely noticeable. TEXAS *H. ferruginea* (Horn) (1870).

Median longitudinal impression of pronotum deep and broad on basal fourth	3.
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3. Male genitalia with the median lobe spatulate. MEXICO *H. scabrosus*, sp. n.

Male genitalia with the median lobe evenly narrowed to the apex; with a row of short and stout spines on ventral side of middle tibia	4
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4. Male genitalia with the median lobe not twice as long as parameres.

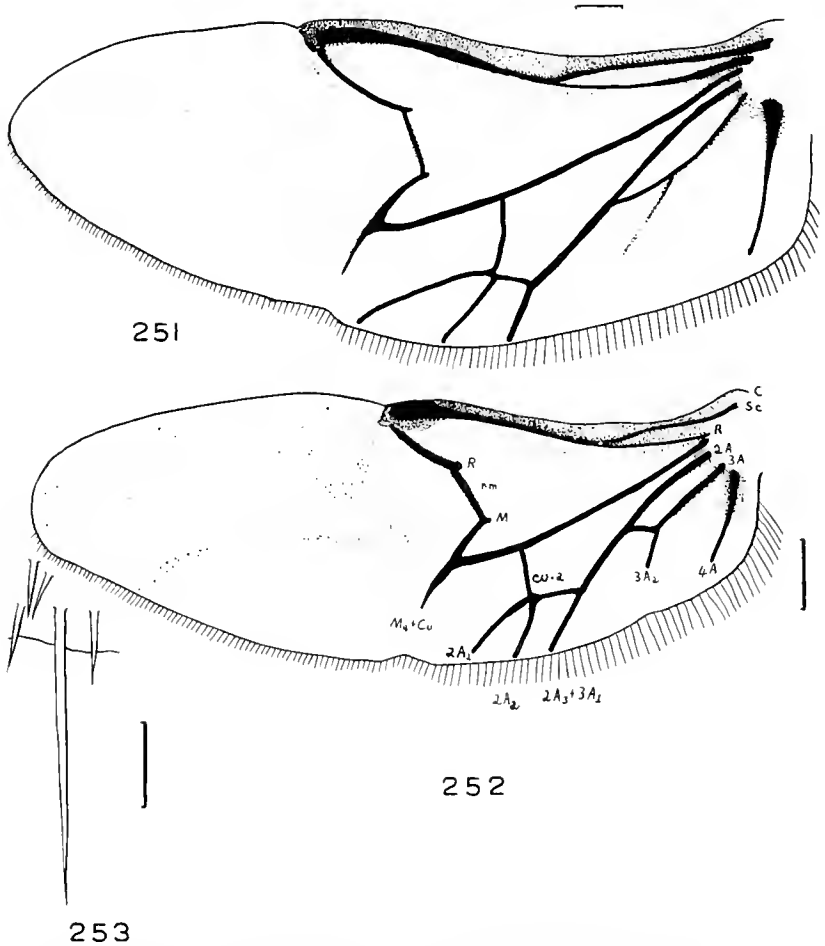
MEXICO	<i>H. abditus</i> (Hinton) (1937).
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Males without a row of short and stout spines on ventral side of middle tibia. Male genitalia with the median lobe more than twice as long as parameres. MEXICO *H. horni* (Hinton) (1937).
H. ferruginea (text-fig. 259) is included in this key, as it is already known from localities very near to the Mexican border and will undoubtedly be found in Mexico later on.

Hexacylloepus apicalis, sp. n.

(Text-figs. 252, 254-258.)

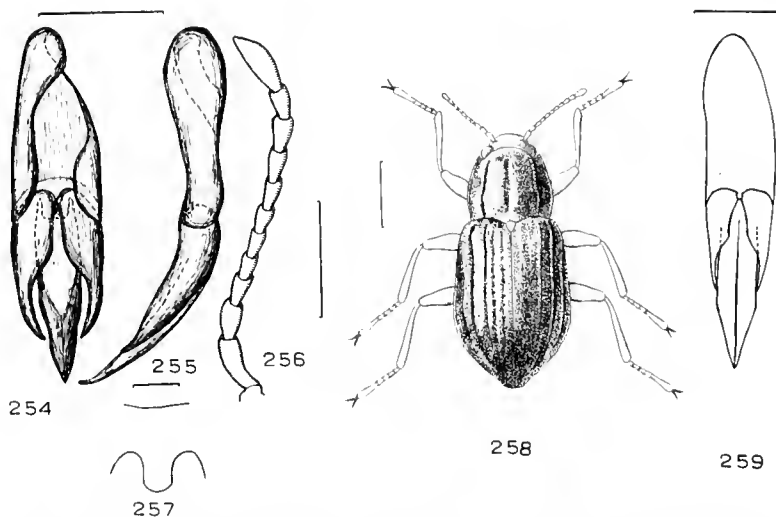
Male: Length, 1.8 mm.-1.95 mm.; breadth, 0.92 mm. Clothed with fine short (about 0.025 mm. long), recumbent, testaceous hairs which arise mostly at intervals equal to slightly less than their lengths: antennae similarly clothed



TEXT-FIGS. 251-253.—(251) Hind wing of *Cylloepus puncticollis* (Hinton). (252) Hind wing of *Hexacylloepus apicalis* Hinton. Venation after Forbes. (253) Microtrichia of apex near inner margin of wing of *C. puncticollis*.

but with the hairs sparser, slightly longer, and less recumbent; apical portion of labrum clothed with equally fine but longer (0.050 mm. or more) and paler hairs which are more erect, much denser, and usually confined to sides of labrum. Cuticle feebly shining and for the most part finely alutaceous; piceous to rufo-piceous; antennae, mouth-parts and legs somewhat rufo-testaceous; tomentum cinereous with golden reflections. *Head* with a feeble, broad, slightly oblique impression on each side near anterior half of eyes extending to a line drawn across

head from anterior margin of antennal cavities. Antennae as figured (text-fig. 256). Clypeus with the fronto-clypeal suture well impressed and transverse; anterior margin broadly and very feebly arcuately emarginate, with the angle on each side obtuse and bluntly rounded; sides feebly arcuate. Labrum with the anterior margin broadly and feebly rounded. Surface set with round to feebly oblong and apparently flat-topped granules, which are about as coarse or slightly coarser than facets of eyes and are mostly separated by less than a third to once their diameters; granules on clypeus finer; labrum without granules and with the very fine punctures separated by once to twice their diameters. *Pronotum* at broadest point which is near basal half broader than long (0.75 mm. : 0.62 mm.) and base broader than apex (0.65 mm. : 0.48 mm.). Apical margin as seen from above strongly arcuate at middle and deeply sinuate on each side before apical



TEXT-FIGS. 254-258.—*Hexacylloepus apicalis* Hinton. (254) Dorsal view of male genitalia. (255) Left lateral view of same. (256) Antenna. (257) Prosteronum. (258) Adult to show general appearance.

TEXT-FIG. 259.—*Hexacylloepus ferruginea* (Horn). Dorsal view of male genitalia

angle behind eye; apical angles acute, strongly produced forwards and slightly inwards; sides moderately arcuate, slightly more strongly so at basal half and feebly sinuate before basal angles; lateral margins finely and rather regularly crenate, this crenation being due to granules placed on sides; basal angles acute, feebly produced outwards, inconspicuous; base trisinate, broadly and moderately strongly so on each side and shortly and very shallowly so in front of scutellum. *Pronotum* with the sublateral carina prominent, slightly converging towards apex, moderately strongly sinuate at basal half, and becoming obsolete at apical seventh; median longitudinal impression extending from near base to very near apex where it becomes obsolete, and broadest from basal fourth to apical half where it is slightly broader than scutellum. Surface apparently microscopically, confluent granulate throughout; also set with much larger granules as follows: sides between lateral margins and sublateral carinae with the granules about as fine as those of head, usually round and separated mostly by two to three times their diameters; granules on outer side of carinae slightly coarser, often more

oblong, and separated by about once their lengths; sides of disk near sublateral carinae granulate as area near lateral margins; area on each side of median impression with the granules slightly coarser and seldom separated by more than once their diameters; bottom of median impression without the coarser granules. Base of pronotum without oblique impressions; disk near situation of sublateral carinae with a very shallow, very broad, and indefinitely bounded impression. *Elytra* slightly more than twice as long as pronotum (1.40 mm. : 0.62 mm.) and feebly broadening posteriorly to broadest point which is at apical third and here broader than base of pronotum (0.92 mm. : 0.65 mm.). Apices feebly produced, conjointly broadly and feebly rounded. Lateral margins finely and regularly crenate, the crenation being due to fine lateral granules. Surface striate with the striae becoming finer towards apex and obsolete at apical fifth; discal striae punctures round to feebly subquadrate, moderately deep, about a half to a third as broad as intervals, and separated mostly by two to three times their diameters; these striae punctures become finer towards apex and are nearly obsolete at apex. Discal intervals feebly convex and subequal in breadth, at base all except sutural more strongly convex; surface of intervals without the microscopic granules of pronotum but with coarser granules similar to coarse ones of pronotum and generally slightly sparser; sublateral carinae similarly but more densely granulate. *Scutellum* flat, subovate, broader than sutural interval (0.10 mm. : 0.06 mm.), longer than broad (0.11 mm. : 0.10 mm.), feebly and broadly rounded basally, and slightly narrowed at apex; surface granulate similarly to adjacent portions of elytra. *Prosternum* with the process as figured (text-fig. 257); middle area of prosternum moderately coarsely and very densely granulate and subrugose; sides more finely, more sparsely, and less rugosely granulate. *Mesosternum* strongly depressed and with a large and deep median pit; surface more finely sculptured than surface of prosternum. *Metasternum* moderately depressed posteriorly, with a fine median longitudinal impression which is traceable nearly to anterior margin, sides with the granules finer and separated by two to three times their diameters. First abdominal sternite with the middle basal portion strongly depressed and the surface of the depression slightly less coarsely and rugosely granulate than metasternum; carinae of first sternite scarcely developed, very indistinct. Surface of sides of first sternite and all of other sternites with granules which are slightly finer than those of pronotum and usually separated by two to three times their lengths. Apex of last sternite with a large (about a third as long as segment), oval, moderately deep impression which is free of granules and somewhat polished. *Genitalia* as figured (text-figs. 254, 255).

Female: Externally similar to male.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Estado de Morelos, Cuernavaca, vi. 1934 (*H. E. Hinton*).

Paratypes: 176, collected at the same time as the type; and 1, MEXICO: Dist. de Temascaltepec, Tejupilco, alt. about 4000 ft., vii. 1934 (*H. E. Hinton*).

Variations: The series before me is very uniform in size and structure, but there are slight differences in the density of the granules on the various sclerites, and the apical pit on the last abdominal sternite is subject to a slight variation in extent and depth.

Comparative notes: Both males and females of this species may be separated from all other species of the subgenus except *H. abdominalis* (Hinton) by the pit on the apex of the last abdominal sternite. The males of *H. abdominalis* have no pit on the apex of the abdomen, and the females may be distinguished

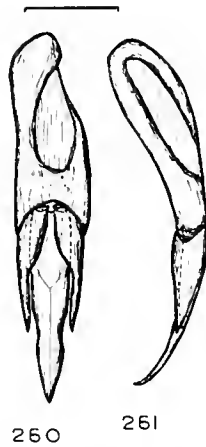
from both males and females of *apicalis* as follows: (1) the median longitudinal impression of the pronotum is not present on basal fourth in *abdominalis*, while on this part of the pronotum it is very distinct in *apicalis*; and (2) the sublateral carinae of the elytra are much less prominent in *abdominalis* than they are in *apicalis*. These two species are so widely separated geographically, one being from southern Brazil and the other from central Mexico, that there is little chance of their being confused in collections.

Hexacylloepus scabrosus, sp. n.

(Text-figs. 260-261.)

Male: Length, 2.0 mm.; breadth, 0.95 mm. Clothed with fine, short (about 0.025 mm. long) recumbent, testaceous hairs which arise mostly at intervals equal to slightly less than their lengths; antennae similarly clothed but with the hairs much sparser (the vestiture of the antennae cannot be more accurately described, as all specimens before me are badly rubbed); apical portion of labrum clothed with equally fine but longer (0.050 mm. or more) and paler hairs which are more erect, much denser, and mostly confined to sides of labrum. Cuticle for the most part finely alutaceous and shining; piceous to rufo-piceous; antennae, mouth-parts, and legs paler rufo-piceous. Tomentum cinereous with golden reflections. *Head* with a feeble, broad, slightly oblique impression on each side near anterior half of eyes extending to slightly behind an imaginary line drawn across head from anterior margin of antennal cavities. Clypeus with the fronto-clypeal suture nearly straight and well impressed; anterior margin very broadly and very feebly arcuately emarginate; angle on each side obtusely and bluntly rounded; sides feebly arcuate. Labrum with the anterior margin broadly rounded in front, with the angle on each side broadly rounded. Surface set with round to feebly oblong granules which are apparently flat-topped, as coarse as facets of eyes, and separated mostly by less than a third to once their lengths; granules on clypeus slightly finer; labrum without granules and punctate with very fine, microscopic punctures which are separated mostly by once to twice their diameters. *Pronotum* at broadest point near basal half broader than long (0.82 mm. : 0.70 mm.) and base broader than apex. Apical margin as seen from above moderately arcuate at middle and broadly and deeply sinuate on each side behind eye before apical angles; apical angles acute, strongly produced forwards and slightly inwards; sides moderately arcuate, slightly more strongly so at basal half and scarcely noticeably sinuate before basal angles; lateral margins finely and rather regularly crenate, this crenation being due to granules placed on sides; basal angles feebly acute, nearly rectangular, and feebly produced backwards; base trisinate, broadly and moderately strongly sinuate on each side and shortly and very shallowly sinuate in front of scutellum. Pronotum with the sublateral carina prominent, slightly converging towards apex, moderately sinuate at basal half, and becoming obsolete at apical seventh; median longitudinal impression extending from near base to near apex where it becomes obsolete, broadest from basal fourth to apical third where it is slightly broader than scutellum; base of pronotum without oblique impressions; disk near sinuation of sublateral carina with a very shallow and broad indefinitely bounded impression. Surface of pronotum microscopically alutaceous so that it appears to be minutely and confluent granulate throughout; also set with granules as follows: side between lateral margins and sublateral carina about as fine as those of head, usually round, and separated mostly by two to three times their diameters;

granules on outer sides of sublateral carina slightly coarser and usually separated by about once their diameters; sides of disk near sublateral carina granulate similarly to but more densely than area near lateral margin; area on each side of median impression with granules about as coarse as those on sides of sublateral carina and about equally dense. *Elytra* twice as long as pronotum (1.4 mm. : 0.70 mm.) and very feebly broadening posteriorly to broadest point which is at apical third (here appearing scarcely broader than across humeri) which is broader than base of pronotum (0.95 mm. : 0.71 mm.). Apices moderately produced, conjointly broadly and feebly rounded, subtruncate. Lateral margins finely and regularly crenate, the crenation being due to lateral granules. Surface striate with the striae becoming finer towards apex and nearly obsolete beyond apical fourth; discal strial punctures round to feebly subquadrate, deep, about a third to a half as broad as intervals, and separated longitudinally by two to three times



TEXT-FIGS. 260, 261.—*Hexacylloepus scabrosus* Hinton. (260) Dorsal view of male genitalia. (261) Left lateral view of same.

their diameters though occasionally they are more closely placed; these punctures become finer towards apex and are nearly obsolete at apex. Discal intervals feebly convex and subequal in breadth, at base all except sutural more strongly convex; surface of intervals with the alutaceous microsculpture not similar to that of pronotum; also set with granules which are slightly coarser and sparser but otherwise similar to those of pronotal disk; sublateral carinae slightly more densely granulate but with the granules here as elsewhere on elytra mostly round. *Scutellum* flat, subovate, broader than sutural interval (0.10 mm. : 0.06 mm.), longer than broad (0.11 mm. : 0.10 mm.), feebly and broadly rounded basally, and slightly narrowed at apex; surface granulate similarly to adjacent portion of elytra. *Prosternum* with the margins of the process somewhat raised so that the median area appears slightly concave at middle; middle area of prosternum moderately coarsely and very densely rugosely granulate; sides more finely, more sparsely, and also less rugosely granulate. *Mesosternum* strongly depressed and with the median pit deep and large; surface slightly more finely sculptured than middle area of prosternum. *Metasternum* moderately feebly depressed posteriorly; with a fine median longitudinal impression which

is traceable nearly to anterior margin; disk sculptured as middle area of prosternum; sides with the granules slightly finer and separated by two to three times or more than their diameters. First abdominal sternite with the middle basal portion moderately depressed and here with the surface nearly as coarsely and rugosely granulate as that of disk of metasternum; carinae of first sternite not evident; sides of basal sternite and entire surface of other sternites with granules which are slightly finer than discal pronotal ones and are usually separated by two to three times their diameters. *Genitalia* as figured (text-figs. 260, 261).

Female: Externally similar to male.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Estado de Morelos, Cuernavaca, vi. 1934 (*H. E. Hinton*).

Paratypes: 2 ♂♂ and 1 ♀ with same data as type.

Variations: In the small series before me no variations have been observed.

Comparative notes: This species is nearly identical in external characters to *H. apicalis*, as may be seen from a comparison of the two descriptions. The only external difference which can be relied on to distinguish the two is the apical abdominal pit of both sexes of *apicalis*. The four specimens before me have the prosternal process more strongly concave along the middle and the margins of the process more thickly and strongly raised than is the case in *apicalis*, but these slight differences may be bridged when a longer series is studied.

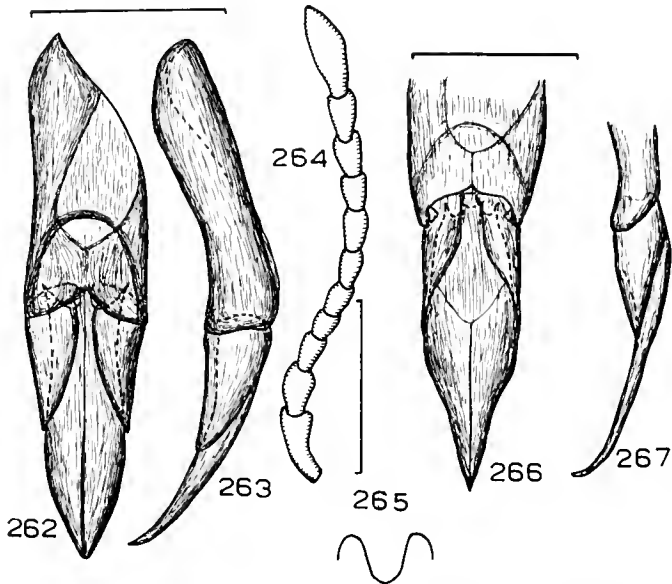
Hexacylloepus abditus (Hinton).

(Text-figs. 262-265.)

1937. *Cylloepus abditus* Hinton, *Arb. morph. taxon. Ent. Berlin-Dahlem*, 4 (2): 106, figs. 13-16.

Male: Length, 1.7 mm.; breadth, 0.77 mm. Clothed with fine, short (about 0.025 mm. long), recumbent, testaceous hairs which arise mostly at intervals equal to slightly less than their own lengths; antennae similarly clothed but with the hairs sparser and less recumbent; apical portion of labrum clothed with equally fine but longer (about 0.050 mm., but occasionally about 0.062 mm.) and paler testaceous hairs which are more erect, much denser, and usually confined to sides of apical portion. Cuticle for the most part finely alutaceous and shining; piceous to rufo-piceous; antennae, mouth-parts and legs paler. Tomentum cinereous with golden reflections. *Head* with a feeble, broad, slightly oblique impression extending on each side near anterior half of eyes to a point opposite anterior margins of antennal cavities. Clypeus with the fronto-clypeal suture nearly straight and well impressed; anterior margin broadly and feebly arcuately emarginate, with the angle on each side broadly rounded and the sides feebly arcuate. Labrum broadly and feebly rounded in front, with the angle on each side broadly rounded. Surface set with round to feebly oblong, flat-topped granules which are nearly as coarse as facets of eyes and are usually separated by twice their diameters though often by much less; granules on clypeus finer and denser; labrum without granules but punctate with fine, microscopic punctures which are mostly separated by once to twice their diameters. *Pronotum* at broadest point which is near basal half broader than long (0.062 mm. : 0.52 mm.) and base broader than apex (0.57 mm. : 0.42 mm.). Apical margin as seen from above moderately strongly arcuate at middle and deeply sinuate on each side behind eye before apical angle; apical angles moderately acute, moderately strongly produced forwards and slightly inwards;

sides moderately arcuate but slightly more strongly so at basal half, scarcely noticeably sinuate just before basal angles. Lateral margins feebly and rather regularly crenate, this crenation being due to granules placed on sides; basal angles acute and very feebly produced backwards; base trisinate, broadly and deeply so on each side and shortly and more shallowly sinuate in front of scutellum. *Pronotum* with the sublateral carina prominent, slightly converging towards apex, moderately strongly sinuate on basal half, and becoming obsolete at about apical fourth; median longitudinal impression extending from near base to near apex where it becomes obsolete and broadest from basal fourth to apical third, where it is slightly broader than scutellum; base of pronotum without oblique



TEXT-FIGS. 262-267.—(262) Dorsal view of male genitalia of *Hexacylloepus abditus* (Hinton). (263) Left lateral view of same. (264) Antenna. (265) Prosternum. (266) Dorsal view of male genitalia of *Hexacylloepus horni* (Hinton). (267) Left lateral view of same.

impressions; disk near situation of sublateral carina with a shallow, broad, indefinitely bounded impression. Surface microscopically alutaceous in such a manner as to appear confluent granulate throughout; also set with distinct granules as follows: Sides between sublateral carinae and lateral margins set with granules about as fine as those of head, usually round, and separated mostly by two to three times their diameters; granules on outer sides of sublateral carinae slightly coarser and usually separated by once to twice their diameters; sides of disk near sublateral carina granulate as area near lateral margin; area near median impression with the granules slightly coarser and denser than those of sides of disk. *Elytra* more than twice as long as prothorax (1.18 mm. : 0.52 mm.) and feebly broadening posteriorly to broadest point, which is at apical third and is broader than base of pronotum (0.77 mm. : 0.57 mm.). Lateral margins finely and regularly crenate, the crenation being due to fine lateral granules. Surface with the striae becoming finer towards apex and all except sutural obsolete

beyond apical sixth; discal stria punctures round to feebly subquadrate, moderately deep, about a third to a half as broad as intervals, and separated longitudinally usually by two to three times their diameters; these stria punctures become finer towards apex and at apical fifth they are shallow, sparse, and only about a third to a sixth as coarse as discal intervals; discal intervals subequal in breadth and feebly convex, at base with the fourth interval more strongly convex (there is much variation in this respect and sometimes none are convex); surface of intervals at base alutaceous somewhat as on pronotum but elsewhere on elytra the microsculpture does not appear granulate; granules mostly similar in size and density to those of pronotum; granules on carinate intervals slightly larger and denser but also round to feebly oblong as elsewhere on elytra. Apices moderately produced, conjointly broadly and very feebly rounded. *Scutellum* flat, subovate, broader than sutural interval (0.09 mm. : 0.06 mm.), longer than broad (0.10 mm. : 0.09 mm.), feebly and broadly rounded basally, and slightly narrowed to apex; surface granulate similarly to adjacent portion of elytra. *Prosternum* with the process as figured (text-fig. 265) and feebly concave with the lateral margins somewhat raised; middle area of prosternum with the granules as coarse as those of elytra but with the surface also densely rugose, at sides much less rugose and with the granules finer and sparser. Mesosternum strongly depressed and with a median pit at the bottom of the depressed area. Metasternum moderately strongly depressed posteriorly; with a fine, median longitudinal line which is traceable to nearly anterior margin; disk sculptured as middle area of prosternum but with the granules usually slightly larger; sides less rugose and with the granules sparser. Middle portion of first abdominal sternite moderately strongly depressed and with the surface of this depression sculptured as sides of metasternum; first sternite without obvious carinae; sides of first sternite and all of surface of other sternites with granules which are about as coarse as discal pronotal ones and are usually separated by less than to twice their lengths. Middle tibiae with a row of small, short, stout, and close teeth on ventral side. *Genitalia* as figured.

Female: Externally similar to male but without the row of spines on the ventral side of middle tibiae.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Tejupilco, alt. about 4000 ft., vi. 1934 (*H. E. Hinton*).

Specimens examined: 56, with same data as type but collected on 16. vi. 1933 (*H. E. Hinton, R. L. Usinger*).

Variations: No variations worthy of mention have been noted in the series available.

Comparative notes: The males of this species may be distinguished from those of *H. scabrosus* by the row of fine teeth on the middle tibiae and the differently formed male genitalia, but the females, as far as I know, are inseparable. *H. abditus* and *H. scabrosus* have not yet been found to overlap geographically.

***Hexacylloepus horni* (Hinton).**

(Text-figs. 266, 267.)

1937. *Cylloepus horni* Hinton, *Art. morph. taxon. Ent. Berlin-Dahlem*, 4 (2) : 100, figs. 17, 18.

Male: Length, 1.7 mm.; breadth, 0.80 mm. I have written a description of nearly 1000 words for this species, but a comparison of this description with

that of *abditus* shows that the two are identical in nearly every respect, so that to give the description of *horni* here would be a waste of space. For an understanding of the external characters of this species the student is referred to the description of *abditus*. The males of the new species differ from those of *abditus* by not having a row of short teeth on the ventral side of the middle tibiae and by the structures of the male genitalia (*cf.* figs.). Both males and females of the two species may be readily separated by the differences in the length of the legs. The following table is drawn up from a male specimen of each equal in length and very nearly equal in breadth :

	Front femora.	Front. tibiae.	Middle femora	Middle tibiae.	Hind femora	Hind tibiae.
<i>abditus</i>	0·375 mm.	0·425 mm.	0·40 mm.	0·437 mm.	0·437 mm.	0·500 mm.
<i>horni</i>	0·425 mm.	0·487 mm.	0·512 mm.	0·587 mm.	0·537 mm.	0·650 mm.

Female : Externally similar to male.

Type : ♂ in the British Museum (Nat. Hist.). MEXICO : Dist. de Temascaltepec, Tejupilco, alt. 3500-4000 ft., vii. 1934 (*H. E. Hinton*).

Specimens examined : 2, MEXICO : Sierra de Durango, 1922 (*C. Schaufuss*).

Comparative notes : Apart from the characters of the male genitalia, this species is inseparable from *H. scabrosus*. The latter has the length of the legs intermediate between *abditus* and *horni*.

CYLLOEPUS Erichson.

1847. *Cylloepus* Erichson, *Naturges. Ins. Deutschl.*, 3 : 521.

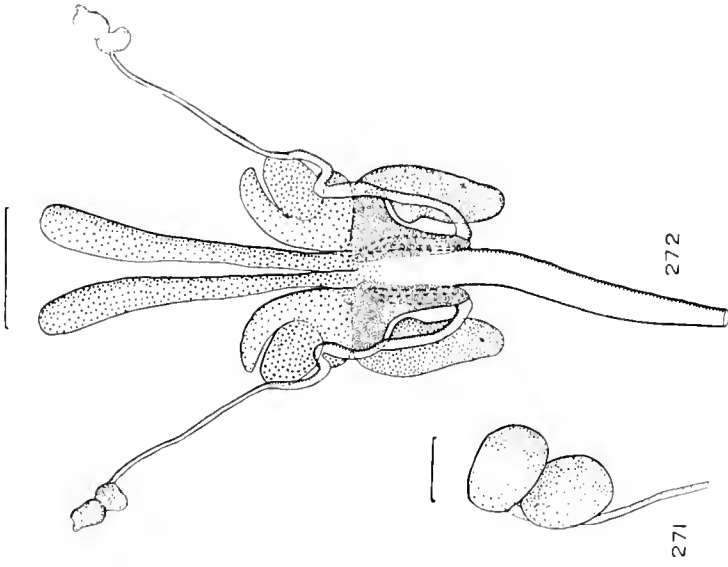
1854. *Cylloepus* Lacordaire, *Gen. Col.*, 2 : 510.

1882. *Cylloepus* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2) : 120.

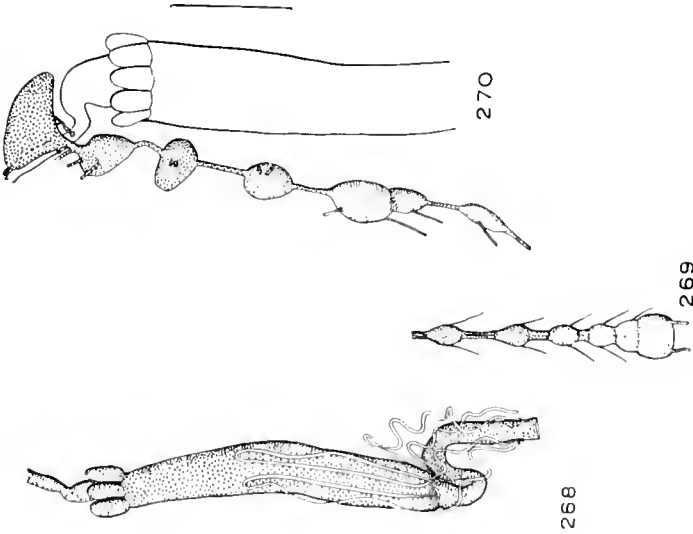
This genus was erected by Erichson (1847) to contain *Limnius araneolus* Müller (1806) of Peru. Erichson had before him a male of *C. araneolus*, and a good proportion of his brief generic diagnosis is devoted to describing the apical segment of the labial palpus which in this, as well as in the males of many other species of *Cylloepus*, is very much broadened at the apex.

The generic limits of this genus have been little understood. Grouvelle correctly assigned five species to this genus and described many others as species of *Elmis* Latreille and one as an *Elsianus* Sharp. Sharp (1882) in his work on the Central American Elmidae correctly referred one species to *Cylloepus* and placed a number of others in *Elmis* Latreille. Darlington (1927) described a number of West Indian forms under the name of *Elmis*. These species were later correctly placed in *Cylloepus* by Musgrave (1935), but were again assigned to *Elmis* by Darlington (1936). A redescription of *Cylloepus (sensu stricto)* follows :

Body elongate, subparallel. Dorsal surface clothed with short, sparse or dense, usually recumbent hairs. Tomentum confined to the following areas : (1) genae ; (2) epipleurae ; (3) sides of prosternum, mesosternum, metasternum, and abdominal sternites, but in a few species nearly the entire ventral surface may be clothed with scale-like or hairy tomentum ; and (4) all of legs except tarsi, though in most species the scale-like tomentum is sparse or absent on the tibiae. The hypomera are nearly always without a trace of tomentum, and only rarely is there a very narrow belt of tomentum along the anterior portion of the sterno-pleural suture. *Head* when seen from below capable of being retracted, so that none of the mouth-parts is visible. Antennae 11-segmented. Mandible

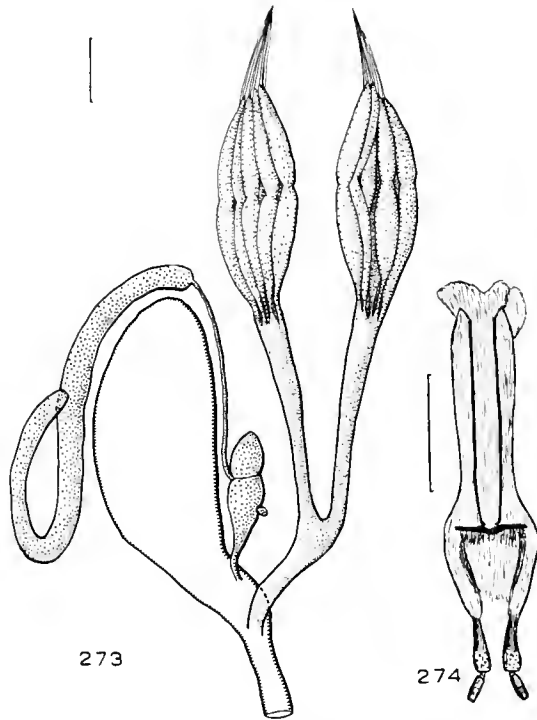


TEXT-FIGS. 271, 272.—*Cylloepus consobrinus* Grouvelle. (271) Enlarged view of sperm tubes of sexually mature specimen. (272) Male reproductive system.



TEXT-FIGS. 268-270.—*Cylloepus consobrinus* Grouvelle. (268) Alimentary canal. (269) Posterior portion of central nervous system. (270) Lateral view of anterior portion of central nervous system.

with three acute apical teeth; prostheca large, entirely membranous and with the apex spinose or hairy. Maxillary palp 4-segmented and stipes with a well-developed palpifer; galea and lacinia separate and apex of each densely spinose. Labial palp 3-segmented and prementum with a palpiger. Mentum transverse and about as broad and long as submentum. Gula anteriorly nearly as broad as submentum and slightly narrowed posteriorly. *Pronotum* with a sublateral longitudinal carina on each side generally extending from base to apex, though in a few species this carina does not quite reach either base or apex; with a median longitudinal impression on the disk; with a shallow impression which



TEXT-FIGS. 273, 274.—(273) Female reproductive system of *Cylloepus consobrinus* Grouvelle. (274) Female genitalia of *Cylloepus puncticollis* (Hinton).

extends obliquely outwards from base on each side of scutellum to sublateral carina which it bisects at about basal third. *Elytra* striate and punctate; without accessory striae; and with two or very rarely (*sculptipennis* Sharp) one sublateral carina. Hind wing (text-fig. 251) without a radial cross vein and without an anal cell; with the first anal absent; second anal with the first and second branches present; third anal with a second branch; cubito-anal cross vein complete and joining cubitus to second anal. *Prosternum* (text-fig. 278) very long in front of anterior coxae; prosternal process long and posterior margin usually broadly rounded. Mesosternum with a deep and moderately narrow groove for the reception of the prosternal process. Metasternum with a median longitudinal impressed line. *Legs* with the visible portion of the coxae rounded and trochantin completely concealed by the hypomera. Claws without teeth. *Alimentary canal* (text-fig. 268) with eight caeca on the anterior margin of the

mid-gut. Hind gut with six Malpighian tubules which end near the rectum freely or imbedded in fatty tissue. *Male reproductive system* (text-fig. 272) with the lateral accessory glands divided into several lobes. Each testis of two sperm tubes. *Female reproductive system* (text-fig. 273) with about 18 egg tubes to each ovary. Spermathecal duct opening at base of bursa copulatrix. *Central nervous system* with three discrete thoracic ganglia. First abdominal ganglion partly fused to third thoracic; two to five free; and six to eight partly fused together, though the limits of each are distinguishable.

GENOTYPE: *Limnius araneolus* Müller (1806).

The internal anatomy of three species has been examined and found to agree in essential details. *C. consobrinus* Grouvelle of Bolivia is figured.

In external appearance this genus is very close to *Stenelmis* Dufour from which it may be distinguished as follows: (1) There is no accessory stria on each elytron at base between the first and second striae; (2) the inner apex of each tibia is densely pubescent, while in *Stenelmis* this part of the tibia is without a fringe of hairs; and (3) there are only two instead of three sperm tubes to each testis.

This genus is confined to the Americas, where it occurs from Southern United States to Chili and is well represented in the West Indies.

The specific characters of greatest importance in separating the species of *Cylloepus* seem to be the following:

- (1) General proportions, length and breadth.
- (2) Size and density of the punctures of all the sclerites and the type of microsculpture between the punctures.
- (3) Extent and depth of the impressions on the head.
- (4) Condition of fronto-elypeal suture.
- (5) Anterior margin of clypeus, whether truncate, rounded, or emarginate, and shape of angle on each side.
- (6) Condition of anterior margin of labrum.
- (7) Colour. In many species the antenna is bicoloured.
- (8) Outline of pronotum and the extent and depth of the various impressions on its surface. Shape and extent of the sublateral carinae.
- (9) Shape of elytral apices.
- (10) Condition of lateral margin of elytra, whether crenate or smooth.
- (11) Number of sublateral elytral carinae and number of carinate or convex intervals.
- (12) Depth and extent of striae and stria punctures.
- (13) Shape of scutellum and if convex or flat.
- (14) Shape of prosternum and prosternal process.
- (15) Impressions on disk of metasternum.
- (16) Condition of carinae on first abdominal sternite.
- (17) Extent and depth of depression on middle of first abdominal sternite.
- (18) If a depression is present on the second abdominal sternite its depth and extent should be described carefully.
- (19) Depth and extent of depression sometimes present on apex of fifth abdominal sternite.
- (20) Secondary sexual characters. These are, as in most genera of the family, among the most highly specific characters.
- (21) Structure of the male genitalia. The structure of this organ is more important than that of any other in associating specimens with specific descriptions. Unless a species is exceptionally distinct, it should not be described without illustrating the genitalia.

Secondary sexual characters are abundant in *Cylloepus*, and the following have been observed in the species before me.

- (1) Male with the apex of the last segment of the labial palp very much broadened (*araneolus*, *barberi*, *consobrinus*, *pulpalis*, *puncticollis*, *optatus*).
- (2) Male with the mesosternum on each side of the middle with a strong gibbosity, at the apex of which is a group of erect hairs, while in the female this portion is only slightly convex and without hairs (*spinipes*).
- (3) Disk of metasternum not as strongly nor as broadly depressed in the females as in the males (most species).
- (4) Female with an acute tubercle on each side of metasternum in front of mesal margin of hind coxa (*ventralis*).
- (5) First abdominal sternite at middle more strongly depressed in male than in female (most species).
- (6) Male with the carinae of first abdominal sternite more convex than those of female and curving inwards while in the female they are straight (*sculptipennis*).
- (7) Male with the carinae of the first abdominal sternite relatively longer than those of the female (*sculptipennis*).
- (8) Second abdominal sternite depressed in male and convex or flat in female (*sculptipennis*, *sexualis*).
- (9) Male without a tooth-like tubercle on mesal margin of hind coxa (*spinipes*).
- (10) Male with three large teeth on ventral apical fourth of front tibia (*spinipes*).
- (11) Male with a carina-like swelling on inner side of front tibia near apex (*sexualis*).
- (12) Male with a row of close, stout, and short teeth on inner side of middle tibiae (*barberi*, *optatus*, *sexualis*).
- (13) Male with a large and flat tooth on inner half of hind tibia (*spinipes*).
- (14) Male with the hind tibia at middle of its length more swollen and curved than that of the female (*optatus*, *sexualis*).
- (15) Male with numerous pale and erect hairs on the ventral surface of the first four segments of the front tarsi (*optatus*).

A KEY TO THE MEXICAN SPECIES OF *Cylloepus*.

1. Elytra on each side with only one distinct sublateral carina. GUATEMALA, MEXICO *C. sculptipennis* (Sharp) (1882).
Elytra with two distinct sublateral carina on each side 2.
2. Base of pronotum in front of scutellum with an impression which is about as broad as scutellum and half as deep. Elytra with the basal discal intervals flat and with the surface of the intervals not granulate. GUATEMALA, COSTA RICA *C. barberi* Hinton (1934).
Base of pronotum in front of scutellum without an impression; or if one is present it is very shallow and scarcely noticeable. Elytra with the basal discal intervals always granulate if flat 3.
3. Elytra with none of the basal discal intervals strongly convex. MEXICO *C. blairi* Hinton (1936).
Elytra with one or more of the basal discal intervals strongly convex 4.
4. Elytra with the fourth discal interval strongly convex at base 5.
Elytra with the fourth discal interval flat 7.

- 5. Elytra with the third discal interval flat. GUATEMALA, MEXICO
C. heterocerus (Sharp) (1882).
 Elytra with the third discal interval near base nearly or more strongly
 convex than fourth 6.
- 6. Apical segments of antennae black, or if not black at least distinctly
 darker than the two basal segments. Pronotum with the disk punctate
 on either side of median longitudinal impression. Males with the last
 segment of the labial palp very much broadened at apex; metasternal
 disk only feebly depressed; abdomen with the first sternite depressed
 at middle from base to apex; front and hind tibiae without spines.
 MEXICO *C. puncticollis* (Hinton) (1934).
 Antennae unicolorous. Pronotum with the disk granulate on either side
 of the median longitudinal impression. Males with the last segment
 of the labial palpi not strongly broadened at apex; metasternal disk
 strongly depressed; abdomen with the first sternite depressed at
 middle only on basal three-fourths; front tibiae on inner apical fourth
 with three spines, and hind tibiae on inner side at basal two-fifths
 with a large flat spine. MEXICO *C. spinipes* Hinton (1934).
- 7. Elytra with the fifth interval near base strongly convex for a short
 distance. Males with a short and prominent carina-like swelling on
 inner apical fourth of front tibiae. MEXICO *C. sexualis* Hinton (1937).
 Elytra with the fifth interval near base at most feebly convex. Males
 without a carina on inner apical side of front tibia 8.
- 8. Antennae with the two basal segments pale rufo-piceous and the others
 piceous to black. Males with the four basal segments of the front
 tarsi not densely clothed with erect hairs on the ventral side; abdomen
 with the middle of the second sternite at most feebly depressed on
 extreme base. MEXICO *C. proximus* Hinton (1937).
 Antennae unicolorous. Males with the four basal segments of the front
 tarsi clothed on ventral side with moderately long, erect, and pale
 hairs; abdomen with the middle of the second sternite moderately
 strongly depressed on basal two-thirds. PANAMA, GUATEMALA,
 COSTA RICA *C. optatus* Sharp (1882).

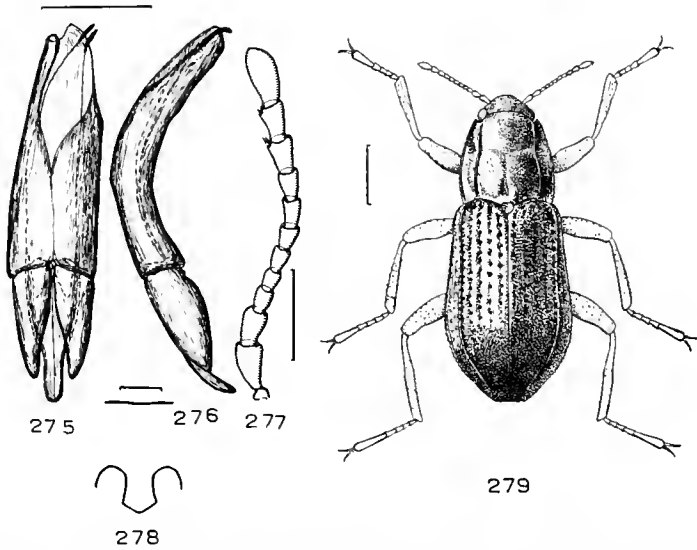
Two species, *C. barberi* Hinton and *C. optatus* Sharp, which are widely distributed in Central America are included in the key given above, as they may be found in Mexico when this country is more thoroughly explored.

***Cylloepus sculptipennis* (Sharp).**
 (Text-figs. 275-276.)

1882. *Elmus sculptipennis* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2): 135.

Male: Length, 2.8 mm.; breadth, 1.12 mm. Subparallel, moderately convex. Clothed with fine, recumbent, brownish hairs which are about 0.05 mm. long and arise at intervals equal to more than once their lengths; labrum at sides with the hairs much longer and denser and paler. Cuticle shining and rufo-piceous to nearly black; densely and minutely alutaceous on head, pronotum, hypomera, prosternal process, meso- and metasternum, all of first abdominal sternite, and sides of sternites two to five. *Head* without distinct impressions; surface densely and very minutely alutaceous so that under a

magnification of $\times 150$ it appears to be finely granulate; also set with low and irregularly shaped granules which are slightly finer than facets of eyes and are usually separated by less than to twice their diameters. Clypeus when viewed from in front with the anterior margin feebly and arcuately emarginate for its entire breadth, with the angle on each side broadly rounded; clypeal suture feeble and arcuate; surface similar to that of head but with only the base and sides alutaceous. Labrum with the anterior margin truncate and the angle on each side feebly rounded; surface with punctures which are not more than half as broad as granules of clypeus and are usually separated by less than to once their diameters. *Pronotum* with the broadest point at basal two-fifths and here broader than long (0.85 mm. : 0.80 mm.) and base broader than apex (0.80 mm. : 0.54 mm.). General shape and form and extent of the various impressions as



TEXT-FIGS. 275-279.—*Cylloepus sculptipennis* (Sharp). (275) Dorsal view of male genitalia. (276) Right lateral view of same. (277) Antenna. (278) Prosternum. (279) Adult to show general appearance.

figured (text-fig. 279). Surface sculptured as head except for area near inner side of sublateral carinae on basal half, extreme base, and sides near lateral margins which are only feebly or not at all alutaceous. *Elytra* more than twice as long as prothorax (1.87 mm. : 0.80 mm.) and feebly broadening posteriorly to broadest point which is near apical third and which is distinctly broader than broadest point across humeri (1.12 mm. : 1.00 mm.). Lateral margins coarsely and densely crenate. Surface coarsely striate, discal striae finer and shallower as they approach apex but never altogether absent; discal strial punctures subquadrate to round, moderately deep, and at middle of disk as broad as intervals to slightly narrower and separated longitudinally by slightly more than to slightly less than their own diameters; towards sides the punctures become coarser and denser and towards apex finer and sparser. Discal intervals flat, the third at base being only very slightly convex. *Elytra* with only one sublateral carina. Surface of intervals with the granules slightly larger, more convex, and more regularly round than those of pronotum and separated usually by one to four

times their diameters; sutural interval on basal two-thirds and first four intervals on apical third with only an occasional granule; surface between granules with punctures similar to those of labrum but separated by one to five times their diameters. *Scutellum* flat, subovate, broader than sutural interval near base (0.12 mm. : 0.05 mm.) and as broad as long; surface sculptured as adjacent elytral intervals. *Prosternum* with the anterior two-thirds (not including process) moderately strongly but not sharply lobed; surface granulate as elytral intervals except for surface of process which is sculptured as head. Hypomera very densely and regularly alutaceous, with only an occasional granule, and without tomentum. Mesosternum sculptured as prosternal process. Metasternum with the posterior third of disk only feebly depressed; with a broad (about 0.03 mm.) and deep median longitudinal impression which extends to apical fourth; surface of disk similarly but distinctly more coarsely sculptured than surface of prosternal process; sides of metasternum with the granules only showing through the tomentum and separated by one to three times their diameters, the surface here strongly resembling that of the legs. Abdomen with the carinae of the first abdominal sternite curving slightly inwards, complete from base to apex, and most prominent at apex; first sternite at middle strongly depressed, this depression very shallowly but nevertheless distinctly encroaching to middle of basal third of second sternite; middle of first sternite on basal two-thirds densely and minutely alutaceous and with deep round punctures which are about 0.02 mm. broad and are contiguous to separated by once their diameters; apical third of first sternite and all of middle up to apical four-fifths of fifth sternite not alutaceous and with the punctures similar to those of first sternite, but becoming progressively finer as apex of abdomen is approached so that on basal fifth of fifth sternite they are only half as coarse. Sides of abdominal sternites granulate as sides of metasternum. *Genitalia* as figured (text-figs. 275, 276).

Female: Externally similar to male except as follows: (1) the carinae of the first abdominal sternite straight and not curved inwards, absent on apical sixth, and least instead of most prominent at apex; and (2) the depression of the middle of the first sternite does not extend on to second sternite.

Type: In the British Museum (Nat. Hist.). GUATEMALA: Rio Naranjo, 450 ft. (*Champion*).

Specimens examined: 8, MEXICO: Estado de Morelos, Cuernavaca, vi. 1934 (*H. E. Hinton*); 2, MEXICO: Dist. de Temascaltepec, alt. 6000-7000 ft., vi. 1934 (*H. E. Hinton*); and 1 with same data as above but at Tejupilco, alt. about 4000 ft., vii. 1934.

Variations: No variations worthy of mention have been noted.

Comparative notes: This is the only species of *Cylloepus* known to-day which has only one sublateral elytral carina, the usual outer one being completely absent. In general appearance it is close to *C. blairi* Hinton. The mouth-parts and wing venation are like those of typical members of the genus.

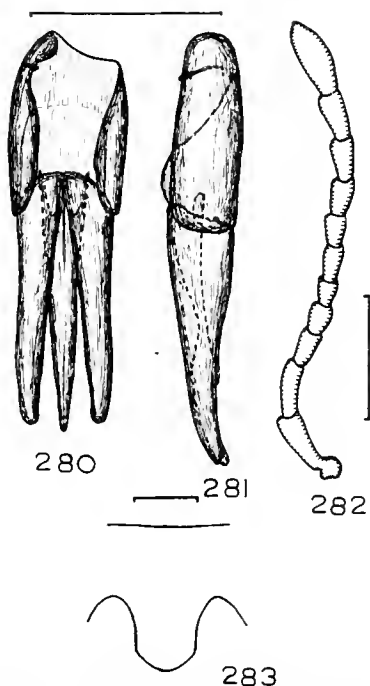
***Cylloepus blairi* Hinton.**

(Text-figs. 280-283.)

1936. *Cylloepus blairi* Hinton, *Ent. mon. Mag.*, 72: 1, figs. 1-4.

Male: Length, 3.0 mm.; breadth, 1.2 mm. Subparallel, moderately convex. Clothed with fine, short (about 0.037 mm. long), recumbent, brownish-testaceous hairs which arise mostly at intervals equal to about their own lengths;

antennae (all specimens before me are badly rubbed) with a few equally fine but more erect hairs at apical angles of segments; apical portion of labrum with equally fine but much longer (often 0.06 mm.) hairs which are apparently confined to the sides; beneath with the hairs generally finer and shorter but otherwise similar. Cuticle moderately shining and for the most part finely alutaceous; piceous to rufo-piceous; tomentum of body cinereous with golden reflections. *Head* on each side near anterior one-half of eyes with a feeble, scarcely noticeable, broad and oblique impression. Antennae as figured (text-fig. 282). Clypeal suture well-marked; anterior margin of clypeus very broadly and very feebly



TEXT-FIGS. 280-283.—*Cylloepus blairi* Hinton. (280) Dorsal view of male genitalia. (281) Right lateral view of same. (282) Antenna. (283) Prosternum.

arcuately emarginate; angle on each side obtusely rounded; sides feebly arcuate. Labrum broadly and feebly rounded in front, nearly truncate; anterior angles broadly rounded. Surface with the alutaceous microsculpture appearing confluent granulate; set with usually round granules which are about as coarse as facets of eyes and are separated mostly by once to twice their diameters; granules on clypeus finer, middle apical margin nearly smooth and with a few fine punctures; labrum without granules, apical half punctate with fine punctures which are separated by once to twice their diameters. *Pronotum* at broadest point near basal half broader than long (0.925 mm. : 0.825 mm.) and base broader than apex (0.90 mm. : 0.60 mm.). Apical margin when seen from above moderately arcuate and deeply sinuate on each side behind eye before apical angle; apical angles acute and moderately strongly produced forwards and slightly inwards; sides moderately arcuate, scarcely noticeably sinuate before basal angles, somewhat regularly, finely crenate; basal angles nearly rectangular, scarcely

produced; base moderately strongly trisinate, broadly so on each side and very shortly so in front of scutellum. *Pronotum* with the sublateral carinae prominent, slightly converging towards apex, feebly sinuate at apical and basal thirds, complete from base to apical margin, and very broad from basal to apical third. Surface sculptured as follows: a very broad and feebly raised portion extends from base in front of scutellum to base of disk; on each side of this raised portion with a feeble, moderately broad, feebly curved, and oblique impression extending to a broad, moderately feeble, indefinite impression near basal sinuation of sublateral carina; median longitudinal impression beginning at base and ending at about apical one-half, throughout very shallow, broadest at basal two-fifths where it is as broad as scutellum. Surface with the alutaceous microsculpture similar to that of head; disk with the granules slightly coarser than facets of eyes but rather low (*i.e.* not strongly convex) and usually separated by two to three times their diameters, though often, especially on apical portion of disk, more sparsely placed; granules on sides slightly denser but otherwise similar; granules on basal portion of sublateral carina slightly more convex and very slightly denser. *Elytra* more than twice as long as prothorax (1.87 mm.: 0.82 mm.) and very feebly broadened posteriorly to broadest point at apical one-third which is broader than base of pronotum (1.22 mm.: 0.90 mm.). Apices moderately produced, conjointly broadly and feebly rounded. Lateral margins moderately strongly and regularly crenate. Discal surface rather coarsely striate basally, with the striae becoming finer towards apex, and only very feebly impressed beyond apical third; discal strial punctures on basal half nearly subquadrate, deep, about as broad as intervals, and usually separated longitudinally by little more than their own diameters, these strial punctures suddenly becoming nearly obsolete beyond apical half but at sides they are continued further towards apex. Discal intervals flat in apical half and (except sutural) feebly convex on basal half and still more strongly convex at base, with the third interval at base very feebly elevated; surface of intervals, especially at base, alutaceous somewhat similarly to pronotum; set with granules which are similar to pronotal ones but are more convex and on disk become much sparser towards apex; carinate lateral intervals with the granules similar but slightly denser. *Scutellum* flat, subovate, broader than sutural interval (0.10 mm.: 0.087 mm.), longer than broad (0.12 mm.: 0.10 mm.), feebly and broadly rounded at base, and slightly narrowed to apex; surface sculptured similarly to adjacent elytral intervals but with the granules slightly sparser. Beneath with the surface alutaceous as pronotum. Prosternal process as figured (text-fig. 283); middle area of prosternum feebly depressed, slightly rugose, and obscurely granulate similarly to apical portion of pronotal disk; sides more evidently granulate; hypomera sculptured similarly to middle area. Mesosternum with the surface sculptured similarly to middle area of prosternum but more densely granulate. Metasternum feebly depressed posteriorly; with a broad (about 0.025 mm.), deep, median longitudinal impression which ends abruptly at anterior fourth; on each side of middle near base with a broad, shallow, and subtriangular impression; surface of disk with round, rather convex granules which are distinctly coarser than facets of eyes and are usually separated by two times their diameters; side similarly granulate but with the granules slightly less convex. Middle basal portion of first ventral segment moderately depressed, at base rugose and obscurely granulate, and anterior portion with the granules about half as coarse as those of metasternum and usually separated by about five or more times their diameters; basal sides of first and middle

portion of second and third segments similarly granulate; elsewhere on abdomen with the granules separated by two to three times their diameters. Femora and tibiae granulate similarly to abdominal segments; tibiae with no rows of teeth. *Genitalia* as figured (text-figs. 280, 281).

Female: Externally similar to male.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Tejupilco, alt. about 4000 ft., vii. 1934 (*H. E. Hinton*).

Paratypes: 18, with same data as type; 2, collected at the same locality on 15. vi. 1934 (*H. E. Hinton, R. L. Usinger*); and 6, MEXICO: Estado de Morelos, Cuernavaca, vi. 1934 (*H. E. Hinton*).

Variations: The scutellum in some specimens is distinctly more narrowly obovate than that of the type. The depth of the pronotal depression near basal sinuation of sublateral carina is slightly greater in some specimens, and the median longitudinal impression of the pronotum appears in some specimens to begin at basal fifth. These variations are, however, scarcely worthy of mention.

Comparative notes: This species can be compared only with *C. heterocerus* (Sharp), which it resembles in general shape, but from which it may be distinguished by the following readily observable characters: (1) the antennae are slightly longer and are entirely rufo-piceous, while in *heterocerus* the apical segments are distinctly darker than the two basal; (2) the elytral intervals are subequally convex at base, the third being only very slightly instead of very much more strongly convex than the other discal intervals; and (3) the basal discal striae punctures are very coarse, being nearly as broad as intervals instead of seldom more than one-third as broad as they are in *heterocerus*.

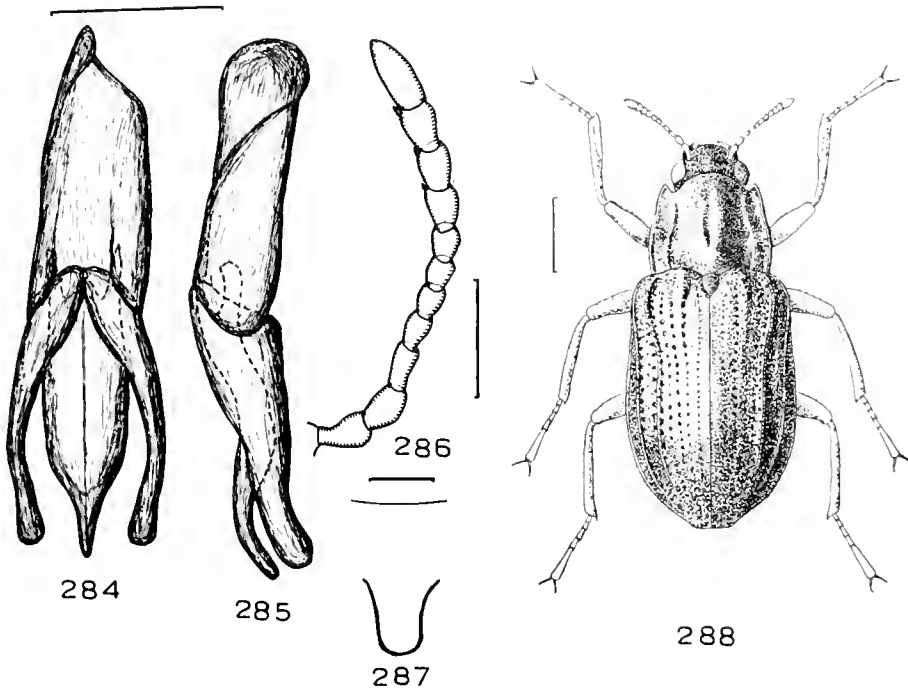
***Cylloepus heterocerus* (Sharp).**

(Text-figs. 284-288.)

1882. *Elmis heterocerus* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2): 135, t. 4, fig. 13.

Male: Length, 3.0 mm.; breadth, 1.4 mm. Subparallel, moderately convex. Clothed with fine, moderately short (about 0.05 mm.-0.06 mm. long), moderately recumbent, brownish-testaceous hairs which arise at intervals equal to half or less of their lengths; antennae (probably badly rubbed in specimens before me) with a few fine and short hairs and on inner apex of eighth, ninth, and tenth segments with a prominent brush or erect hairs; labrum clothed as elsewhere but with the lateral apical portions with denser and longer hairs; beneath with the hairs generally shorter. Cuticle moderately shining and for the most part microscopically alutaceous; piceous to feebly rufo-piceous; basal two to five segments of antennae, mouth-parts, and tarsi pale rufo-piceous. Tomentum cinereous with golden reflections. *Head* between eyes with a very feeble and broad impression which ends anteriorly on each side at base of clypeus and extends posteriorly to slightly behind eye on each side and then transversely across head. Antennae as figured (text-fig. 286), with the basal segments always distinctly paler than the apical. Clypeal suture well-marked and nearly straight; clypeus when viewed from in front very broadly and feebly arcuately emarginate; angle on each side obtusely rounded, and sides feebly arcuate. Labrum broadly and feebly rounded in front with the angle on each side broadly rounded. Surface set with round granules which are slightly but distinctly finer than facets of eyes and are usually separated by twice their diameters though often by less; labrum without granules, rather densely alutaceous, and punctate with fine punctures

generally separated by once to twice their diameters. *Pronotum* at broadest point near basal half broader than long (0.68 mm. : 0.90 mm.) and base broader than apex (0.92 mm. : 0.72 mm.). Apical margin as seen from above moderately arcuate at middle and deeply sinuate on each side behind eye before apical angle; apical angles moderately acute, rather broad, and moderately produced forwards and slightly inwards; sides feebly arcuate though slightly more strongly so at basal half, feebly sinuate before basal angles, and scarcely sinuate at apical fourth; lateral margins finely crenate; basal angles feebly acute, nearly rectangular, and scarcely produced; base trisinate, broadly and moderately deeply



TEXT-FIGS. 284-288. —*Cylloepus heterocentus* (Sharp). (284) Dorsal view of male genitalia. (285) Right lateral view of same. (286) Antenna. (287) Prosternum. (288) Adult to show general appearance.

sinuate on each side and shortly and more shallowly sinuate in front of scutellum. *Pronotum* with the sublateral carinae prominent, most strongly raised on basal half, very feebly curving towards apex, moderately strongly sinuate at basal two-fifths, and feebly sinuate at apical one-third and becoming obsolete at about apical eighth; with impressions as follows: a very broad and feebly raised portion extends from near base in front of scutellum to base of disk; median longitudinal navicular impression extending from basal third to apical third, rather deep and well-defined, and broadest at about basal half of pronotum where it is nearly as broad as scutellum; at sides of disk near basal sinuation of sublateral carina with a broad, deep, and slightly oblique impression which when viewed laterally appears to feebly bisect sublateral carina and continue obliquely to apical third of sides near lateral margin where it again becomes as broad as on disk; at sides of disk near apical sinuation of sublateral carina there is a broad, feeble, and transverse impression. Surface sculptured as follows: sides between

sublateral carinae and lateral margins with granules which are round to obovate, coarser than those of head, slightly coarser than facets of eyes, and occasionally confluent but mostly separated by once to twice their diameters; sides of disk near apex with a few feeble granules and also with an occasional granule elsewhere; disk with the punctures fine, shallow, and separated by less than a third to once their diameters so that the surface frequently appears to be eroded. *Elytra* more than twice as long as pronotum (2.25 mm. : 0.90 mm.) and feebly broadened to broadest point which is at apical third and here broader than base of pronotum (1.40 mm. : 0.92 mm.). Apices feebly produced, conjointly broadly and feebly rounded. Lateral margins very feebly crenate. Disk of elytra scarcely noticeably striate on basal portion and beyond apical two-thirds without a trace of striae; discal strial punctures about one-fifth to one-third as coarse as sutural interval, rather shallow, usually round, and separated longitudinally by less than to twice their diameters; at sides between the two carinate intervals and between outer carina and lateral margin with the punctures about half as coarse as sutural interval, subquadrate, deep, and usually separated longitudinally by less than their diameters; these punctures become finer and nearly obsolete at apex. Discal intervals flat, third strongly convex and slightly curved inwards on basal sixth; surface of discal intervals at base granulate similarly to sides of pronotum but with the granules slightly finer; granules on carinae coarser and denser than discal basal ones. *Scutellum* flat, subovate, broader than sutural interval (0.14 mm. : 0.10 mm.), longer than broad (0.17 mm. : 0.14 mm.), feebly and broadly rounded basally, and more narrowly rounded at apex; surface impunctate, without granules, and strongly shining. *Prosternum* with the process shaped as figured (text-fig. 287); middle area of prosternum feebly concave, set with granules which are about as coarse as those at sides of pronotum and which are seldom separated by as much as twice their diameters; hypopleura similarly punctate. *Mesosternum* with the groove for the reception of the prosternal process very deep and broad; surface granulate similarly to prosternum. *Metasternum* very feebly depressed posteriorly; with a broad (about 0.037 mm., posteriorly), deep, median longitudinal line which is much narrowed anteriorly but attains anterior margin; on each side at base with a moderately large oval and shallow impression; surface of disk with the granules similar to those of prosternum but separated by two to four times their diameters; sides with the granules denser, separated by once to twice their diameters. Middle portion of first abdominal sternite feebly depressed; all of middle of first sternite and middle basal portion of second not granulate but finely alutaceous and with a few sparse punctures; sides of ventral segments with finer granules than metasternum, which are usually separated by one to four times their diameters but are even sparser on basal sides of first and second sternites and middle of third and fourth. Femora and tibiae with the feebly obovate granules similar to those of sides of metasternum. *Genitalia* as figured (text-figs. 284, 285).

Female: Externally similar to male.

Type: In the British Museum (Nat. Hist.). GUATEMALA: Vera Paz, San Joaquín (*Champion*).

Specimens examined: 6, with same data as type. 3, MEXICO: Dist. de Temascaltepec, Temascaltepec, alt. 5000-6000 ft., vi. 1934 (*H. E. Hinton*); and one with same data as above but collected on 5. vi. 1933 (*H. E. Hinton, R. L. Usinger*).

Variations: No variations worthy of mention have been observed in the small series before me.

Comparative notes : This species is nearest to *C. blairi*, and for the differences between the two see the description of the latter. It might possibly be mistaken for *C. spinipes* from which it may be distinguished as follows : (1) The antennae are bicolorous instead of unicolorous ; (2) it is a shorter and proportionally broader species ; (3) the pronotal disk is finely and irregularly punctate instead of densely granulate ; (4) the elytral disk is nearly non-striate and moderately finely punctate instead of noticeably striate and coarsely punctate ; and (5) the third discal interval is only convex at base and the others are flat, while in *spinipes* all the discal intervals are moderately convex at base.

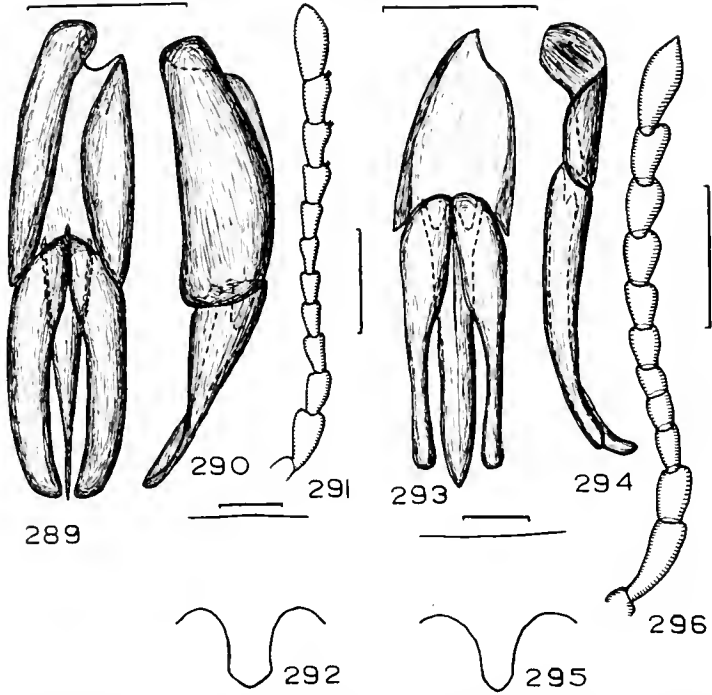
***Cylloepus puncticollis* (Hinton).**

(Text-figs. 251, 297-302.)

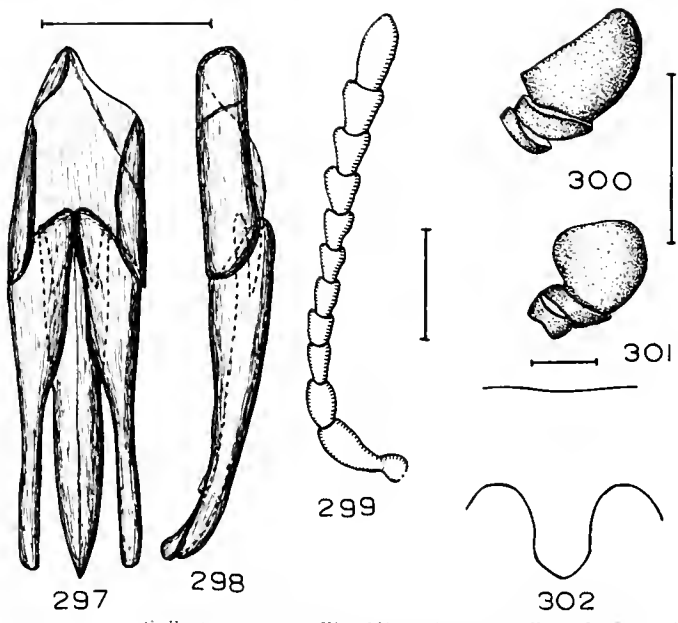
1934. *Stenobius puncticollis* Hinton, *Rev. Ent., Rio de J.*, 4 : 168.

1937. *Cylloepus puncticollis* Hinton, *Ab. morph. taxon. Ent. Berlin-Dahlem*, 4 (2) : 166.

Male : Length, 2.8 mm.-3.7 mm. ; breadth, 1.1 mm. 1.3 mm. Clothed with fine, short (about 0.037 mm. long), recumbent, brownish-testaceous hairs which arise mostly at intervals equal to distinctly less than their own lengths ; antennae with the apical segments more densely clothed with slightly shorter and more erect hairs ; beneath with the hairs generally shorter ; apical portion of labrum clothed with equally fine but longer (about 0.062 mm.), paler and more erect hairs which are rather dense at sides. Cuticle shining and for the most part alutaceous ; black to dark rufo-piceous ; basal two or more segments of antennae, mouth-parts, legs and surface beneath paler rufo-piceous. Tomentum cinereous with feeble golden reflections. *Head* with a moderately shallow and broad impression extending on each side near eyes to clypeal suture ; on vertex with a moderately deep obovate impression which is nearly as broad as second antennal segment. Antennae (text-fig. 299) bicolorous. Clypeal suture nearly straight, strongly impressed ; anterior margin of clypeus when seen from in front very broadly and feebly arcuately emarginate for its entire breadth, with the angle on each side broadly rounded and the sides feebly arcuate. Labrum with the anterior margin broadly and feebly rounded, with the angle on each side broadly rounded. Surface with the alutaceous microsculpture under a magnification of $\times 150$ appearing densely granulate ; set also with moderately flat granules which are about as coarse as facets of eyes and are usually separated by about once their diameters though at base and sides of head they are slightly sparser ; clypeus similarly granulate ; labrum without granules, finely punctate on a transverse middle band with punctures which are seldom separated by as much as twice their diameters ; extreme apex and base nearly impunctate. *Pronotum* at broadest point which is near basal half slightly broader than long (1.12 mm. : 1.07 mm.) and base broader than apex (1.02 mm. : 0.85 mm.). Apical margin moderately arcuate at middle and deeply sinuate on each side behind eye before apical angle ; apical angles moderately produced forwards and moderately acute ; sides feebly arcuate near basal half, nearly straight on apical half, very feebly sinuate at apical third, and feebly sinuate before basal angles ; lateral margins moderately feebly crenate ; basal angles moderately acute, scarcely produced ; base trisinuate, broadly and moderately strongly sinuate on each side and more narrowly and shallowly sinuate in front of scutellum. *Pronotum* with the sublateral carinae prominent, feebly converging towards apex, moderately feebly sinuate at basal half, and becoming obsolete just before apical



TEXT-FIGS. 289-296.—(289) Dorsal view of male genitalia of *Cylloepus optatus* Sharp. (290) Left lateral view of same. (291) Antenna. (292) Prosternum. (293) Dorsal view of male genitalia of *C. barberi* Hinton. (294) Right lateral view of same. (295) Prosternum. (296) Antenna.



TEXT-FIGS. 297-302.—*Cylloepus puncticollis* (Hinton). (297) Dorsal view of male genitalia. (298) Left lateral view of same. (299) Antenna. (300) Labial palp of male. (301) Labial palp of female. (302) Prosternum.

margin; broadest portion of carina is from basal fourth to apical fourth. Pronotum with impressions as follows: a very broad and gradually widening raised portion extends from base in front of scutellum to base of disk at about apical two-thirds of pronotum; on each side of this raised area a feeble impression extends obliquely forwards from a puncture-like impression near base to join a broad, moderately deep, oblique impression which is mostly on basal third but which narrows and when viewed laterally extends moderately deeply across sublateral carina at the basal impression where the carina is slightly narrowed; median longitudinal impression at base (here occupying most of basal raised area) broad but becoming much narrowed at apical two-thirds, where it suddenly broadens out to a navicular impression which becomes obsolete at about apical sixth, this navicular impression being at its broadest point, which is at apical two-fifths as broad as scutellum. Surface only feebly alutaceous at sides, not alutaceous on disk; disk with round to obovate punctures which vary from being twice the diameter of a facet to being one-fourth this size, though most of them are as coarse as facets of eyes; these punctures are seldom separated by more than their diameters, and near anterior margin the punctures become denser and are often confluent so that here the surface appears to be somewhat rugose; sides of disk near sublateral carinae and bottom of depression near basal sinuation of sublateral carina somewhat rugose; basal lateral portion of disk finely and sparsely punctate; surface of sublateral carinae so densely punctate that it becomes rugose and in certain lights appears to be densely granulate; sides between sublateral carinae and lateral margins slightly more sparsely rugose and granulate. *Elytra* more than twice as long as prothorax (2.40 mm. : 1.97 mm.) and very feebly broadening posteriorly to broadest point which is near apical third and is broader than base of prothorax (1.45 mm. : 1.02 mm.). Apices moderately feebly and broadly produced and conjointly feebly rounded. Lateral margins without distinct crenations. Surface moderately densely striate and discal striae only slightly finer at apical tenth; discal strial punctures round to subquadrate, deep, and at middle of disk from a third to two-thirds as broad as sutural interval and usually separated longitudinally by once to twice their diameters; discal punctures between basal convex intervals usually a little finer and denser; punctures on apical tenth about a fourth as coarse as those on middle of disk. Discal intervals subequal in breadth and with the sutural slightly broader than the others; intervals nearly flat and at basal fifth with all except sutural and fifth feebly convex, third distinctly more convex than second or fourth and fourth slightly more convex than second and posteriorly not as abruptly flattened as others but continued as a feebly convex interval to apical third; surface of intervals feebly alutaceous, on basal fifth with the convex intervals having the granules round, feebly convex, about as coarse as those on sides of pronotum, and seldom separated by more than once their diameters; towards apex the granules of the intervals become much sparser; lateral carinae granulate similarly to basal discal intervals; sutural interval and intervals between strial punctures much more sparsely granulate. *Scutellum* flat, subovate, broader than sutural interval at base (0.12 mm. : 0.10 mm.), longer than broad (0.17 mm. : 0.12 mm.), broadly and feebly rounded basally, nearly truncate, and at apex moderately acutely pointed; surface without distinct granules. *Prosternum* with the process as figured (text-fig. 302); prosternum with the anterior two-thirds (not including process) strongly but not sharply lobed; middle area coarsely but not distinctly rugose and granulate, anterior marginal area and sides not rugose and more finely granulate, and with round, feebly convex granules which are slightly

coarser than facets of eyes and are usually separated by once to twice their diameters; hypomera with the granules finer, very feeble, and not distinct. Mesosternum with the groove for the reception of the prosternal process feebly triangular posteriorly and occupying most of the middle; surface sculptured like the middle of the prosternum. Metasternum very feebly depressed posteriorly and on each side of middle at posterior margin with a large, moderately feeble depression; with a moderately narrow median longitudinal impression which is distinct to anterior two-fifths and becomes obsolete shortly before anterior margin; disk with the usually round granules about half again as coarse as facets of eyes and separated mostly by once to twice their diameters; sides similarly granulate but extreme sides with only an occasional very fine granule. Middle portion of first ventral sternite of abdomen very strongly depressed; lateral carina evident only on basal half and even here very broad and but little raised; anterior border of depression rugose and remainder of surface with the granules from a half to a third as coarse as those of metasternum and separated by three to four times their diameters; sides of first sternite for a short distance near depression granulate nearly as coarsely as metasternum and sides elsewhere as well as those of second and third segments with only an occasional granule; middle portion of sides of four apical sternites with the granules a third to two-thirds as coarse as those of metasternum and separated by one to three times their diameters though slightly finer and sparser on middle region of second, third, and fourth. Femora and tibiae with the granules generally coarser than abdominal ones, about two times as coarse as metasternal ones and similarly separated. First tarsal segment of all legs with two fine and erect hairs at ventral apex. *Genitalia* as figured (text-fig. 297, 298).

Female: Externally similar to male but with the terminal segment of the labial palpi about half as broad as that of male.

Type: ♀ in the British Museum (Nat. Hist.). MEXICO: Tejupilco, Dist. de Temascaltepec, alt. about 4000 ft., vi. 1933 (*H. E. Hinton, R. L. Usinger*).

Specimens examined: 1, with same data as above; and 128, collected in the same locality in vii. 1934 (*H. E. Hinton*).

Variations: In addition to the usual slight variation in the size and density of the punctures and granules on the various sclerites, this species exhibits a moderate range of variation as follows:

- (1) On the pronotum of some specimens there is no definite median longitudinal impression from base to apical three-fourths. There is also a slight amount of variation in the extent and depth of the median navicular impression of the pronotum.
- (2) The punctures of the pronotal disk are in some specimens mostly contiguous to confluent so that the surface appears to be subrugose, while in other specimens the punctures of this area are mostly separated by half their diameters, and the surface never appears to be subrugose.
- (3) A noticeable difference in the shape and breadth of the terminal segment of the labial palpi of both males and females. In the males the thickness of the apex may vary as 1 : 2.
- (4) In a number of specimens the lateral margins of the prosternal process are feebly raised, and occasionally the middle of the process is feebly and longitudinally convex.
- (5) The first ventral abdominal sternite varies from being moderately depressed to being strongly depressed. This variation, except for that in the absolute length of the beetle, is the most noticeable.
- (6) A few specimens have the antennae practically uniformly coloured.

Comparative notes: The punctate instead of granulate pronotal disk will separate this species from *C. spinipes* Hinton. From *C. barberi* Hinton it may be distinguished as follows: (1) the surface of the pronotal carinae is granulate instead of punctate; (2) the basal discal elytral intervals are convex instead of flat; and (3) the depressed instead of flat middle portion of the first abdominal sternite. The moderately convex instead of flat fourth basal interval of elytral disk will serve to distinguish it from *C. optatus* Sharp.

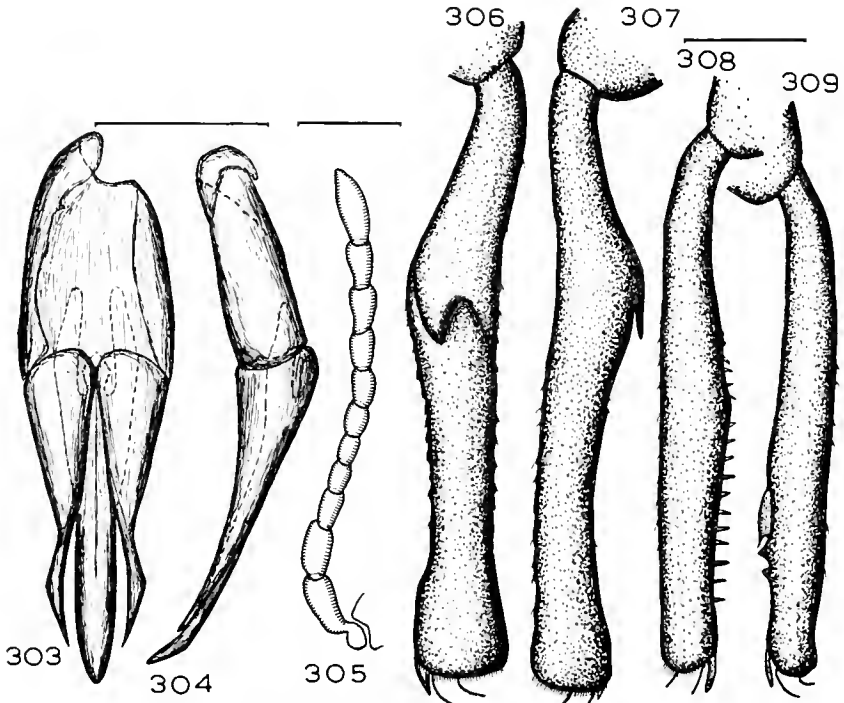
***Cylloepus spinipes* Hinton.**

(Text-figs. 303-309.)

1934. *Cylloepus spinipes* Hinton, *Rev. Ent., Rio de J.*, 4 (2) : 192.

Male: Length, 3.0 mm.-3.4 mm.; breadth, 1.1 mm.-1.3 mm. Clothed with fine, short (about 0.038 mm. long), recumbent, brownish-testaceous hairs which arise mostly at intervals equal to slightly less than their lengths; antennae similarly but more sparsely clothed; apical half of labrum clothed with equally fine but much longer (as long as 0.087 mm. at sides) and paler hairs which are more erect and much denser. Cuticle shining and for the most part densely alutaceous; piceous to dark rufo-piceous; antennae, mouth-parts, and legs paler rufo-piceous. Tomentum cinereous with moderate golden reflections. *Head* with a scarcely noticeable, broad, feebly oblique impression which extends shortly on each side near anterior half of eyes. Clypeal suture strongly impressed and feebly arcuate; anterior margin of clypeus very broadly and feebly arcuately emarginate, with the angle on each side obtusely rounded and sides moderately arcuate. Labrum broadly and feebly rounded in front, with the angle on each side broadly rounded. Surface with the alutaceous microsculpture appearing somewhat granulate; with granules which are usually round, slightly coarser than facets of eyes, and usually separated by less than to once their diameters; granules on clypeus similar; labium without granules, apical half punctate with very fine punctures which are usually separated by once to twice their diameters. *Pronotum* at broadest point, which is at basal half, broader than long (1.05 mm. : 0.97 mm.) and base broader than apex (0.96 mm. : 0.72 mm.). Apical margin as seen from above moderately feebly arcuate at middle and deeply sinuate on each side behind eye before apical angle; apical angles acute and strongly produced forwards and very slightly inwards; sides feebly arcuate, more strongly so at basal half, nearly straight at apical fourth and scarcely noticeably sinuate just before basal angles; lateral margins feebly crenate; basal angles feebly acute, nearly rectangular and scarcely produced; base trisinate, broadly and moderately strongly sinuate on each side and shortly and very shallowly sinuate in front of scutellum. *Pronotum* with the sublateral carinae prominent, very slightly converging towards apex, moderately sinuate at basal two-fifths, and extending to apical margin, while the broadest portion of the carinae is from basal fifth to apical fourth. *Pronotum* also as follows: a very broad and feebly raised portion extends from base to base of disk; on each side of this raised area with a feeble, moderately broad, feebly curved and oblique impression extending to broad, moderately shallow, indefinite impression near sinuation of sublateral carina which when viewed from a nearly lateral position seems to very shallowly extend across sublateral carinae at about middle; median longitudinal impression in some specimens extending from base to basal third as a very shallowly

impressed line and in others beginning only at basal third, but in all extending from basal third to about apical third as a navicular, moderately deep impression which is broadest at middle where it is not quite as broad as scutellum. Surface with the alutaceous microsculpture similar but not as evident as that of head; set with round to feebly obovate granules which are nearly twice as coarse as facets of eyes, low (only feebly convex), and are usually separated by slightly less than their own diameters; granules on sublateral carinae coarser and denser;



TEXT-FIGS. 303-309.—*Cylloepus spimpes* Hinton. (303) Dorsal view of male genitalia (304) Left lateral view of same. (305) Antenna. (306) Inner view of hind tibia of male. (307) Lateral view of hind tibia of male. (308) Inner lateral view of middle tibia of male. (309) Inner lateral view of front tibia of male.

granules anteriorly on disk slightly finer and sparser. *Elytra* more than twice as long as pronotum (2.30 mm. : 0.97 mm.) and feebly broadening to broadest point, which is at apical third, and is here broader than base of pronotum (1.32 mm. : 0.96 mm.). Apices broadly and moderately feebly produced and conjointly broadly rounded. Lateral margins feebly but regularly crenate. Surface striate with the discal striae moderately coarse at base, becoming finer towards apex, and beyond apical fourth obsolete except for sutural; discal strial punctures round to subquadrate and at basal third a third to two-thirds as broad as intervals, separated longitudinally by once to twice their diameters; these punctures are narrower basally and towards apex rapidly become fine and sparse so that at apical eighth they are about a fourth as coarse as those at basal third. Discal intervals nearly flat and subequal in breadth, at base all except sutural are slightly

convex, and of the convex intervals the third is only slightly more so than the others; surface of intervals at base alutaceous somewhat as pronotum, elsewhere much more sparsely and differently alutaceous; on basal fourth set with granules which are similar in size to those of pronotum and similarly distributed; these granules rapidly become sparser so that beyond basal half the disk is free of granules; granules of carinate intervals equal in size and density to those of elytral base. *Scutellum* flat, subovate, broader than sutural interval (0.14 mm. : 0.10 mm.), longer than broad (0.15 mm. : 0.14 mm.), very feebly and broadly rounded basally, nearly truncate, and at apex narrowly rounded; surface nearly free of granules. *Prosternum* with the process rounded at apex; prosternum and process evenly and moderately depressed, with the anterior two-thirds (not including prosternal process) strongly and abruptly lobed; surface granulate as that of elytral base; hypopleura slightly more sparsely granulate. *Mesosternum* nearly entirely depressed for the reception of the prosternal process; sides near middle coxae very strongly and broadly raised and at apex with a dozen or less slender, long (about 0.075 mm.), erect, brownish-testaceous hairs; surface similar to prosternum but more sparsely granulate. *Metasternum* with nearly the entire discal region occupied by a deep, transverse, oval depression; posterior margin on edge of each side of middle with a moderately deep and large subtriangular impression; with a broad (0.375 mm. broad in specimen 3.0 mm. long) and shallow median longitudinal impression which ends rather abruptly at apical fifth and basal seventh; discal surface granulate similarly to pronotum; sides similarly sculptured but with the granules sparser and extreme sides with the granules very flat. Middle basal portion of first abdominal sternite strongly depressed and sculptured similarly to metasternal disk; ventral sternites elsewhere more sparsely granulate than disk of metasternum and especially sparsely so at middle. Front tibiae with three tooth-like structures as figured (text-fig. 309). Middle tibiae with a ventral row of teeth (text-fig. 308). Hind tibiae with a large, flat, knife-like tooth on inner ventral side at basal two-fifths (text-figs. 306, 307). Surface of femora and tibiae granulate similarly to ventral abdominal segments. *Genitalia* as figured (text-figs. 303, 304).

Female: Externally similar to male except as follows: (1) sides of mesosternum only moderately convex and without the group of long hairs; (2) disk of metasternum not as broadly nor as strongly depressed; and (3) front and hind tibiae without the tooth-like structures and middle tibiae without the row of teeth.

Type: ♂ in the U.S. National Museum. MEXICO: Dist. de Temascaltepec, Real de Arriba, alt. 6000-7000 ft., v-vi-vii, 1933 (*H. E. Hinton, R. L. Usinger*).

Specimens examined: 68, with same data as type but a few of these also collected at Temascaltepec, alt. about 5000 ft.; 25, as above but collected in vi. vii, 1934 (*H. E. Hinton*).

Variations: The only notable variation is that in some specimens the median longitudinal line extends from base to basal third as a very shallowly impressed line, while in others it is absent on basal third and only present from basal third to apical third.

Comparative notes: The males may be separated from all other species by the secondary sexual characters of the front and hind tibiae. The females may be distinguished from those of *C. barberi* by the granulate instead of punctate pronotum, while from both *C. puncticollis* and *C. sexualis* they may be distinguished by (1) the strongly instead of feebly depressed metasternal disk and (2) the densely granulate instead of punctate pronotal disk.

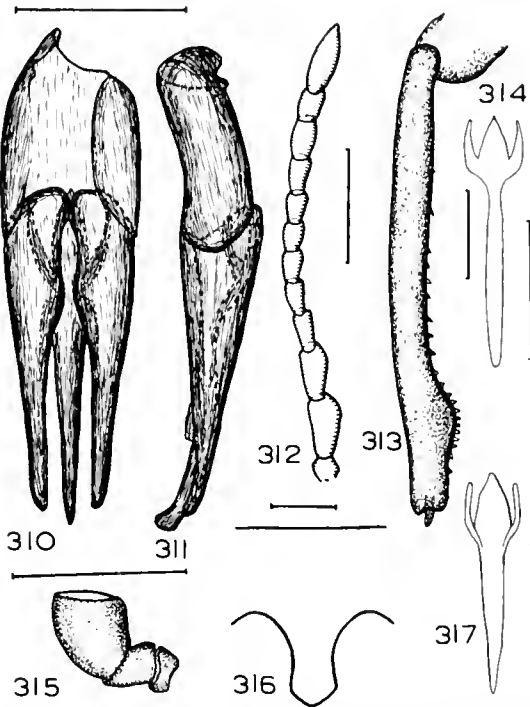
Cylloepus sexualis Hinton.

(Text-figs. 310-316.)

1937. *Cylloepus sexualis* Hinton, *Arb. morph. taxon. Ent. Berlin-Dahlem*, 4 (2) : 102, figs. 4-10.

Male: Length, 3.1 mm.-3.7 mm.; breadth, 1.2 mm.-1.3 mm. Subparallel moderately convex. Clothed with fine, short (about 0.037 mm. long), recumbent, brownish-testaceous hairs which arise mostly at intervals equal to distinctly less than their own lengths; antennae with the apical segments more densely clothed with slightly shorter hairs; labrum clothed with equally fine but generally much longer, more erect hairs which are most numerous at sides. Cuticle shining and for the most part alutaceous; colour black to dark rufo-piceous; basal two segments of antennae, mouth-parts, and legs paler rufo-piceous. Tomentum cinereous with golden reflections. *Head* without distinct impressions, but anteriorly between eyes with a median longitudinal impression which is nearly as long as basal segment of antennae and about two-fifths as broad as long. Antennae as figured (text-fig. 312). Clypeus with the suture straight and strongly impressed; anterior margin of clypeus as usual when seen from in front very broadly and arcuately emarginate, with the angle on each side obtusely and bluntly rounded; labrum very broadly and feebly rounded in front, with the angle on each side broadly rounded. Surface densely and very minutely alutaceous in such a manner that it appears minutely granulate; also set with low granules which are about as coarse as facets of eyes and are usually separated by once to twice their diameters though sparser basally where the surface is also somewhat rugose; granules of clypeus slightly denser and more regularly distributed; labrum without granules, base and apex nearly impunctate, elsewhere with the punctures fine (about two-thirds as coarse as facets of eyes), round, and usually separated by once their diameters or less. *Pronotum* with the greatest breadth near basal half not as great as length (0.97 mm. : 1.05 mm.) and base broader than apex (0.87 mm. : 0.75 mm.). Apical margin as seen from above moderately arcuate and deeply sinuate on each side behind eye before apical angle; apical angles moderately produced forwards and moderately acute; sides moderately arcuate on basal half, nearly straight on apical half, and moderately sinuate before basal angles. Lateral margins finely crenate; basal angles moderately acute and feebly produced backwards; base trisinate, broadly and moderately deeply sinuate on each side, narrowly and moderately deeply sinuate in front of scutellum. *Pronotum* with the sublateral carina prominent, moderately feebly converging towards apex, moderately sinuate at basal half, when viewed from above slightly sinuate on apical third, and extending to apical margin; broadest portion of carina difficult to delimit but apparently extending from basal fourth to apical third. *Pronotum* with the impressions as shown in text-fig. 318 for *C. proximus*. Surface feebly alutaceous, more strongly so at bottom of impressions and at sides and anterior margin but nowhere as strongly alutaceous as head; disk punctate with round to feebly obovate punctures which are moderately deep, usually a half to two or more times as coarse as facets of eyes, often contiguous or confluent and seldom separated by as much as half of their diameters; anteriorly on the disk with most of the punctures confluent and therefore appearing rugose; bottom of the various impressions nearly impunctate and therefore appearing highly polished; basal convex areas on each side of middle with a few punctures similar to those of disk but slightly sparser; surface of sublateral carina punctate as on disk but so densely as to appear rugose; sides near lateral margins much

more sparsely punctate. *Elytra* more than twice as long as pronotum (2.42 mm. : 1.05 mm.) and feebly broadening posteriorly to broadest point which is at apical third and here broader than base of pronotum (1.30 mm. : 0.87 mm.). Lateral margins without distinct crenations. Surface rather coarsely striate, discal striae slightly finer at apical tenth but not obsolete; discal striae punctures subquadrate to nearly round, rather deep, and at middle of disk from two-thirds to as broad as intervals and separated longitudinally by slightly more than to slightly less than their lengths; towards sides the punctures become coarser and



TEXT-FIGS. 310-317.—(310) Dorsal view of male genitalia of *Cylloepus sexualis* Hinton. (311) Left lateral view of same. (312) Antenna. (313) Lateral inner view of front tibia of male. (314) Dorsal view of median lobe of male genitalia. (315) Labial palp of male. (316) Prosternum. (317) Dorsal view of median lobe of male genitalia of *C. proximus* Hinton.

towards apex much finer. Discal intervals (five intervals) all nearly flat, second feebly convex on basal fifth, third strongly convex but becoming flat at about apical three-fourths, fourth flat (with punctures of the two striae almost contiguous so that the fifth seems to be the fourth), and fifth moderately convex on basal seventh; surface of intervals at most only feebly alutaceous; elevated intervals with numerous round and low granules which are slightly coarser than facets of eyes, and the surface here also somewhat rugose; carinate intervals similarly sculptured; surface between punctures with only an occasional granule and often feebly rugose. *Scutellum* flat, ovate, broader than sutural interval at base (0.14 mm. : 0.10 mm.), longer than broad (0.17 mm. : 0.14 mm.), broadly and feebly rounded basally, and at apex moderately acutely rounded; surface with a few coarse and shallow punctures. *Prosternum* with the anterior two-thirds (not including process) strongly but not sharply lobed; prosternal process

as figured (text-fig. 316); surface of middle area densely, moderately coarsely rugose and obscurely granulate, sides with the granules varying much in size but usually about as coarse as facets of eyes or slightly finer and separated by one to three or more times their diameters. Hypomera feebly, moderately sparsely rugose and with a few fine, obscure granules. Mesosternum sculptured similarly to middle area of prosternum. Metasternum with all the middle of the disk except anterior two-fifths moderately strongly depressed but with the area near median line slightly less depressed so that it appears that there are two depressions on disk, one on each side of median line; area just before mesosternum strongly declivous; on each side of middle at posterior margin with a moderately large, oval, deep depression; with a broad (0.037 mm. basally), deep, median longitudinal impression which extends broadly to apical third; surface of disk granulate with round to obovate, flat-topped granules which are as coarse as facets of eyes and are separated by once to twice their diameters; sides similarly granulate but extreme sides and pleura with only a few fine and obscure granules. First abdominal sternite with the entire middle portion strongly depressed and posteriorly at middle this depression seems to encroach upon middle of second segment as far as apical two-fifths; surface of the depression feebly rugose; carinae of first sternite prominent and extending from base to apex; surface of sides of first sternite and extreme sides of others with only an occasional granule; surface of segments elsewhere with rather flat, round granules which are half as coarse as facets of eyes and are usually separated by two to three times their diameters. Hind coxa with a moderately large and deep, usually oval depression. Femora and tibiae very finely but otherwise similarly granulate to metasternal disk; the front tibia on inner apex has a toothed carina (text-fig. 313); inner ventral side of middle tibiae with a row of teeth similar to that of front tibiae; hind tibiae with no rows of prominent teeth; when viewed from inner dorsal side feebly curved and moderately swollen at apical two-fifths for a short distance; when viewed ventrally this swollen portion is somewhat concave and the tomentum is here particularly long and dense. *Genitalia* as figured (text-figs. 310, 311).

Female: Differs externally from male as follows: (1) the basal abdominal depression does not encroach on to second sternite so that there is no trace of a depression here; (2) the front tibia has no carina or teeth as has been figured for the male; (3) the middle tibia has no row of teeth; and (4) the hind tibia though nearly as curved at apical two-fifths as in male is not as thick.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Tejupilco, alt. about 4000 ft., vii. 1934 (*H. E. Hinton*).

Specimens examined: 80, with same data as above; 16, with same data but collected 15-28. vi. 1933 (*H. E. Hinton, R. L. Usinger*); 1, Dist. de Temascaltepec, Temascaltepec, alt. about 5000 ft. (*H. E. Hinton, R. L. Usinger*).

Variations: Besides slight variations in body size and density of granules the following have been noted: (1) a noticeable variation in the depth of the depression which parallels basal raised portion of pronotum at the point where it joins the large impression near basal situation of sublateral carina, being sometimes absent at this point so that basal convex portion appears as part of the disk; and (2) a slightly noticeable difference in the proportions of length to breadth of the prothorax.

Teratology: One female specimen is malformed as follows: the outer sublateral carina (on eighth interval) is broadly interrupted on the left side at apical two-fifths and less broadly interrupted on the right side at the same place, and the inner sublateral carina is broadly interrupted at basal third on left side only.

Comparative notes: The punctate instead of granulate pronotal disk will serve to distinguish it from *C. spinipes*. The bicoloured instead of uniformly coloured antennae, the coarsely and densely instead of finely and moderately sparsely punctate pronotal disk, the strongly convex instead of nearly flat third basal interval of elytra, and the strongly depressed instead of nearly flat middle of basal abdominal sternite will separate it from *C. barberi*. From *C. optatus*, to which it is most closely related, it may be distinguished as follows:

- | <i>C. sexualis.</i> | <i>C. optatus.</i> |
|---|--|
| 1. Antennae with the two basal segments pale rufo-piceous and the others piceous to black. | 1. Antennae uniformly pale rufo-piceous; sometimes with the two basal segments slightly paler. |
| 2. Elytra with the fifth interval at base moderately strongly convex. | 2. Elytra with the fifth interval at base at most feebly convex. |
| 3. Male with the second abdominal sternite depressed only at middle of basal half. | 3. Male with the second abdominal sternite depressed at middle of basal two-thirds. |
| 4. Male with a short, prominent carina-like swelling at inner apical fourth of front tibia. | 4. Male without a carina on front tibia |
| 5. Front tarsi of males without numerous erect hairs on ventral surface | 5. Males with the four basal segments of the front tarsi densely clothed on ventral side with moderately long, erect, pale-testaceous hairs. |

C. sexualis superficially resembles *C. puncticollis* but may at once be separated by the flat fourth and convex fifth, instead of flat fifth and convex fourth basal discal elytral intervals. The terminal segment of the labial palp is normal in the males of *C. sexualis*, while in those of *C. puncticollis* it is very much broadened at apex.

***Cylloepus proximus* Hinton.**

(Text-figs. 317, 318.)

1937. *Cylloepus proximus* Hinton, *Arb. morph. taxon. Ent. Berlin-Dahlem*, 4 (2) : 106, figs. 11, 12.

Male: Length, 3.3 mm.; breadth, 1.28 mm. Similar to male of *sexualis* except as follows: *Elytra* with the fifth interval very shortly and scarcely noticeably elevated, while that of *sexualis* is distinctly elevated for a short distance. *Abdomen* with the depression of the first sternite not, or just barely, encroaching on second sternite. Inner apex of front tibia without a toothed ridge, as is the case in *sexualis*; hind tibia with the apical half not as strongly curved or swollen as that of *sexualis*. *Male genitalia* of both species very similar, the chief differences being found in the median lobes which have been dissected out and illustrated (*sexualis*, text-fig. 314; *proximus*, text-fig. 317).

Type: ♂ in the Deutsches Entomologisches Institut, Berlin-Dahlem. MEXICO: Puebla, Necaxa (*Georg Heine*).

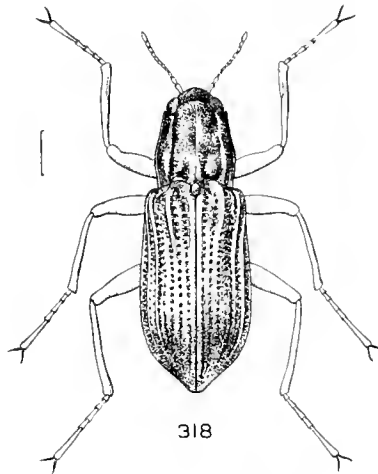
LARVAE.

The larvae of *Cylloepus* have been determined by elimination and locality. Only one Mexican species is available, and it appears to be either *C. puncticollis* (Hinton) or *C. sexualis* Hinton. The larva of a species (*C. consobrinus* Grouvelle?)

from the Yungas Valley of Bolivia is also available. The following generic characterization is drawn from a study of these two species.

Generic Characters of Larvae of Cylloepus.

Cylindrical, parallel. *Head* when viewed from above exposed and not concealed by the pronotum. With one ocellus on each side. Antennae 3-segmented, feebly retractile. Clypeus with the suture distinct. Mandibles of both sides similar and with three acute apical teeth; protheca long, slender, and densely spinose. Maxilla with the palp 4-segmented and the stipes showing no differentiation into a palpifer; galea and lacinia separate and apex of each densely spinose. Labium with the postmentum undivided; palp 2-segmented and prementum without a palpiger. Gula well developed. *Prothoracic pleurae* not



TEXT-FIG. 318.—*Cylloepus proximus* Hinton.

divided, meeting on middle line of body. Meso- and metathoracic pleurae with only the sterno-pleural suture present. First abdominal segment with only the sterno-pleural suture present; second to eighth with discrete pleurae bounded by tergo- and sterno-pleural sutures and these sutures are continued to basal half of ninth segment; these sutures do not converge where they terminate, as in most Elmidae, but remain parallel. Anterior and posterior part of prosternum divided by a complete median longitudinal suture. Ninth abdominal segment with the apex broadly and strongly emarginate; operculum with two strongly sclerotized claws attached to dorsal membrane. Spiracles annular and biforous, present on antero-lateral part of mesothorax and first eight abdominal segments, and opening at level of cuticle and not on well-developed tubercles; tracheae without air sacs; with three tufts of retractile, anal, tracheal gills. *Alimentary canal* with a small dorsal oesophageal sclerite on posterior margin of oesophagus. Hind gut with six Malpighian tubules. *Central nervous system* with three thoracic and eight abdominal discrete ganglia. Stomodaeal nervous system with two occipital ganglia and a single oesophageal ganglion.

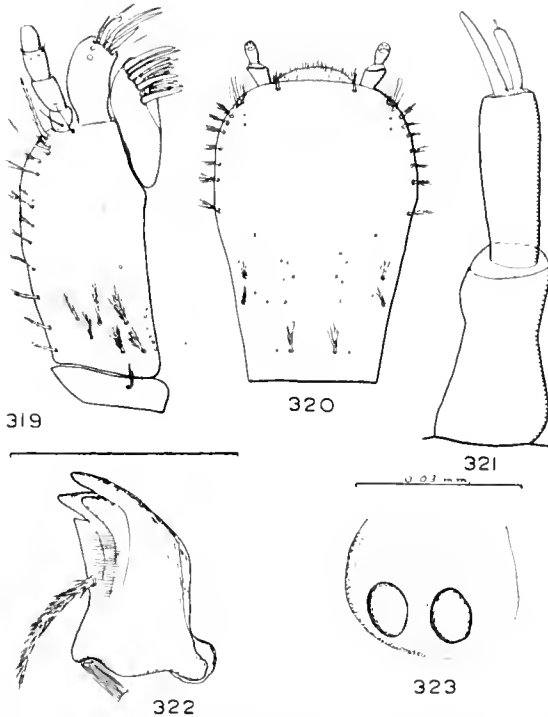
In general appearance the larvae of this genus are very similar to those of *Stenelmis* Dufour, but they may at once be distinguished from *Stenelmis* and all

other known genera by the complete absence of tergo-pleural thoracic sutures and the presence of both tergo- and sterno-pleural sutures on the ninth segment.

Description of Mature Larva of Cylloepus sp.

(Text-figs. 319-329.)

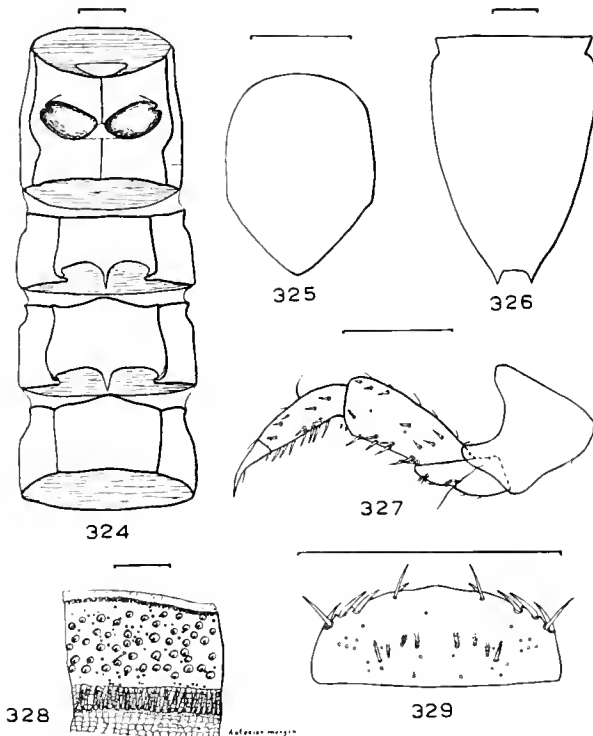
Length, 8.0 mm. ; breadth (across broadest point which is near base of meta-thorax), 0.70 mm. Cuticle brownish-testaceous to brown. *Head* rectangular, slightly broader than long (0.52 mm : 0.50 mm.). Epicranial suture nearly



TEXT-FIGS 319-323.—Larva of *Cylloepus* sp. (319) Ventral view of right maxilla. (320) Ventral view of labium. Setae of prementum are only approximately correct. (321) Antenna. (322) Mandible. (323) Mesothoracic spiracle.

straight and 0.07 mm. long ; frontal suture extending nearly in a straight curve on each side to margin of head opposite base of antenna. Cuticle on a basal belt which is nearly as long as epicranial suture finely and transversely alutaceous ; elsewhere with round punctures which are about 0.02 mm. broad and are separated by less than to nearly three times their diameters ; from these punctures arise fine setae which are usually only slightly longer than the breadth of their respective punctures though occasionally they are about five times this length. Antenna as figured (text-fig. 321) ; retractile to basal third of first segment. Frontal margin of head with a tooth-like projection on each side of clypeus between clypeus and base of antenna which is two-thirds as long as basal segment of antenna. Clypeus with the fronto-clypeal suture distinct ; slightly longer and broader than labrum ; and with the anterior margin truncate, with the angle on

each side rounded. Labrum (text-fig. 329) with the epipharynx smooth. Mandibles, maxillae and labium as figured (text-figs. 322, 319, and 320). *Thorax* and first abdominal segment with the proportions as figured (text-fig. 324). Surface of thorax and abdomen for the most part punctate as frontal region of head but with the punctures about a third larger; posterior margin of each segment except ninth with a dense and complete ring of tubercles (text-fig. 328) near anterior margin of each segment with a dense and complete ring of tubercles



TEXT-FIGS. 324-329.—Larva of *Cylloepus* sp. (324) Ventral view of thorax and first abdominal segment to show sclerotization. (325) Operculum. (326) Dorsal view of ninth abdominal segment. (327) Posterior view of left front leg. (328) A section of third abdominal tergite. (329) Dorsal view of labrum.

from which long flat setae arise (text-fig. 328). *Legs* all fairly close in size and chaetotaxy to front leg (text-fig. 327).

Specimens examined: 2, apparently mature larvae taken in a small (5-30 ft. across) and rapid flowing stream. MEXICO: Dist. de Temascaltepec, Tejupilco, alt. about 4000 ft., vii. 1934 (*H. E. Hinton*).

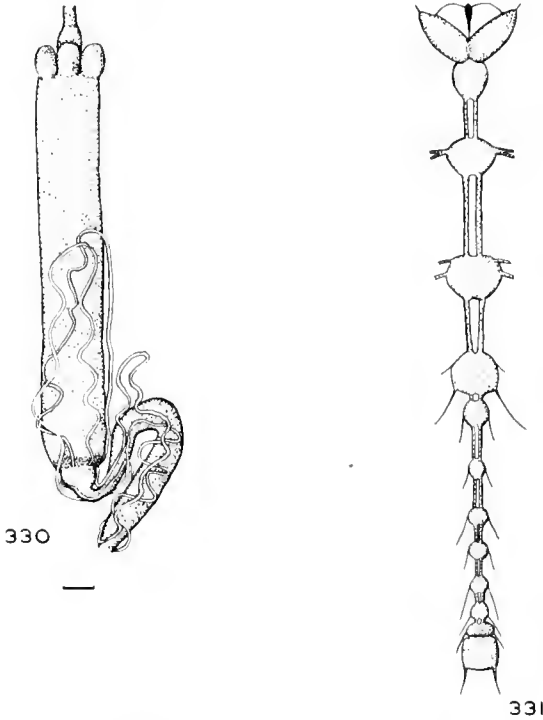
HETERELMIS Sharp.

1882. *Heterelmis* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2): 130.

At the time of writing 10 species and 1 subspecies of this genus have been described. To these two new species and one new subspecies are added in this paper. The species occur from southern United States to south Brazil, and are

also known from Trinidad and Tobago in the British West Indies. A redescription of the genus follows:

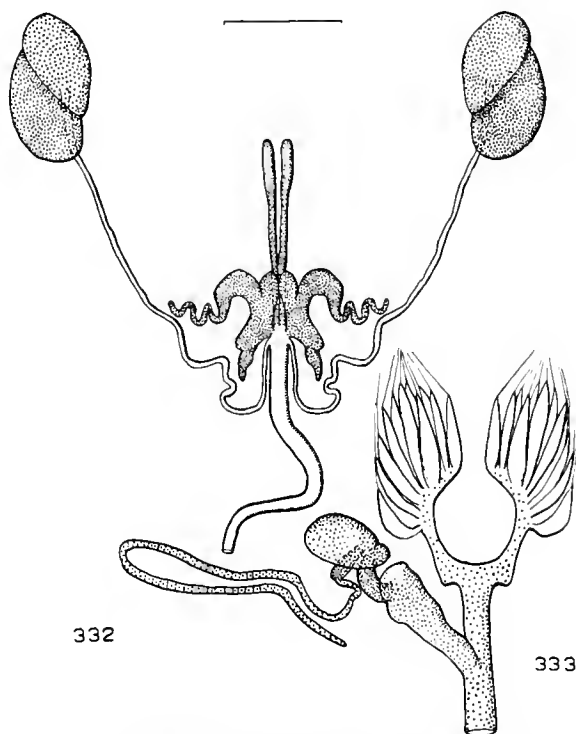
Body subovate to subparallel. Non-tomentose areas glabrous or clothed with sparse and short recumbent to suberect hairs. Scale-like or hairy tomentum confined to the following areas: (1) genae; (2) epipleura; (3) hypomera from posterior fourth to anterior half with a ventral belt which at broadest is two-fifths of hypomera, and this belt extends to anterior margin as a narrow fringe along sterno-notal suture; (4) sides of prosternum, mesosternum, and abdominal sternites; and (5) part or all of legs except tarsi. *Head* when seen from below



TEXT-FIGS. 330, 331.—*Heterelmis longior* (Grouvelle). (330) Alimentary canal. (331) Dorsal view of central nervous system.

capable of being retracted so that none of the mouth-parts are visible. Antenna (text-fig. 337) 11-segmented. Mandibles (text-fig. 335) with three subacute apical teeth; prostheca long and entirely membranous with numerous long spines and hairs apically. Maxilla (text-fig. 334) with the palp 4-segmented and the stipes with a well-developed palpifer; galea and lacinia separate and apex of each densely spinose or hairy. Labium with the palp (text-fig. 365) 3-segmented and prementum without a distinct palpifer. Mentum as broad and three-fourths as long as submentum. Gula about a fifth longer than submentum, at anterior margin about three-fourths as broad as submentum, and with the sides feebly converging so that at posterior margin it is only half as broad as submentum. *Pronotum* with the anterior margin moderately arcuate at middle and on each side behind eye before apical angle broadly and moderately deeply sinuate. Base trisinate, broadly and moderately deeply so on each side and more narrowly

and shallowly so in front of scutellum. Pronotum on each side with a sublateral carina which extends from base to, or very nearly to, anterior margin; without or with a transverse impression at middle; with or without a median longitudinal discal impression; and with or without an oblique impression on each side on basal half. *Elytra* punctate and striate; each elytron with a longitudinal carina on sixth interval and one on eighth. Hind wing (text-fig. 341) without an anal lobe; without a radial cross vein or an anal cell; first anal absent; second anal with the first and second branches present; third anal without a second branch; fourth anal well-developed; and cubito-anal cross



TEXT-FIGS. 332, 333.—*Heterelmis longior* (Grouvelle). (332) Male reproductive system. (333) Female reproductive system.

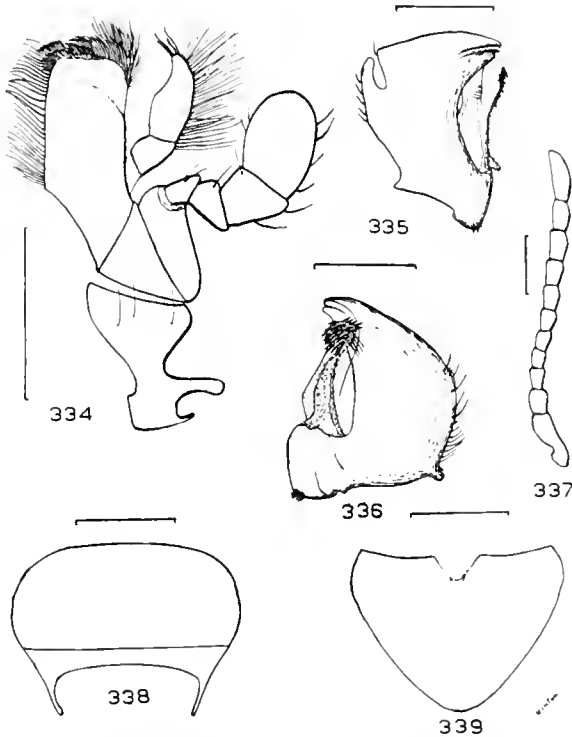
vein complete and joining cubitus to second anal. *Prosternum* very long in front of anterior coxae; prosternal process long, very broad, and with the posterior margin broadly rounded to nearly truncate. *Mesosternum* with a moderately deep and very broad groove for the reception of the prosternal process. *Metasternum* with a median longitudinal impressed line. *Legs* with the visible portion of the front coxae rounded and trochantin completely concealed by the hypomera and sternum. Claws without teeth. *Alimentary canal* (text-fig. 330) with six caeca on the anterior margin of the mid-gut. *Hind gut* with six Malpighian tubules which end freely near the rectum. *Male reproductive system* (text-fig. 332) with the lateral accessory glands lobed. Each testis with two sperm tubes. *Female reproductive system* (text-fig. 333) with 11 egg tubes to each ovary. Spermathecal duct opening into apex of bursa copulatrix. *Central nervous*

system (text-fig. 331) with three thoracic discrete ganglia; abdominal ganglia one to six discrete and seven and eight only partly fused together.

GENOTYPE: *Heterelmis obscura* Sharp (1882).

The internal anatomy of three species has been examined and found to agree in essential details, and that of *H. longior* (Grouvelle) (*Elmis*) is figured.

This genus is close to no other so far described, and the fact that it is isolated is also borne out by the structure of the larvae (*vide infra*). Occasionally the smaller species superficially resemble members of the genus *Hexacylloepus*

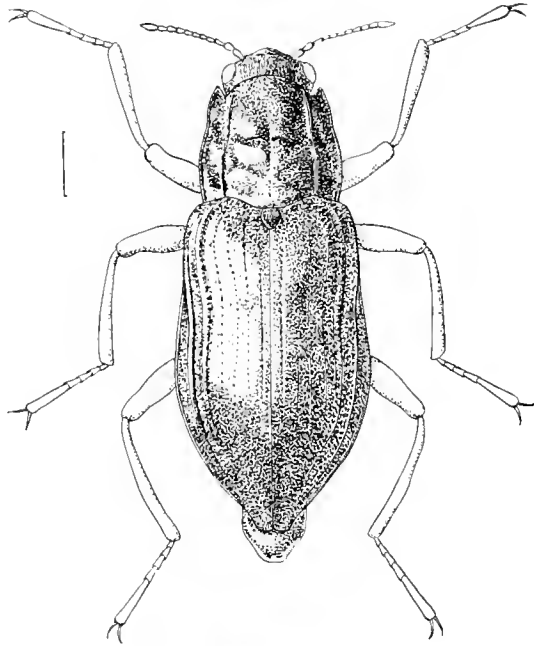


TEXT-FIGS. 334-339.—*Heterelmis longula* Sharp. (334) Maxilla. (335) Dorsal view of left mandible. (336) Ventral view of same. (337) Antenna. (338) Outline of labrum. (339) Outline of apical abdominal tergite.

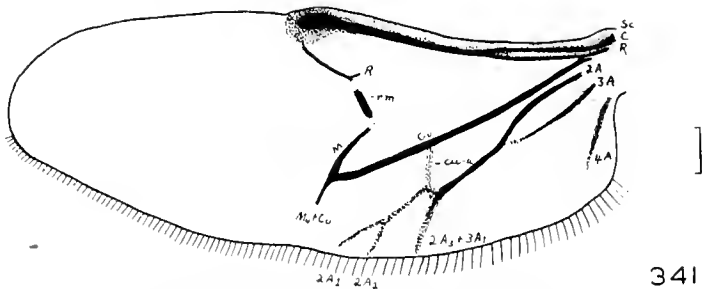
Hinton, but may be distinguished from this genus as follows: (1) the hypomeron always has adjacent to sterno-notal suture a narrow belt of tomentum which extends to anterior margin and there is never a complete transverse belt, whereas in *Hexacylloepus* there is no anterior belt of tomentum adjacent to the sterno-notal suture, and there is at about the middle a complete transverse belt; (2) the hind wing has the second branch of the third anal absent whereas in *Hexacylloepus* it is present; (3) the hind gut has six instead of only four Malpighian tubules; (4) the lateral accessory glands of the male reproductive system are lobed, whereas in *Hexacylloepus* they are not lobed; (5) each ovary has 11 egg tubes instead of only seven; and (6) the central nervous system has the first six abdominal ganglia discrete, whereas in *Hexacylloepus* the first is partly fused to the third thoracic and only two to five are discrete.

The most important characters for distinguishing the various species seem to be the following:

- (1) General proportions, length and breadth.
- (2) Colour.



340



341

TEXT-FIGS. 340, 341.—*Heterelmis longula* Sharp. (340) Adult to show general appearance. (341) Hind wing. Venation after Forbes.

- (3) Size and distribution of the punctures and tubercles on the various sclerites, and density and type of microsculpture, if present, between tubercles and punctures.
- (4) Condition of fronto-clypeal suture.
- (5) Condition of the anterior margin of clypeus and labrum, and also the condition of the angle on each side.
- (6) Outline of pronotum and its general proportions.
- (7) Extent and depth of pronotal impressions.

- (8) Shape of elytral apices.
- (9) Shape of scutellum.
- (10) Shape and extent of prosternal carinae.
- (11) Breadth of prosternal process and shape of posterior margin.
- (12) Extent and depth of the various impressions on disk of metasternum.
- (13) Length and shape of carinae of first abdominal sternite.
- (14) Secondary sexual characters.
- (15) Structure of the male genitalia.

Only one of the species before me has secondary sexual characters, and since only a male has been found, it is entirely by analogy with other genera that the following are considered to be secondary sexual characters :

- (1) Male with the disk of the metasternum strongly concave (*tarsalis*).
- (2) Male with a large oval area of dense, recumbent, testaceous hairs on inner side of posterior gibbosity of metasternal disk (*tarsalis*).
- (3) Male with the apex of front tibiae moderately gibbous (*tarsalis*).
- (4) Male with numerous pale, erect hairs on ventral surface of four basal segments of front and middle tarsi (*tarsalis*).

A KEY TO THE MEXICAN SPECIES OF *Heterelmis*.

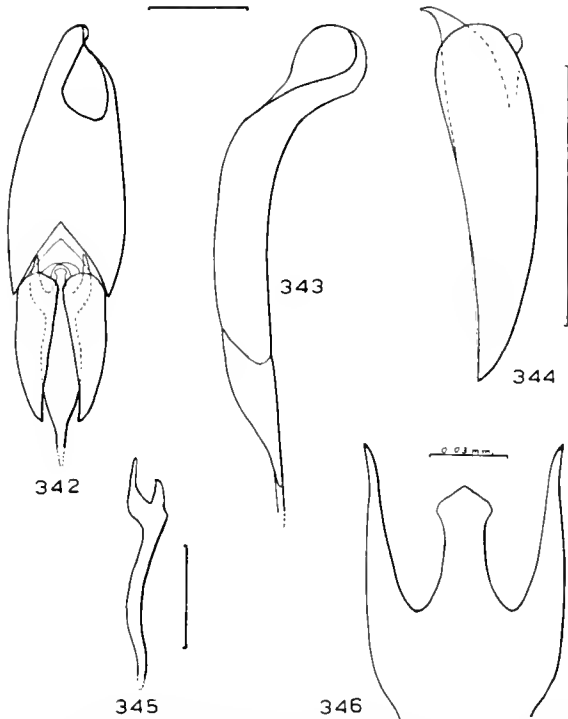
1. Metasternal disk strongly, longitudinally concave for its entire length ; tibiae of front legs clavate ; basal four segments of front and middle tarsi of male with a conspicuous fringe of erect hairs ; male genitalia with the median basal projection of median lobe triangularly broadened. MEXICO *H. tarsalis*, sp. n.
- Metasternal disk only feebly concave posteriorly ; tibiae of front legs not clavate at apex ; basal four segments of front and middle tarsi of male without a conspicuous ventral fringe of erect hairs ; male with the median basal projection of median lobe aciculate, not triangularly broadened 2.
2. Basal segment of all tarsi with two close, stout, short spines on inner apex ; parameres of male genitalia without an inner apical fringe of hairs, though (when stained carefully) with an occasional very minute hair 3.
- Basal segment of tarsi without two stout spines on inner apex ; parameres of male genitalia with an inner apical fringe of moderately long hairs 5.
3. Length of prothorax nearly always more than 0.025 mm. ; median lobe of male genitalia with the basal median projection seen from the side gradually sloping behind. MEXICO *H. longula* Sharp (1887).
- Length of prothorax nearly always less than 0.025 mm. ; median lobe of male genitalia when seen from the side strongly declivous behind 4.
4. Pronotum with the disk not evenly convex, *i.e.* with impressions. MEXICO, GUATEMALA *H. obesa* Sharp (1882).
- Pronotum with the disk evenly convex. MEXICO *H. obesa plana*, subsp. n.
5. Median lobe of male genitalia broad, opposite apices of parameres it is 0.050 mm. broad. TEXAS, MEXICO, GUATEMALA, COSTA RICA, PANAMA, BRAZIL *H. obscura* Sharp (1882).
- Median lobe of male genitalia narrow ; opposite apices of parameres it is 0.170 mm. broad (it has not been possible to separate females of *obscura* from those of *acicula*). MEXICO *H. acicula*, sp. n.

Heterelmis tarsalis, sp. n.

(Text-figs. 342-346.)

Male: Length, 2.2 mm.; breadth, 1.02 mm. Obovate. Surface pubescent as usual in the genus; hairs on dorsal surface usually brownish-piceous. Cuticle moderately shining and black; antennae, mouth-parts and legs rufopiceous. *Head* without distinct impressions; surface minutely, densely eroded and also with the surface of the callosities punctate with fine (about 0.007 mm. broad) punctures which are about half as coarse as facets of eyes and are separated by less than to two or three times their diameters. Clypeus with the fronto-clypeal suture moderately deep and nearly straight; anterior margin feebly, arcuately emarginate for its entire breadth, and with the angle on each side broadly rounded; surface more coarsely and sparsely eroded (or rugulose) than head; the punctures are larger and seldom appear to be on callosities. Labrum with the anterior margin broadly, feebly arcuate and with the angle on each side broadly rounded; surface not eroded, minutely alutaceous, and with punctures which are finer than those of head and slightly sparser. *Pronotum* at broadest point, which is at basal third, broader than long (0.875 mm. : 0.660 mm.) and base broader than apex (0.825 mm. : 0.500 mm.). Sides moderately strongly arcuate at basal third, elsewhere more feebly arcuate but at middle opposite median transverse impression they are feebly sinuate. Median transverse impression broad, moderately strongly impressed, and distinct to sublateral carinae; at middle this impression is crossed by a deep, oval impression which is about 0.075 mm. broad and 0.125 mm. long. Oblique impression begins on middle fourth of basal third of pronotum, is broader and not as deep as transverse impression, nearly meets transverse impression at sublateral carinae, and extends obliquely forwards to meet lateral margin at basal two-fifths. Base on each side of scutellum with a moderately deep, oval impression which is only a little smaller than median discal impression. Surface of pronotum between sublateral carinae with two sizes of punctures as follows; coarse punctures, which are about as large as facets of eyes or occasionally slightly larger, are contiguous to separated by as much as five times their diameters; fine punctures usually about a fourth to a third as coarse and separated by five or more times their diameters (as on apical discal region), though often (as on apical sides) coalescing to form a densely and minutely eroded area; there are also numerous intergradations between these two sizes of punctures. Sides of pronotum between sublateral carinae and lateral margins minutely, densely eroded, and also with round granules which are usually about a third coarser than facets of eyes and are mostly separated by once to twice their diameters. *Elytra* twice as long as pronotum (1.3 mm. : 0.660 mm.) and broadest point is at about apical two-fifths. Striae very feebly impressed, slightly more strongly impressed at sides and apex; strial punctures deep and usually round, on discal region from a fourth to more than a third as coarse as discal intervals and separated longitudinally by once to twice their diameters. Second and third intervals slightly broader than sutural; surface of intervals on a narrow basal belt and laterally beyond inner carinae with occasional granules similar to those of sides of pronotum; surface elsewhere with the punctures from which the hairs arise as fine as finest of pronotum and separated by two to ten times their diameters. *Scutellum* subovate and with only fine punctures similar to those of elytral intervals. *Prosternum* which is unusually broad for this genus has the ratio of breadth (at broadest point which is at basal fourth) to length

0.350 mm. : 0.200 mm. ; the apical margin is broadly truncate with the angle on each side broadly rounded ; the sides are reflexed upwards at an angle of about 30° with the result that the prosternal process appears strongly concave ; on each side from base of process the fine, straight, *i.e.* not oblique, carina extends to apical third of prosternum. Metasternum with the disk strongly concave and sloping downwards anteriorly, and at the bottom of this cavity with a fine, median longitudinal line which extends from posterior margin to anterior fifth ; on each side near posterior margin the disk is strongly and broadly gibbous, and



TEXT-FIGS. 342-346.—*Heterelmis tarsalis* Hinton. (342) Dorsal view of male genitalia. (343) Right lateral view of same. (344) Dorsal view of paramere. (345) Lateral view of median lobe. (346) Dorsal view of base of median lobe.

on the mesal side of each gibbosity is a large, oval patch of testaceous hairs which are as coarse and half again to twice as long as discal hairs ; surface of disk at middle with punctures which are but slightly coarser than those of elytral intervals and are separated by two to five times their diameters ; at sides of disk and on sides of metasternum the surface is often finely and densely eroded and also set with punctures which are slightly coarser than coarse ones of disk of pronotum but are similarly distributed ; extreme sides also with fine granules which are slightly finer than coarse punctures. Abdominal sternites on middle between tomentose portions with punctures a little coarser (base of basal segment with punctures as much as a third coarser) than discal pronotal ones and separated by less than to three times their diameters. *Legs* with the front tibiae gradually becoming stouter towards apex so that at broadest point, near apical fifth, they are 0.100 mm. in diameter. Ventral surface of basal four segments of front

tarsi with about 25 erect hairs which are slightly longer than apical diameter (or occasionally shorter) of the second segment. Ventral surface of basal four segments of middle tarsi have about 60 erect hairs which are slightly longer than apical diameter of second segment. Ventral surface of four basal segments of hind tarsi with an occasional erect hair. *Genitalia* as figured (text-figs. 342-346).

Female: Unknown.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Tejupilco, alt. 3500 ft., vii. 1934 (*H. E. Hinton*).

Comparative notes: This is one of the most aberrant species of the genus. It may be distinguished from all other described species of *Heterelmis* by the following: (1) the straight instead of oblique prosternal carinae; (2) the unusually broad and short prosternal process; (3) the longitudinally concave disk of the metasternum which slopes downwards towards anterior margin; (4) the broadly and strongly gibbous region on each side of posterior part of metasternal disk; (5) the dense patch of testaceous hairs on mesal side of each discal gibbosity; (6) the clavate front tibiae; (7) the fringe of erect hairs on the ventral surface of the four basal segments of all tarsi; and (8) the structure of the male genitalia. It seems probable that of these characters only the first two will be possessed by the female, the others probably being secondary sexual characters.

***Heterelmis longula* Sharp.**

(Text-figs. 334-341.)

1887. *Heterelmis longulus* Sharp, *Biol. Centr.-Amer. Col.*, 1 (2): 775.

Male: Length, 3.5 mm.-4.0 mm.; breadth, 1.2 mm.-1.6 mm. Elongate, subparallel. Dorsal surface clothed with fine, recumbent to suberect, testaceous setae which are usually about 0.075 mm. long and arise from minute punctures which are separated by distances equal to or slightly less than the lengths of the hairs; on elytra these hairs are mainly confined to the surface of the intervals so that in specimens which have not been rubbed they appear to be arranged in longitudinal rows. Ventral surface—apart from tomentose areas—clothed with finer, sparser, and generally slightly longer hairs. Cuticle moderately to strongly shining and black to dark rufo-piceous; antennae, mouth-parts, legs and often middle portion of ventral surface paler rufo-piceous. *Head* without distinct impressions; surface minutely and densely eroded and punctate as follows: throughout with numerous microscopic (about 0.005 mm. broad) punctures; and also with larger (0.020 mm. broad) punctures which are on the small, irregular, flat callosities and are separated by much less than to twice their diameters. Clypeus with the fronto-clypeal suture deeply impressed and nearly straight; anterior margin scarcely noticeably, arcuately emarginate for its entire breadth, and with the angle on each side broadly rounded; surface at sides sculptured similarly to head but on middle region not distinctly eroded and with the punctures slightly coarser and never on callosities. Labrum as figured (text-fig. 338); surface punctate more finely but otherwise similarly to middle region of clypeus; basal region very finely, transversely alutaceous and without coarse punctures. *Pronotum* (for dimensions see Table VIII) with the greatest breadth at about basal third. Sides moderately strongly arcuate at basal third, elsewhere only feebly arcuate; feebly and broadly sinuate at middle half opposite transverse impression. Transverse impression at middle broad, moderately strongly impressed and distinct to sides; at middle bisected by a deep, oval impression

which is (in a specimen 3.60 mm. long) 0.100 mm. broad and 0.125 mm. long; near middle third on basal third of pronotum an oblique impression extends on each side so as nearly to join transverse impression at sublateral carinae, this oblique impression being half again as broad and equally as strongly impressed as the transverse impression. Near base on each side of scutellum in front with an oval feebly impressed area about two-thirds as large as median oval impression. Surface punctate as middle of clypeus, the punctures being of various sizes so that the smallest are no more than a fourth as large as the largest and are usually round but often irregular, and are confluent to separated by about (on apical discal portion) twice their diameters; sides between sublateral carinae and lateral margins slightly more coarsely but otherwise similarly sculptured to middle region of head though often with round granules which are a little larger than punctures. *Elytra* longer than pronotum (ratio usually about 92:42). On basal third feebly but very broadly impressed from first interval to inner carinae. Apices broadly and conjointly rounded. Striae feebly impressed on sides and apical fourth, elsewhere not distinctly impressed; striae punctures deep, round and only occasionally on lateral intervals subquadrate. Intervals with the second and third slightly broader than sutural and with the others narrower; sutural, second, and third elytral intervals on basal third two and one-half times as broad as their respective punctures; surface of intervals occasionally smooth but generally with fine transverse wrinkles and with the punctures at base occasionally as coarse as coarse pronotal ones, though mostly about a fourth to a third as coarse as coarse pronotal ones and separated by two to five times their diameters. *Scutellum* subovate and surface with punctures which are finer and more sparsely separated than usual punctures of elytral intervals. *Prosternum* with the carinae present on basal three-fourths (not including process), straight, as wide apart as process at base, prominent on basal half and indistinct on apical fourth; sides of process strongly and broadly gibbous so that middle of process is concave; process as broad as in the great majority of the species and with the posterior margin feebly rounded, nearly truncate. *Metasternum* with the median longitudinal line attaining anterior fourth of disk, anteriorly fine but posteriorly, particularly on posterior third, broader and deeper. Disk only feebly convex on each side of median impression; surface of disk with the punctures usually round, about as coarse as coarsest of pronotum, and separated by less than twice their diameters; surface between punctures smooth, though at sides, particularly anteriorly, very densely set with punctures which are about a fifth again as coarse as usual ones and here also densely and finely eroded and with an occasional granule which is about half as broad as coarse mesal punctures. Abdominal sternites with the non-tomentose areas punctate as disk of metasternum except for basal three-fifths of basal segment which is slightly more coarsely and densely punctate. *Genitalia* of male as figured (text-figs. 347-352).

Female: Externally similar to male.

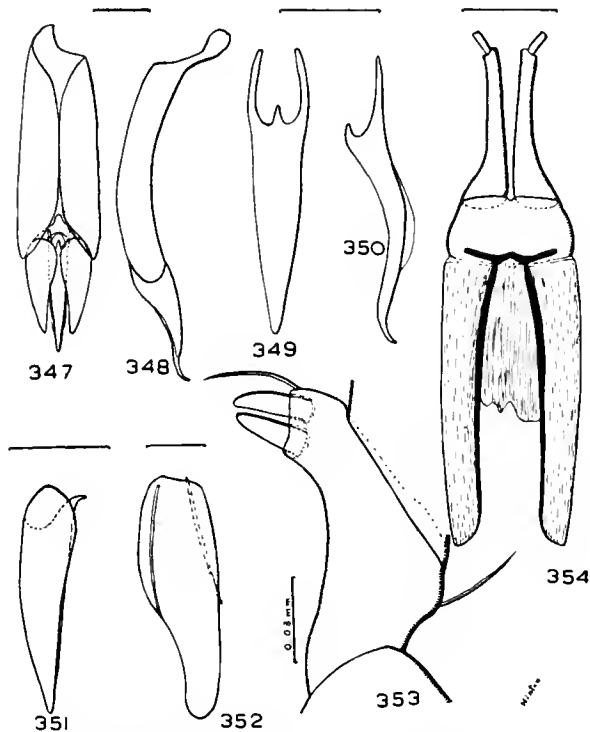
Type: In the British Museum (Nat. Hist.). MEXICO: Salazar (*Flohr*).

Specimens examined: MEXICO: 1, Salazar (*Höge*); 1, Las Vigas (*Flohr*); 4, Fedral District, La Venta, 1933 (*H. E. Hinton, R. L. Usinger*); and 160, Dist. de Temascaltepec, Temascaltepec to Las Cruces, alt. 5600-6000 ft., vi-vii, 1932-34 (1932, 1934, *H. E. Hinton*) (1933, *H. E. Hinton, R. L. Usinger*).

Variations: The punctuation of the various sclerites may be slightly finer or coarser than that of the specimen described above, the transverse impressions of the pronotum are often deeper and broader or shallower and narrower, and the median oval impression of the pronotal disk in exceptional cases is half as broad

and slightly longer than in the specimen described above. The transverse impression on basal third of elytra is occasionally absent. In a few specimens there is on the pronotal disk a narrow and very shallow impression extending from base to discal oval impression.

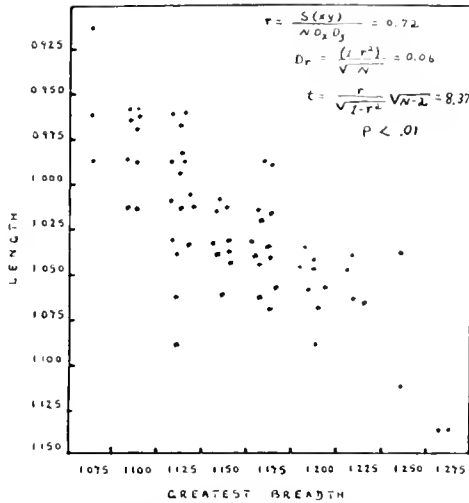
The following remarks apply to the District of Temascaltepec. *H. longula* occurred nowhere below 5600 ft. It was the only Elmids taken as high as 9000 ft. From my data it is not possible to determine at which altitude this species was most abundant. The majority of the specimens before me were taken at altitudes above 7000 ft. At this altitude most of the other Elmids began to fall off



TEXT-FIGS. 347-354.—*Heterelmis longula* Sharp. (347) Dorsal view of male genitalia. (348) Right lateral view of same. (349) Dorsal view of median lobe. (350) Right lateral view of median lobe. (351) Dorsal view of paramere. (352) Abdominal spicule of male. (353) First segment of front tarsus. (354) Female genitalia.

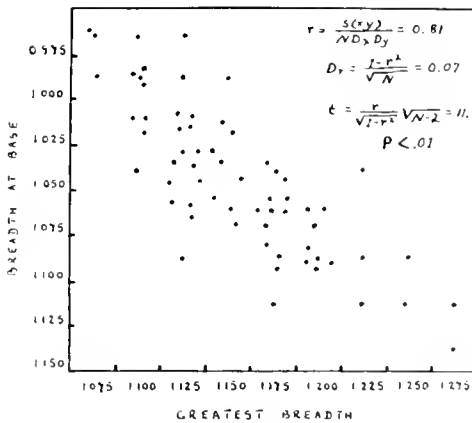
rapidly in numbers, so that even if the numbers of *longula* had remained constant at the different altitudes the method used for collecting would yield the greater number at the greater altitude. At 5600-7500 ft., for example, it was often not possible to examine more than 10 to 20 netfuls a day, so great were the numbers of Elmids in each netful, but at 8000 ft. more netfuls could be examined in the same time. The material was divided into two groups, 58 collected between 5600 and 7500 ft. and 66 collected between 7500 and 9000 ft. Owing to insufficient accurate altitude data the two groups are divided at the 7500-ft. level very inaccurately, and it is not unlikely that specimens placed in the first group in reality belong to the second and *vice versa*. However, this difficulty in separating the two samples at their adjacent levels does not materially affect what follows.

All specimens were measured for the length of the pronotum, breadth at base, breadth at broadest point (which is at about basal third), and breadth across apex. The results of a statistical study of these measurements are recorded in Table VIII. The chief interest of this table is that it shows that the individuals



355

TEXT-FIG. 355. —*Heterelmis longula* Sharp. Dot diagram of the correlation between the length of the prothorax and the breadth at broadest point. Measurements are given in mm.



356

TEXT-FIG. 356. —*Heterelmis longula* Sharp. Dot diagram of the correlation between the breadth at base of the prothorax and the breadth at broadest point. Measurements are given in mm.

living at altitudes of 5600-7500 ft. are on the whole larger than those living above 7500 ft. The differences between the means of the two samples may be regarded as significant for the four different measurements (Table IX). An increase in one of the prothoracic measurements indicates an increase in absolute size, for the length of the prothorax was found to be highly and positively correlated with the absolute length of the individual and the length of the prothorax highly and

positively correlated with its breadth. Using the formula $r = \frac{S(xy)}{NDxDy}$, where r is the coefficient of correlation, $S(xy)$ the sum of the products of x and y for each individual— x and y being the differences between the individual measures and their means, N is the number of individuals and Dx and Dy the standard deviation of the two series, $r = 0.720$ for length times breadth at broadest point (text-fig.

355). From the formula $D_r \sqrt{\frac{1-r^2}{N}}$ the standard deviation of the coefficient of

correlation is found to be 0.06. The formula $t = \frac{r}{\sqrt{\frac{1-r^2}{N-2}}}$ gives the value of t as 8.37, and this value in Fisher's (1936) table V A shows that it is extremely improbable that the value for r should have arisen by random sampling from an uncorrelated population, the probability being very much less than .01. For breadth at broadest point times breadth at base (text-fig. 356) $r = 0.81 \pm 0.07$, $t = 11$ and $P < .01$.

TABLE VIII.

Sample.	Pronotum.	Mean.	Max.	Min.	S. D.	S.E.D.	S.F. M.	Numbers.
A	Length	1.073	1.150	1.000	0.0342	0.00324	0.0043	58
B	"	1.035	1.150	0.925	0.0423	0.00368	0.0052	66
A	Broadest	1.108	1.325	1.075	0.0450	0.00420	0.0059	58
B	"	1.155	1.275	1.075	0.0478	0.00415	0.0059	66
A	Breadth at apex	0.784	0.850	0.725	0.0260	0.00246	0.0034	58
B	"	0.760	0.850	0.700	0.0282	0.00245	0.0035	66
A	" Base "	1.004	1.175	0.975	0.0306	0.00375	0.0052	58
B	"	1.054	1.150	0.975	0.0430	0.00372	0.0052	66

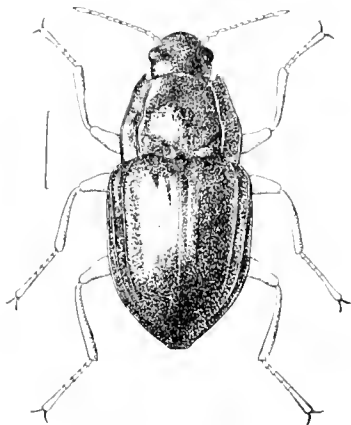
The altitude of sample A is 5000–7500 ft., while that of sample B is 7500–9000 ft. Measurements are given in mm. S.D. equals standard deviation, S.E.D equals standard error of the deviation, and S.E.M. equals standard error of the mean.

TABLE IX.

Prothorax.	x .	P.
Length	5.43	$< 10^{-7}$
Breadth at broadest	4.82	$< 10^{-5}$
Breadth at apex	3.77	$= 10^{-4}$
Breadth at base	1.4	$= .16$

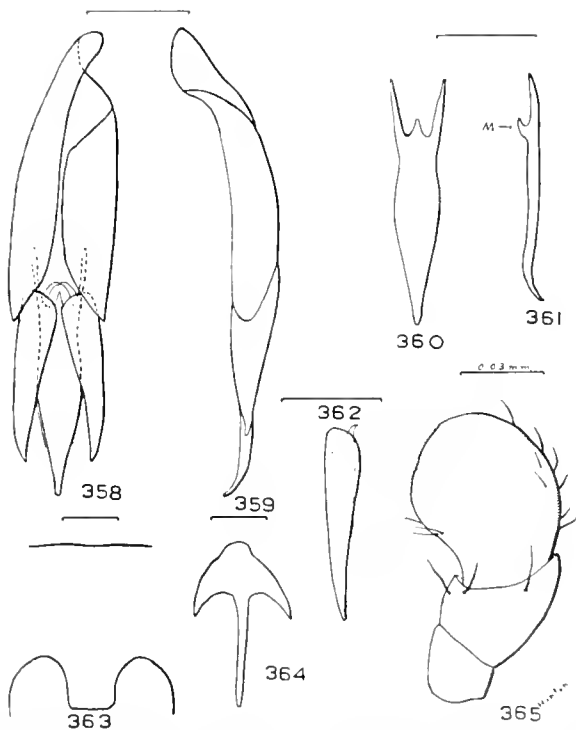
The significance of the difference between the means of the two samples of *longula* from different altitudes has been calculated from the formula $x = \frac{M_1 - M_2}{\sqrt{(S.E.M._1)^2 + (S.E.M._2)^2}}$ where M is the mean and S.E.M. the standard error of the mean.

Comparative notes: This is the largest North American species of *Heterelmis*. It is close only to *H. obesa* from which it may be distinguished as follows: (1) the parameres of the male genitalia are broader in *longula*; and (2) the median lobe when seen from the side is broader and more sinuate, and the basal median projection is gradually sloping behind instead of strongly declivous as in *obesa* (cf. text-figs.). Nearly all individuals may be separated from *obesa* by their greater length, the pronotum nearly always being more than 0.925 mm. long. It has not been possible to separate very small females from large females of *obesa*.



357

TEXT-FIG. 357.—*Heterelmis obesa* Sharp.



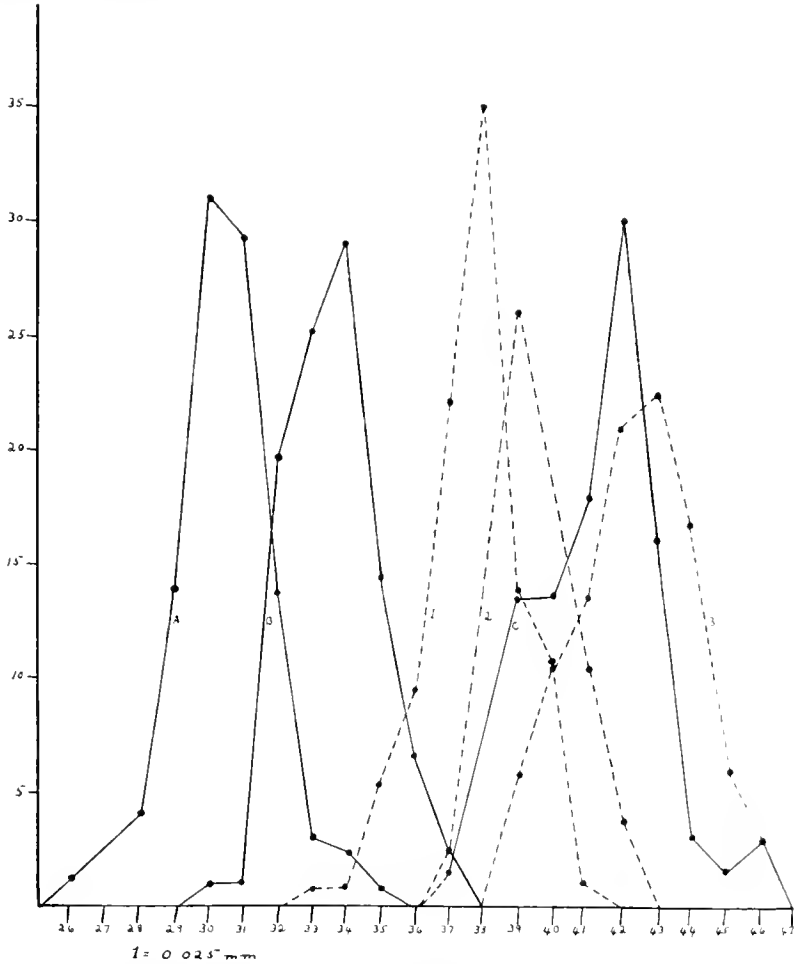
TEXT-FIGS. 358-365. —*Heterelmis obesa* Sharp. (358) Dorsal view of male genitalia. (359) Left lateral view of same. (360) Dorsal view of median lobe of male genitalia. (361) Right lateral view of median lobe. (362) Sublateral view of paramere. (363) Prosteronum. (364) Sixth abdominal sternite of male. (365) Labial palp.

Heterelmis obesa Sharp.

(Text-figs. 357-365.)

1882. *Heterelmis obesus* Sharp, *Biol. Centr.-Amer. Col.*, **1** (2) : 131, t. 4, f. 10.

Male : Length, 2.5 mm.-2.3 mm. ; breadth, 1.1 mm.-1.5 mm. Similar to *longula* except as follows : (1) length of prothorax nearly always less than 0.925



366

TEXT-FIG. 366.—Frequency polygons of prothoracic dimensions of *Heterelmis* adjusted to equal areas. Smooth line refers to length of prothorax, while broken line refers to its breadth at base. (A and 1) *H. obesa plana* Hinton; (B and 2) *H. obesa* Sharp; (C and 3) *H. longula* Sharp.

mm. ; (2) pronotum seldom with a median discal impression but in the rare specimen where this impression is well-developed it is never as deep as that of *longula*, though it is often proportionally as broad and long ; (3) elytra only rarely with a visible transverse impression on basal third ; (4) median lobe of male genitalia with the basal median projection, seen from the side, sharply

instead of gradually sloping behind; and (5) the parameres are narrower than those of *longula*.

Female: Externally similar to male.

Type: In the British Museum (Nat. Hist.). GUATEMALA: San Joaquín (*G. C. Champion*).

Specimens examined: 8, with same data as the type. 5003 from MEXICO as follows: 7, Altisco (*F. D. Godman*); District of Femascaltepec: 4708, Femascaltepec to Real de Arriba, alt. 5000-7500 ft., 5.vii.1932 (*H. E. Hinton*), 1933 (*H. E. Hinton, R. L. Usinger*), and 1934 (*H. E. Hinton*); 278, Río Verde de la

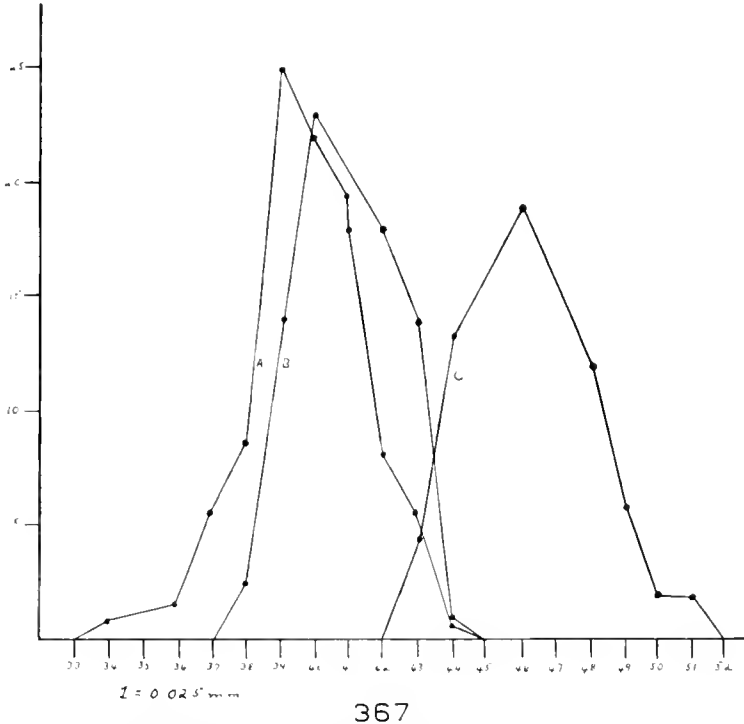


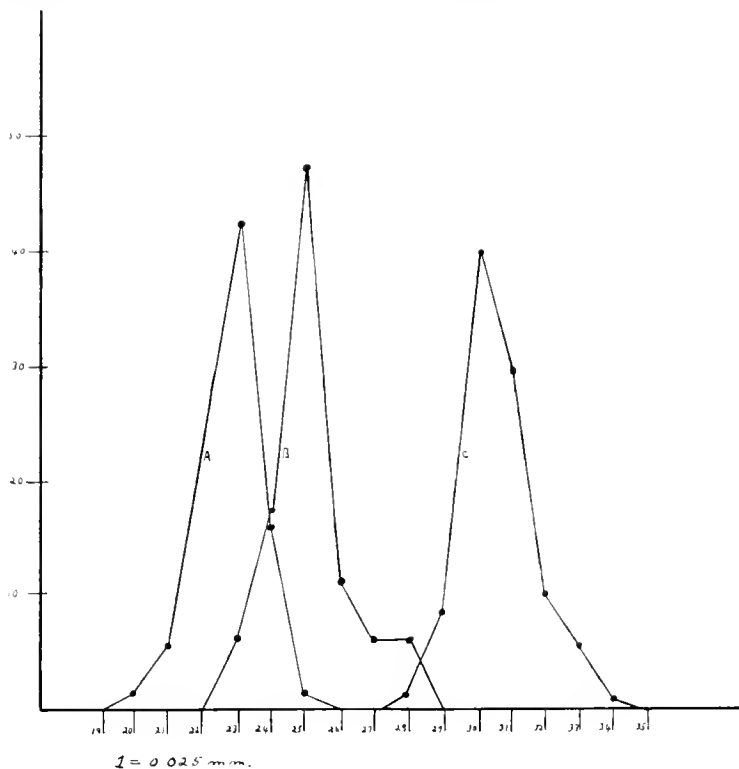
FIG. 367.—Frequency polygons adjusted to equal areas of the breadth of the prothorax at broadest point. (A) *Heterelmis obesa plana* Hinton; (B) *H. obesa* Sharp; (C) *H. longula* Sharp.

Comunidad, alt. 8000 ft., 14.vi.1934 (*H. E. Hinton*); 1, Tejupilco, alt. 3500-4000 ft., vi-vii, 1932 (*H. E. Hinton*), 4, 1933 (*H. E. Hinton, R. L. Usinger*), and 1, 1934 (*H. E. Hinton*); 4, Estado de Morelos, Cuernavaca, alt. 4800 ft., vi.1934 (*H. E. Hinton*).

Variations: The punctuation of the various sclerites is similar to that of *longula*, and the variations in density are much the same. In a few specimens the transverse pronotal impression is barely noticeable, but in the great majority it is as well developed as that of *longula*.

A statistical study was made of the prothoracic measurements of two samples selected at random to find out if there was an increase of size with an increase in altitude. 45 specimens were taken from 5000-7500 ft. and 75 from 8000 ft., and the pronotum of all was measured for length, breadth at broadest point

(usually at about basal third), breadth across base, and breadth across apex. The results of this study are shown in Table X. Table XI shows that there are no significant differences between the means of the various prothoracic measurements, so that it appears that a difference in altitude of probably more than 500 ft. does not on the whole affect the absolute size of the individual.



368

TEXT-FIG. 368.—Frequency polygons adjusted to equal areas of the breadth of the prothorax at apex. (A) *Heterelmis obesa plana* Hinton; (B) *H. obesa* Sharp; (C) *H. longula* Sharp.

TABLE X.

Numbers.	Pronotum.	Mean	Max.	Min.	S.D.	S.E.D.	S.E.M.
75	Length	0.841	0.925	0.750	0.0345	0.00282	0.0040
45	..	0.820	0.875	0.775	0.0246	0.00200	0.0037
75	Broadest	1.024	1.100	0.950	0.0375	0.00315	0.0045
45	..	1.025	1.075	0.950	0.0340	0.00352	0.0050
75	Base	0.084	1.050	0.025	0.0305	0.00242	0.0035
45	..	0.090	1.050	0.025	0.0310	0.00328	0.0047
75	Apex	0.030	0.700	0.575	0.0335	0.00274	0.0033
45	..	0.025	0.675	0.575	0.0238	0.00251	0.0030

The sample, consisting of 75 specimens, was collected at 6000 ft., while the other was collected between 5000 and 7500 ft. Lengths are given in mm. S.D. equals standard deviation, S.E.D. equals standard error of the deviation, and S.E.M. equals standard error of the mean.

Comparative notes: Its small size usually enables it to be easily distinguished from *longula*, but, as may be seen from the frequency polygons (text-figs. 366-368), the various pronotal measurements occasionally overlap. When *obesa* is the same size as *longula*, the males can only be distinguished by an examination of the male genitalia and the females cannot, as far as I know, be separated.

TABLE XI.

Pronotum.	x.	P.
Length	0.94	.35
Breadth at broadest	0.06	.95
Breadth at base	0.03	.53
Breadth at apex	0.42	.67

The difference between the means of the various pronotal measurements is significant in no case. Even where the difference is greatest, *i.e.* between the means for length, it is not twice the standard error of the mean.

Heterelmis obesa plana, subsp. n.

(Text-figs. 369, 370.)

Male: Length, 2.12 mm.-2.65 mm.; breadth, 1.00 mm.-1.25 mm. Similar to *obesa* except as follows: (1) there is no distinct transverse impression on the pronotum; (2) it is a slightly smaller species (Table XII); and (3) the pronotum is proportionally broader, the value for the mean of the length into that of the breadth at broadest point is 1.30, while the value for *obesa* is 1.24.

Female: Externally similar to male.

Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Tejnpileco, alt. 3500-4000 ft., vii.1934 (*H. E. Hinton*).

Paratypes: MEXICO: 7, with same data as type; 1178, Estado de Morelos, Cuernavaca, alt. 4800 ft., vi.1934 (*H. E. Hinton*); 7, Sierra de Durango (*C. Schaufuss*); and 1, Cuantla (*Höge*).

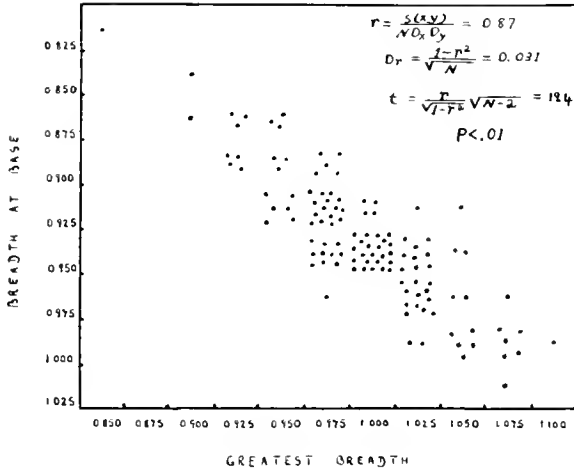
Variations: There is a little variation in the density of the punctures on various sclerites, but no other variations worthy of mention have been observed.

The coefficient of correlation, *r*, for length times breadth at broadest point is: $r = 0.79 \pm 0.034$, $t = 11.4$ and $P < .01$. For breadth at broadest point times breadth at base, $r = 0.87 \pm 0.03$, $t = 10.4$ and $P < .01$.

TABLE XII.

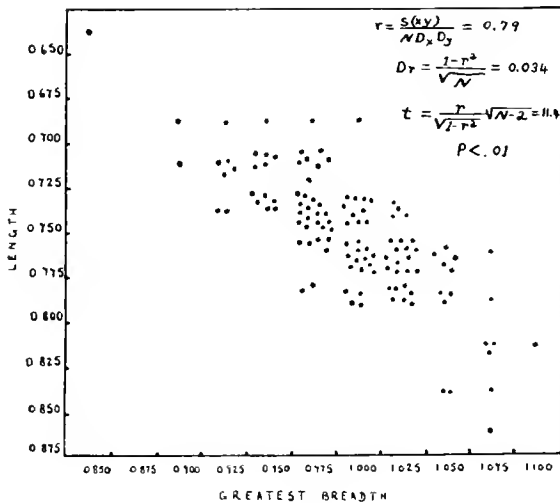
Pronotum	Mean	Max	Min	S.D.	S.E.D.	S.E.M.	Numbers
Length	0.793	0.875	0.650	0.0342	0.00250	0.00312	122
Broadest	0.094	1.100	0.850	0.0413	0.00295	0.00370	122
Base	0.044	1.025	0.825	0.0358	0.00220	0.00905	122
Apex	0.597	0.925	0.500	0.0222	0.00142	0.00370	122

Lengths given in mm. of various pronotal measurements of a sample selected at random of *H. obesa plana* from Cuernavaca. S.D. equals standard deviation, S.E.D. equals the standard error of the deviation, and S.E.M. equals the standard error of the mean.



369

TEXT-FIG. 369.—*Heterelmis obesa plana* Hinton. Dot diagram of the correlation between the breadth of the prothorax at base and the breadth at broadest point. Measurements are given in mm.



370

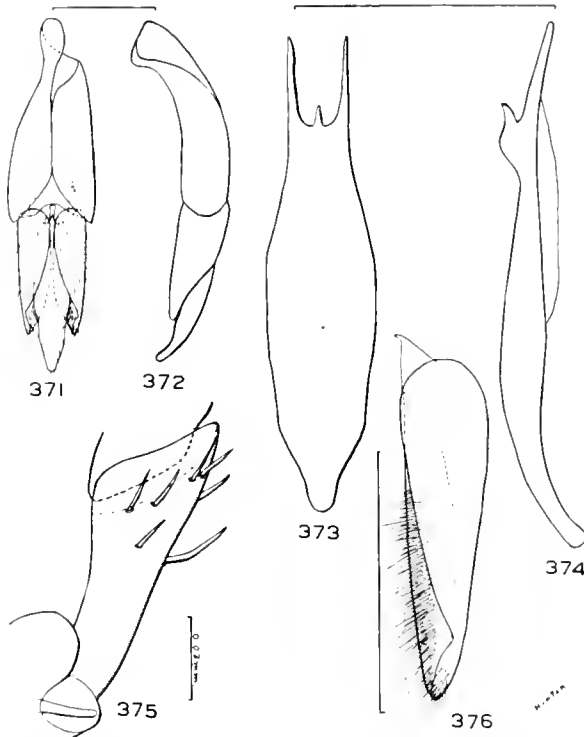
TEXT-FIG. 370.—*Heterelmis obesa plana* Hinton. Dot diagram of the correlation between the breadth of the prothorax at broadest point and its length. Measurements are given in mm.

Heterelmis obscura Sharp.

(Text-figs. 371-376.)

1882. *Heterelmis obscurus* Sharp, *Biol. Centri.-Amer. Col.*, **1** (2) : 139.1888. *Heterelmis obscura* Grouvelle, *Ann. Soc. Ent. Fr.*, **8** (6) : 400, t. 7, f. 8.

Male: Length, 1.9 mm.-2.2 mm.; breadth, 0.9 mm. 1.1 mm. Similar to *H. obesa* except as follows: (1) the body is as a general rule proportionally more elongate, seldom as broad; (2) the impressions of the pronotum, particularly



TEXT-FIGS. 371-376. —*Heterelmis obscura* Sharp. (371) Dorsal view of male genitalia. (372) Left lateral view of same. (373) Dorsal view of median lobe. (374) Right lateral view of median lobe. (375) First segment of front tarsus. (376) Dorsal view of right paramere.

apical transverse impression, are deeper and more distinct, these impressions being similar to those of *longula* but the median discal impression is as a rule not so well developed; (3) the ventral apex of the basal segment of all tarsi is as figured (text-fig. 375), *i.e.* without two stout spines as in *obesa* and other members of the *longula* group; and (4) the parameres of the male genitalia (text-figs. 371-374, 376) have a conspicuous fringe of fine, long hairs on the inner apical half.

Female: Externally similar to male.

Type: In the British Museum (Nat. Hist.). GUATEMALA: San Joaquín (*G. C. Champion*).

Specimens examined: 34, with same data as type; and 3, GUATEMALA: Guatemala City (*G. C. Champion*). TEXAS: 1, Ft. Sam Houston. COSTA RICA:

I, San Jose, alt. 1000-1200 m., 18.v.1931 (*F. Nevermann*); and 1, Coronado, alt. 1400-1500 m. 1607 from MEXICO as follows: 249, Estado de Morelos, Cuernavaca, alt. 4800 ft., vi.1934 (*H. E. Hinton*); Dist. de Temascaltepec: 21, Tejupilco, alt. 3500-4000 ft., vi-1933 (*H. E. Hinton, R. L. Usinger*); 13, as preceding but in vii.1934 (*H. E. Hinton*); 1324, from Temascaltepec to Rio Verde de la Comunidad, alt. 5600-8000 ft., v-vii (1932, 1934, *H. E. Hinton*) and 1933 (*H. E. Hinton, R. L. Usinger*).

Other locality records: Grouvelle (1888, *loc. cit.*) has recorded this species from Theresopolis, Brazil, but since he did not compare the male genitalia of his specimens with those of typical *obscura* from Central America, his locality record cannot be considered as proof that this species occurs in southern Brazil.

Variations: As usual, the punctures on the different sclerites vary slightly in density, and, apart from size, no other variations worthy of mention have been observed.

TABLE XIII.

Numbers.	Pronotum.	Mean.	Max.	Min.	S.D.	S.E.D.	S.E.M.
28	Length	0.682	0.725	0.625	0.0256	0.00349	0.00495
38	"	0.662	0.725	0.600	0.0290	0.00334	0.00477
73	"	0.650	0.700	0.600	0.0242	0.00202	0.00280
14	"	0.648	0.700	0.600	0.0340	0.0057	0.00835
28	Broadest	0.826	0.900	0.750	0.0325	0.00432	0.00627
38	"	0.802	0.850	0.750	0.0265	0.0034	0.00435
73	"	0.795	0.875	0.725	0.0339	0.00282	0.0040
14	"	0.788	0.825	0.750	0.0257	0.00485	0.00705
28	Base	0.784	0.850	0.725	0.0375	0.00419	0.00593
38	"	0.770	0.850	0.725	0.0205	0.0035	0.00437
73	"	0.754	0.825	0.700	0.0312	0.0026	0.00368
14	"	0.750	0.775	0.700	0.0218	0.00413	0.00607
28	Apex	0.541	0.575	0.475	0.0255	0.00348	0.00495
38	"	0.534	0.575	0.500	0.0220	0.00375	0.00377
73	"	0.528	0.575	0.475	0.0210	0.00175	0.00248
14	"	0.525	0.575	0.500	0.0183	0.00345	0.00507

The sample of 28 specimens is from Rio Verde de la Comunidad, alt. 8000 ft.; that of 38 is from Temascaltepec to Real de Arriba, alt. 5600-7500 ft.; that of 73 is from Cuernavaca, alt. 4800 ft.; and that of 14 is from Tejupilco, alt. 3500-4000 ft. The measurements are given in mm. S.D. equals the standard deviation, S.E.D. equals the standard error of the deviation, and S.E.M. equals the standard error of the mean.

A statistical study was made of the length of the pronotum and the breadth at three different points. The samples were selected at random and each of the four samples is from a different altitude. The results of this study are recorded in Table XIII, and the significance of the difference of the means for all possible pairs of altitude samples is given in Table XIV. A comparison of the sample (73) collected at Cuernavaca (4800 ft.) with (14) that collected at Tejupilco (3,500-4000 ft.) shows that for each pronotal measurement the mean value is slightly greater for the former, but in no case is the difference significant. The minimum difference in the altitude between these two samples is 800 ft. This fact justifies the conclusion that in latitude 19° N. a difference in altitude of more than 800 ft. is probably necessary before any significant difference in size can be detected.

TABLE XIV.

Sample	Length of pronotum		Broadest point		Breadth at base		Apex	
	x	P	x	P	x	P	x	P
28 } 73 }	5.4	10 ⁻⁷	4.4	10 ⁻⁴	4.38	10 ⁻⁵	2.20	.03
38 } 28 }	3.01	.01	2.84	.01	1.84	.07	1.11	.27
38 } 73 }	1.77	.07	1.20	.21	2.08	.11	1.20	.20
28 } 14 }	3.49	10 ⁻³	4.04	10 ⁻⁴	4.00	10 ⁻⁴	2.20	.03
38 } 14 }	1.35	.18	1.81	.07	2.72	.01	1.45	.15
73 } 14 }	0.35	.72	0.94	.35	0.48	.03	0.90	.55

The altitudes of the four samples are given in Table XIII. The significance of the difference between the means of the samples was calculated from the formula $x = \frac{M_1 - M_2}{\sqrt{(\text{S.E.M.}_1)^2 + (\text{S.E.M.}_2)^2}}$ where M is the mean and S.E.M. the standard error of the mean. The probabilities, P , for the various values of x were found in Fisher's (1936) table of x .

Comparative notes: No difficulty is met with in distinguishing *H. obscura* from the species belonging to the *H. longula* group, all of which have the first segment of the tarsi modified. In size and general appearance *obscura* only approaches—of those species I have already dealt with—*obesa*, and apart from the differences mentioned above, the pronotal measurements of these two but rarely overlap; and in practice it has been possible to separate them on size with great ease, only about 1 in 200, being mistaken.

Heterelmis acicula, sp. n.

(Text-figs. 377-381.)

Male: Length, 1.0 mm.-2.2 mm.; breadth, 1.0 mm.-1.1 mm. Similar to male of *obscura* except as regards the structure of the male genitalia (*cf.* text-figs.) which differ as follows: (1) the parameres are more slender and the apical fringe of hairs is sparser; (2) the median lobe is narrower (0.0170 mm. broad) opposite apices of parameres, whereas the median lobe of *obscura* at the same point is 0.050 mm. broad; and (3) the basal median projection of the median lobe is, when seen from the side, rounded instead of pointed at the end, and immediately behind is strongly instead of feebly sinuate.

Female: Unrecognized. There are probably a number of females before me, but if so, I cannot distinguish them from the females of *obscura*. This means that wherever *obscura* and *acicula* are found together, *e.g.* in Tejupileco, female specimens cannot be assigned to their respective species.

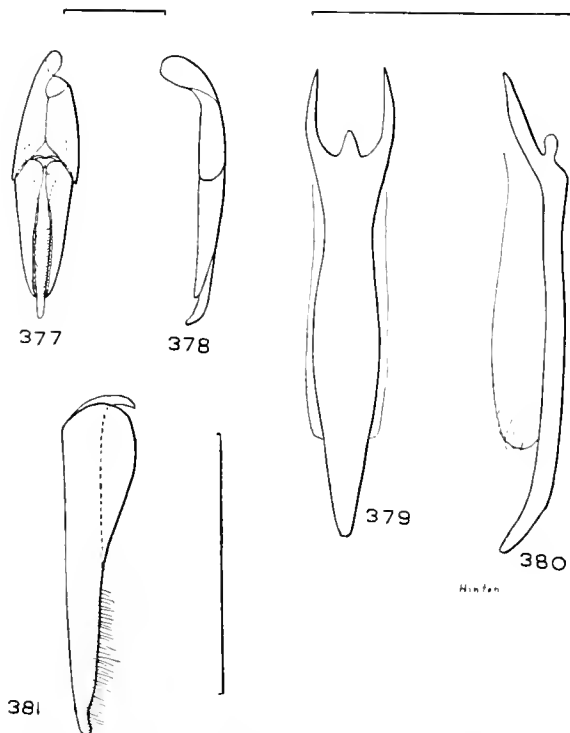
Type: ♂ in the British Museum (Nat. Hist.). MEXICO: Dist. de Temascaltepec, Tejupileco, alt. 3500-4000 ft., vii, 1934 (*H. E. Hinton*).

Paratypes: 15, with data as above; and 16, collected in the same locality in vi, 1933 (*H. E. Hinton, R. L. Usinger*).

Variations: No variations worthy of mention have been observed.

Comparative notes: 19 male specimens were used in a statistical study to determine the means of four pronotal measurements and the significance of the

differences between these means and those of 14 male specimens of *H. obscura* also collected in Tejupilco. From the results given in Table XV it is obvious that *acicula* is a smaller species. In Table XVI the probabilities of the two species being homogeneous for size are given. When *acicula* occurs at the same altitude and latitude as *obscura* it is a smaller species. It is important to remember that these size differences between the two species only apply in the same altitudes and latitudes, e.g. if the great difference in the size of *obscura* taken above 7000 ft. and below 4000 ft. is considered, it can be reasonably inferred that at lower altitudes than Tejupilco we will get populations equal in size to those of *acicula* at Tejupilco.



TEXT-FIGS. 377-381.—*Heterelmis acicula* Hinton. (377) Dorsal view of male genitalia. (378) Left lateral view of same. (379) Dorsal view of median lobe of male genitalia. (380) Left lateral view of same. (381) Dorsal view of left paramere.

LARVAE.

The larvae have not been associated with *Heterelmis* by rearing but by constantly finding them associated with the adults over a number of years and in many localities in Mexico, Peru, Bolivia, Brazil, French Guiana, and Trinidad (B.W.I.). A distributional map of the larvae here considered to belong to *Heterelmis* will fit only that of the adults of *Heterelmis*.

Generic Characters of Larvae of Heterelmis.

Body subparallel and cylindrical to subtriangular in cross section; dorsal surface (except for ninth abdominal tergite which has median longitudinal ridge)

evenly convex and with parallel, feebly oblique rows of closely placed and large tubercles each of which bears a large, stout spine. *Head* when seen from above exposed and not concealed by the pronotum; anterior margin on each side between base of antenna and clypeus with a large and acute tooth. Clypeus with the fronto-clypeal suture well developed. With one ocellus on each side. Antenna (Text-fig. 388) 3-segmented and feebly retractile. Mandibles of both sides similar and with three obtuse, apical teeth; prostheca long, slender, and densely spinose. Maxilla (text-fig. 386) with the palp 4-segmented and the stipes showing no differentiation into a palpifer; galea and lacinia separate and apex

TABLE XV.

Species	Pronotum.	Mean.	Max.	Min.	S. D.	S. E. D.	S. E. M.	Numbers.
<i>obscura</i>	Length	0.648	0.700	0.600	0.0340	0.0057	0.00535	14
<i>acicula</i>	"	0.616	0.650	0.600	0.0151	0.00245	0.00360	10
<i>obscura</i>	Broadest	0.788	0.825	0.750	0.0257	0.0048	0.00705	14
<i>acicula</i>	"	0.795	0.800	0.725	0.0191	0.0031	0.00452	10
<i>obscura</i>	Base	0.750	0.775	0.700	0.0218	0.0041	0.00607	14
<i>acicula</i>	"	0.727	0.750	0.700	0.0165	0.0026	0.00388	10
<i>obscura</i>	Apex	0.525	0.575	0.500	0.0183	0.0034	0.00507	14
<i>acicula</i>	"	0.491	0.525	0.475	0.0160	0.0027	0.00397	10

Measurements are given in mm. S. D. equals standard deviation, S. E. D. equals standard error of the deviation, and S. E. M. equals standard error of the mean. Both samples are from Teapulco, alt. 3500-4000 ft.

TABLE XVI.

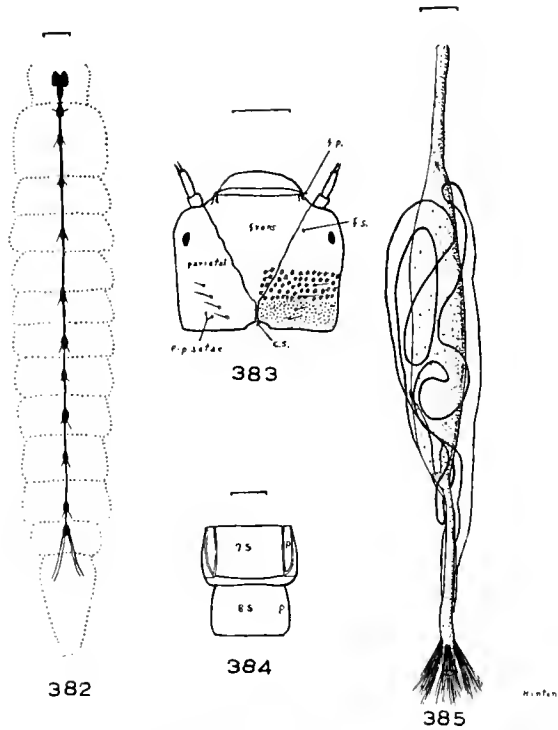
Pronotum	χ^2	P
Length	3.51	10^{-4}
Breadth at broadest	2.58	.01
Breadth at base	3.00	10^{-3}
Breadth at apex	4.40	$< 10^{-5}$

The significance of the difference of the means of four pronotal measurements of *obscura* compared with *acicula* was calculated from the formula $x = \frac{M_1 - M_2}{\sqrt{(S.E.M_1)^2 + (S.E.M_2)^2}}$ where M is the mean and S.E.M. the standard error of the mean. The probabilities for various values of x were found in Fisher's (1930) table of χ^2 . The samples of both species are from Teapulco.

of each densely spinose. Labium with the postmentum undivided; labial palp (text-fig. 387) 2-segmented and prementum without a distinct palpiger. Gula well developed. Prothoracic pleura (text-fig. 391) divided into two parts and anterior part meeting on middle line of body so that the sternum is here completely suppressed. Meso- and metapleura divided into three parts on each side (text-fig. 391). Abdominal segments one to seven with the pleura bounded by tergo- and sterno-pleural sutures which in seventh segment (text-fig. 384) converge and meet near posterior margin; segment 8 forming a complete sclerotized ring; apex of ninth very feebly and broadly, arcuately emarginate. Operculum (text-fig. 401) with two strongly sclerotized claws (text-fig. 398) attached to its dorsal membrane. Spiracles present on mesothorax and first eight abdominal segments and opening at apices of small tubercles; tracheae without air sacs; with three tufts of anal, retractile, tracheal gills. *Alimentary canal* (text-fig. 385)

with an oesophageal sclerite on the dorsal posterior margin of the oesophagus. Hind gut with six Malpighian tubules which end freely near the rectum. *Central nervous system* (text-figs. 382) with three thoracic and eight abdominal discrete ganglia.

The larvae of this genus have a very characteristic appearance due to the slightly oblique and parallel rows of close and large tubercles. Each tubercle bears a spine so that the larvae appear to have a series of sharply carinate ridges when viewed dorsally. The division of the meso- and metapleura into three parts on each side will distinguish the genus from all genera except *Phanocerooides* Hinton,



TEXT-FIGS. 382-385.—Larva of *Heterelmis longula* Sharp. (382) Central nervous system. (383) Dorsal view of head. (384) Ventral view of seventh abdominal segment to show sclerotization. (385) Alimentary canal.

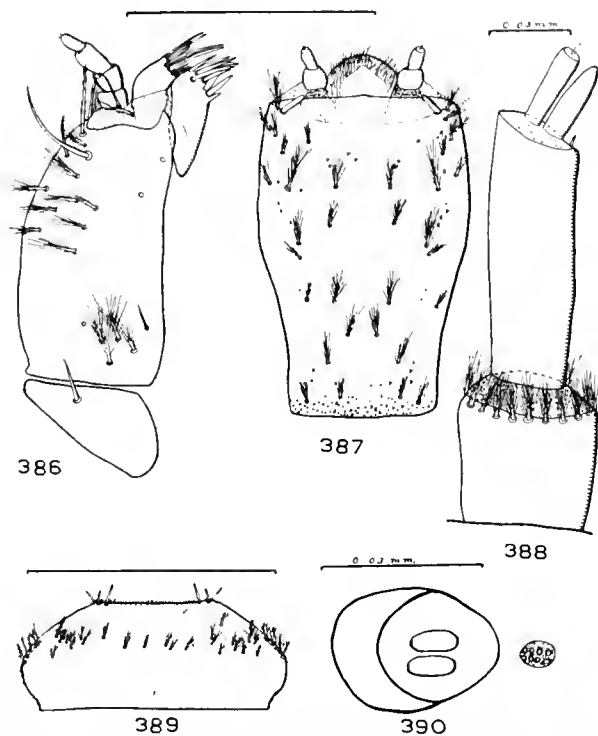
and from this it may be distinguished as follows: (1) its cylindrical instead of flattened and onisciform body; (2) the prothoracic pleura are divided into anterior and posterior parts, whereas in *Phanocerooides* they are undivided; and (3) by the eighth abdominal segment which here forms a complete sclerotized ring, whereas in *Phanocerooides* it has the pleura bounded by tergo- and sterno-pleural sutures.

Description of Mature Larva of Heterelmis longula Sharp.

(Text-figs. 382-401.)

Length, 7.6 mm.; breadth, at broadest point which is near apex of abdomen 1.0 mm. *Head* with the frontal sutures complete (text-fig. 383); coronal

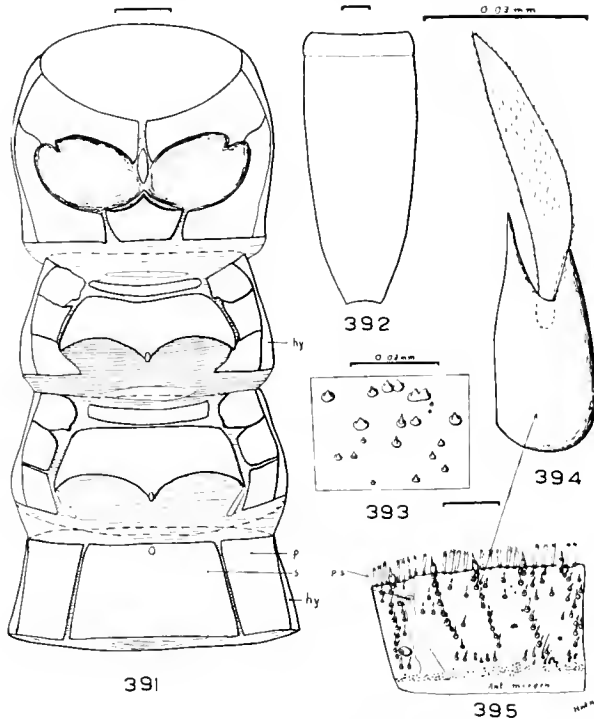
suture short (text-fig. 383); head without other sutures. Parietals finely tuberculate on a basal belt which is as long as coronal suture; elsewhere for the most part tuberculate as figured (tuberculate area of drawing) (text-fig. 383) and with a number of fine setae; four post-parietal setae (text-fig. 383) placed in an oblique row. Frons with a tooth-like process on each side and with the surface tuberculate as the parietals. Clypeus about as broad as base of labrum but only about a third as long. Labrum as figured (text-fig. 389). Ocellus on each side composed of a single large pigmented area and hence not distinctly faceted.



TEXT-FIGS. 386-390.—Larva of *Heterelmis longula* Sharp. (386) Ventral view of right maxilla. (387) Ventral view of labium. Setae of prementum are only placed to give general appearance of this region. (388) Dorsal view of left antenna. (389) Dorsal view of labrum. (390) Mesothoracic spiracle.

Antenna with the setae as figured (text-fig. 388). Mandibles of both sides similar; one-fourth longer than broad at broadest point which is at base; and with a seta-like prostheca which is about two-thirds as long as mandible and is itself densely and very finely setose. Maxilla and labium with the setae as figured (text-figs. 386, 387). Pronotum at broadest point, which is near base, slightly broader than long (0.025 mm. : 0.850 mm.); anterior margin broadly and feebly arcuate, apical angles obliterated, sides feebly arcuate, basal angles inconspicuous and broadly rounded, and base feebly arcuate for its entire breadth; surface very evenly convex; surface anteriorly with round to oval setose tubercles which are about 0.025 mm. broad and are separated by less than to twice their diameters; on posterior three-fifths of pronotum most of these tubercles are arranged in five

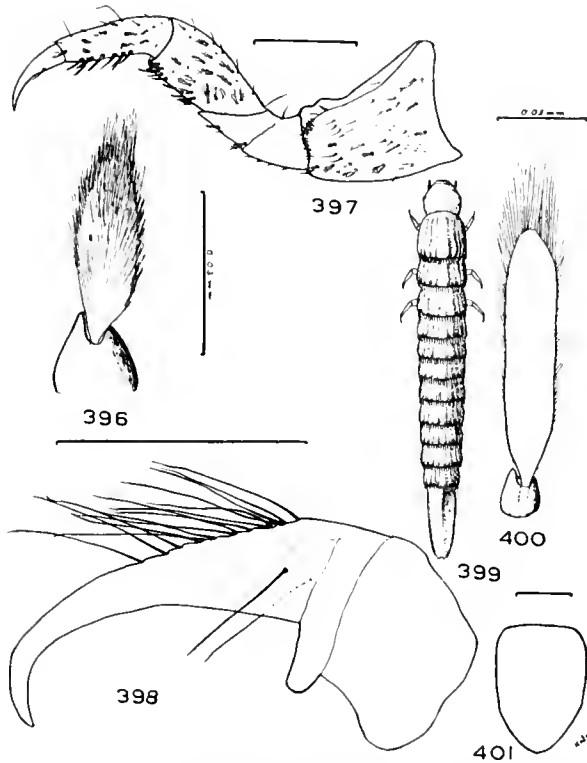
rows on each side which are feebly oblique towards sides and become increasingly well defined posteriorly; posteriorly the tuberculation of this tergite resembles that of the fifth abdominal segment (*vide* text-fig. 395); anteriorly this segment has a row of flat setae which is similar to posterior row and both of these rows are similar to posterior row of fifth tergite (text-fig. 395). Tergites of mesothorax, metathorax, and first eight abdominal segments with the ratio of breadth to length as follows: 0.050 mm. : 0.450 mm.; 0.075 mm. : 0.450 mm.; 1.00 mm. : 0.400 mm.; 1.00 mm. : 0.400 mm.; 0.075 mm. : 0.450 mm.; 0.025 mm. : 0.425



TEXT-FIGS. 391-395.—Larva of *Heterelmis longula* Sharp. (391) Ventral view of thorax and first abdominal segment to show sclerotization. (392) Dorsal view of ninth abdominal segment. (393) Section to show tuberculation near anterior margin of fifth abdominal tergite. (394) One of the tubercles forming the rows on fifth abdominal tergite. (395) A section of fifth abdominal tergite to show various types of tubercles.

mm.; 0.850 mm. : 0.425 mm.; 0.800 mm. : 0.450 mm.; 0.700 mm. : 0.425 mm. 0.625 mm. : 0.375 mm.; all of these tergites are alike in having the anterior and posterior margins nearly truncate, the sides feebly arcuate, the apical and basal angles broadly rounded, the surface evenly convex, and the tubercles and setae as shown in text-fig. 395. Ninth abdominal tergite with the outline as shown in text-fig. 392; with a median ridge extending from base to apex and on this ridge are two nearly contiguous rows of tubercles, the rows diverging slightly basally; on each side with an extreme dorso-lateral row of setose tubercles extending from base to apex, and also on each side with a ventro-lateral row of similar tubercles; areas between these rows of tubercles have themselves somewhat similar rows of tubercles which are separated by less than to twice their diameters; apical

margin with a conspicuous fringe of posteriorly directed setae which are about 0.03 mm. long. *Ventral surface* with the setose tubercles about two-thirds as coarse as those of tergites and usually separated by one to three times their diameters—two common types are figured from the fifth abdominal sternite (text-figs. 396 and 400), and there are setae showing every intergradation between them. Operculum with the shape as figured (text-fig. 401) and the claws as figured (text-fig. 398). *Legs* all somewhat similar to front leg (text-fig. 397).



TEXT-FIGS. 396-401.—Larva of *Heterelmis longula* Sharp. (396) One of the types of seta found on the fifth abdominal sternite. (397) Inner face of right front leg. (398) Dorsal face of right opercular claw. (399) Mature larva to show general appearance. (400) One of the types of seta found on the fifth abdominal sternite. (401) Operculum.

Specimens examined: 4, MEXICO: Dist. de Temascaltepec, Las Cruces, alt. 9000 ft., vi. 1934 (*H. E. Hinton*).

In addition there are 119 larvae collected in the same district from Tejuvilco alt. 3500 ft., to Rio Verde, alt. 8000 ft.; and 31, MEXICO: Estado de Morelos, Cuernavaca, alt. 4800 ft., vi. 1934 (*H. E. Hinton*).

From the distributional data available it is evident that there are at least two species and one variety before me (*longula*, *obesa*, and *obesa plana*) and possibly two other species (*obscura* and *acicula*). The larvae of *longula* were determined as such by the altitude data, this being the only species which occurs in the Dist. de Temascaltepec as high as 9000 ft. What is apparently the last stage larva of

this species may be distinguished from the last stage larva taken at Cuernavaca (where *longula* does not occur) as follows :

1. Abdominal tergites of last stage larva without tubercles or only with an occasional smaller tubercle between first and third rows of tubercles
H. obesa, *H. obesa plana*, and *H. obscura*.
- Abdominal tergites of last instar larva with numerous large tubercles between the first and third rows of tubercles (text-fig. 395) *H. longula*.

Larvae representing probably three earlier instars are before me. These are all alike and similar to the mature larva except in the case of *longula* where the mature larva has numerous tubercles between first and third rows of tubercles of abdominal terga.

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THE TRUSTEES OF THE BRITISH MUSEUM

VOL. 42

PART 3, pp. 397-508

WITH FOUR PLATES

12 March, 1948

LONDON :

PRINTED BY ORDER OF THE TRUSTEES
BRITISH MUSEUM (NATURAL HISTORY)

CROMWELL ROAD, LONDON, S.W.7

1948

Price Fifteen Shillings

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No. 3

ENTOMOLOGICAL RESULTS FROM THE SWEDISH EXPEDITION 1934 TO BURMA AND BRITISH INDIA— COLEOPTERA : CURCULIONIDAE

BY SIR GUY A. K. MARSHALL, K.C.M.G., F.R.S.

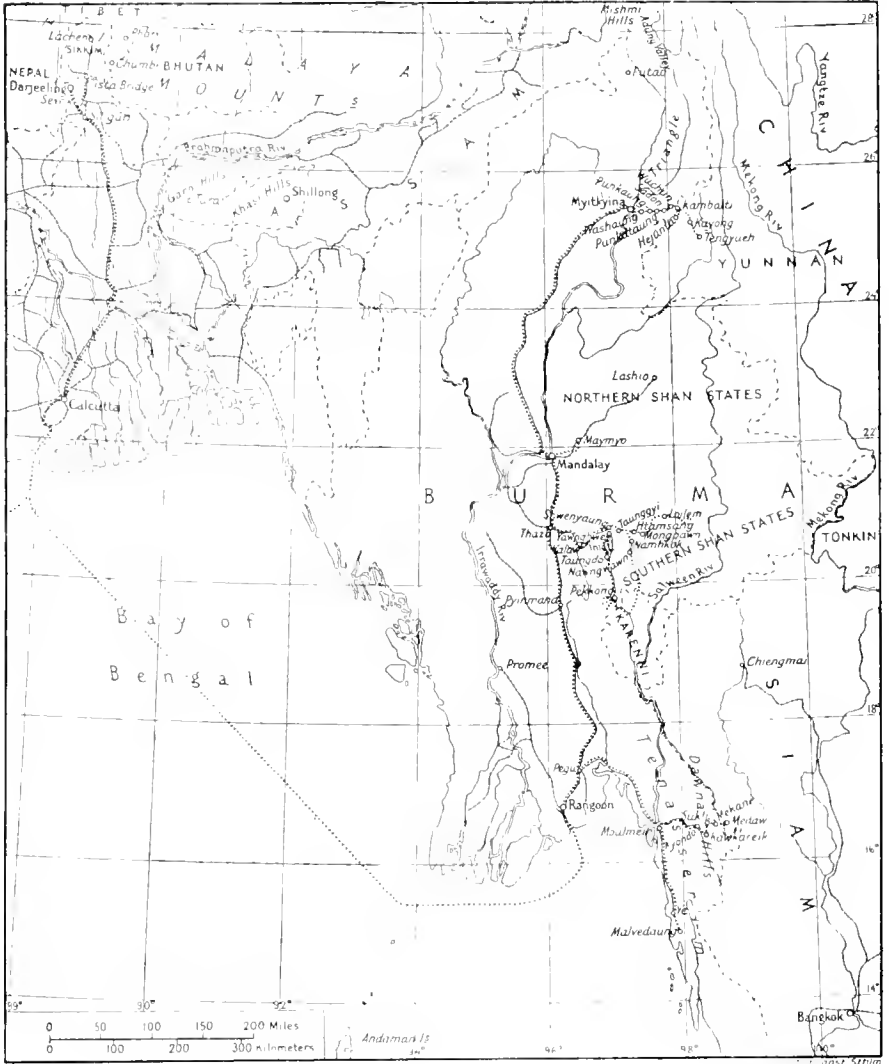
THE fine collection of Curculionidae made by Dr. René Malaise in Burma serves to illustrate once again the striking richness of that fauna. The dates on the specimens range from April to November, but the great majority was taken in only four months—April to July. In all, 343 different species were found, but unfortunately a high proportion of these were represented by single specimens that could not be determined.

Part of the collection was dealt with in a paper published in 1941 (*Ann. Mag. nat. Hist.* (11) 8: 345-379) comprising the subfamilies Brachyderinae, Otiorrhynchinae, Eremninae and Sitoninae. The species identified amount to 196, of which no less than 114 were new to science. If it be assumed that of the 147 unnamed species 85 per cent. are new (a conservative estimate) the new forms would represent 70 per cent. of the species.

Although, as may be seen from the accompanying map, Dr. Malaise covered a fairly wide area in his expedition, from Tenasserim in the south to Myitkyina in the north, the great majority of the weevils were taken at Kambaiti, due east of Myitkyina, as shown by the fact that of the 114 new species no less than 87 are recorded from that locality only.

The only large collection of weevils from Burma that has previously been worked out fully is that made by Leonardo Fea during four years' residence (1885-89) for the Genoa Museum. This was dealt with by Faust (*Ann. Mus. Stor. nat. Genova*, 34, 1894 [1895]: 153-370), who recognized about 450 species, of which he identified 321, and of these 184 were new; he estimated that in the whole collection 60 per cent. (or 270 species) were probably new.

An interesting point is the great difference in the two collections. The combined total of identified species is 483, yet of these only 34 are common to them both. This is no doubt mainly due to differences in the localities investigated, for Fea's captures came principally from farther south, especially around Bhamo and in the Karen Hills; but differences in methods of collecting seem also to have affected the results.



Except where otherwise stated, the types of all the new species are in the Stockholm Museum and cotypes in the British Museum (Natural History).

In those cases in which no collector's name is given the specimens were collected by Dr. René Malaise.

Subfamily CLEONINAE.

Tetragonothorax macilentus Oliv.—Rangoon, 1♀, xii.

Nemoxenus zebra Chev.—20 km. E. of Myitkyina, c. 200 m., vii.

Xanthochelus faunus Oliv.—N.E. Burma, Sadon, 1200 m., 1♂, vi-vii. S. Shan States, 40 km. E. of Taunggyi, 3♂ 1♀, ix-x.

Lixus vetula F.—S. Shan States, Taunggyi, 1500 m., 4♂ 3♀, viii-ix.

Lixus prainae Fst.—40 km. E. of Taunggyi, 1♂, ix-x.

Lixus languidus Fst.—N.E. Burma, Sadon, 1♂ 1♀, vi-vii.

Gasteroclisus arcurostris Petri.—N.E. Burma, Sadon, 1200 m., 2♂ 1♀, vi-vii.

Subfamily HYLOBIINAE.

Peribleptus scalptus Boh.—Kambaiti, 7000 ft., 4♂ 7♀, v-vi.; Sadon, 4000 ft., 1♂ 1♀, vi-vii; Punkaung, between Sadon and Myitkyina, 1♂, vii.; Washaung, 20 km. E. of Myitkyina, 2♀, vii.

Peribleptus bardus Mshl.—Kambaiti, 6♂, v.

Peribleptus frenatus Mshl.—Kambaiti, 1♂, v.

Peribleptus bisulcatus Fst.—S. Shan States, Taunggyi, 2♂ 2♀, ix.

Peribleptus dealbatus Bdv.—Sadon, 4000 ft., 1♂, vi-vii.

DYSCERUS Faust

Heller (*Abh. Mus. Tierk. Volkerk. Dresden*, 17 (3) 1929: 12) sank *Dyscerus* Fst. as a synonym of *Pagiophloeus* Fst., on the ground that the characters given by Faust appeared to be unreliable; but the assemblage of species thus formed seems far from homogeneous and will probably need redivision, perhaps on other characters. Moreover, I am not yet acquainted with the genotype of *Pagiophloeus* (*pacca* F.), an examination of which will be necessary to establish the relationship of the two genera. Meanwhile I provisionally refer to *Dyscerus* those species in which the front tibiae curve inwards at the apex, however slightly, and to *Pagiophloeus* those in which the upper edge of these tibiae is quite straight in the apical two-thirds.

Dyscerus malaisei sp. n.

♂♀. Derm dull black; prothorax with a faint median stripe formed of two or three rows of fulvous setae, some shorter setae along the basal margin, and a patch above the front coxae; elytra with a few inconspicuous small spots of fulvous setae, mostly forming a sinuous macular band at about one-third from the base and across the top of the declivity; underside with very sparse pale setae and a narrow fulvous band across the base of the metepisterna.

Head longer than usual, subconical, bare, with rather coarse subconfluent punctures that become smaller behind; frons flat, two-thirds the width of the base of the rostrum, with a deep median fovea. *Rostrum* elongate, rather slender, gradually narrowing from base to middle, strongly dilated at apex, longer than the pronotum, rather strongly curved, the dorsal outline continuous with that of the head but sometimes separated by a small shallow impression in ♂; ♂ with coarse confluent punctation from base to antennae and a single low median carina, the punctures in ♀ smaller, non-confluent and confined to the basal half,

the median carina obsolescent, without any trace of a sulcus above the scrobe in either sex. *Antennae* piceous, the funicle with joints 1 and 2 equal, 3 a little longer than 4, 4-6 beadlike, 7 slightly longer and broader. *Prothorax* nearly as long as broad, variable in shape, being sometimes more or less rounded laterally and widest near the base, or subconical with the sides almost straight and widest at the base, the apical constriction also varying from deep to shallow; the apical margin dorsally truncate with a small sinuation in the middle, without any trace of postocular lobes, the gular margin not sinuate; dorsum flat longitudinally in the median line, set with very large, more or less confluent, shallow foveae, the intervals between them forming irregular variable narrow ridges, without any trace of a median carina. *Scutellum* rather large, triangular, about as long as its basal width, slightly raised, closely and finely punctate, setose. *Elytra* one-third wider at the roundly rectangular shoulders than the base of the prothorax, parallel for three-fourths of their length, with large obtuse posterior calli, the apices very shortly and separately acuminate; the shallow striae partly obscured on the disk by more or less irregular large shallow foveae, which are often laterally confluent and disappear entirely on the declivity; the intervals narrow, irregular and often partly obliterated, the higher parts usually with aggregations of small flattened granules, intervals 3 and 5 being slightly more raised than the others. *Legs* long and slender, black, with very sparse short white setae; femora with sparse fine punctures on the basal half, wrinkled apically; anterior pairs of tibiae incurved apically and hardly bisinuate on the inner edge.

Length 14-15 mm., breadth 5.5-6.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., 4♂ 2♀, iv-vi. 1934.

This interesting species presents three characters which have not previously been noted in this genus, namely: the unusual prolongation of the head; the absence of any deep sinuation in the gular margin of the prosternum; and especially the absence of the punctate longitudinal sulcus on the rostrum just above the scrobes.

Dyscerus posticus sp. n.

♂. Derm red-brown, the apex of the rostrum, the basal half of the prothorax, and a variable band across the top of the elytral declivity, blackish; upper surface almost bare, but the declivity of the elytra with rather numerous recumbent setae caked with yellowish powder.

Head with rugose confluent punctures; frons half as wide as the base of the rostrum, with a median fovea. *Rostrum* a little longer than the pronotum (9:8), comparatively slender, almost parallel-sided from the base to the scrobes and slightly widened apically; dorsum with rather coarse confluent punctation and five narrow low carinae, and a shallow sulcus above the scrobe. *Antennae* slender, red-brown; funicle with joint 1 longer than 2, 3-7 moniliform, subequal, 7 not wider than 6; club more slender than usual. *Prothorax* very nearly as long as broad, very gradually narrowing in a slight curve from the base to the broad shallow apical constriction, the apical margin feebly arcuate dorsally, the gular margin sinuate, without postocular lobes; dorsum with the apical area coarsely confluent punctate, the rest fairly closely set with small shiny convex granules, each bearing a short recumbent seta, and a short median carina on the anterior half. *Scutellum* subquadrate, sparsely setose. *Elytra* wider than the base of the prothorax (13:9), parallel for two-thirds of their length, separately pointed at the apex, the posterior calli prominent and obtusely angulate; the rows of large round punctures entirely regular, the rather sinuous intervals narrower than the

septa between the punctures, 3 being a little higher than the others and all with an unevenly spaced row of small flattened granules, the setae, apart from those on the declivity, sparse and minute. *Legs* red-brown, rugosely punctate and with sparse yellow setae, all the femora with a round black apical spot on the inner face and the hind pair with a larger one near the tooth; tibiae incurved at apex and very shallowly bisinuate on the lower edge, the front pair with a distinct triangular mucro.

Length 9.5–10.0 mm., breadth 3.5 mm.

N.E. BURMA : Kambaiti, 7000 ft., 2♂, vi. 1934.

Dyscerus ordinatus sp. n.

♂♀. Derm dull black; prothorax with sparse yellow setiform scales and a broad ill-defined lateral stripe of these scales on each side; elytra with small spots of similar scales, some of them forming a common, deeply bisinuate, macular band before the middle, a spot on intervals 1 and 2 before the middle, an indefinite transverse macular band across the top of the declivity, and some irregular markings on the declivity.

Head with small dense punctures and sparse setae; frons two-thirds the width of the base of the rostrum, with a small shallow fovea. *Rostrum* a little longer than the pronotum, almost parallel-sided to the antennae, only slightly widened at the apex, rather strongly curved and with a shallow depression between the base and the frons; dorsum in ♂ with rather rugose confluent punctures and five low narrow carinae that do not unite at the base, there being two shallow sulci laterally; rostrum of ♀ more shiny, with the punctures less rugose. *Antennae* dark red-brown; funicle with joint 1 distinctly longer than 2, 3–7 moniliform, subequal, 7 scarcely broader. *Prothorax* slightly transverse (8 : 9), rounded laterally, widest behind the middle, very slightly constricted at apex, the apical margin gently arcuate dorsally, the gular margin deeply sinuate, the postocular lobes feeble; dorsum with more or less confluent small rugose punctures and an abbreviated low rugose median costa. *Scutellum* shield-shaped, rather densely setose. *Elytra* much broader at the shoulders than the base of the prothorax (3 : 2), parallel for two-thirds of their length, with obtuse posterior calli, the apices separately produced into a short sharp process; the striae narrow and quite regular throughout, containing small separated punctures; the intervals much broader, mostly flat but with low granular tubercles on which the scale spots are situated, intervals 3 and 5 slightly higher than the others, especially near the base where all the intervals bear some low shiny granules. *Legs* slender, black, with sparse pale setae, the apices of the tarsi red-brown; tibiae incurved at the apex and shallowly sinuate beneath.

Length 9.5–11.0 mm., breadth 3.4–4.0 mm.

N.E. BURMA : Kambaiti, 7000 ft., 6♂ 3♀, v–vi. 1934.

Dyscerus direptus sp. n.

♂♀. Derm dull black, with markings formed of narrow fulvous scales; prothorax with a broad lateral fulvous stripe on each side, usually extending downwards over the whole pleurae, but the pleurae may also be bare with a single median spot and a narrow stripe just above the coxa; elytra with small fulvous spots arranged in the pattern which is highly characteristic of this genus: three or four spots on interval 2, a curved macular band before middle on 4–9, and a sinuous macular band across the top of the declivity.

Head globular, bare, with dense small punctures, sometimes confluent; frons more than two-thirds the width of the rostrum at its base (5 : 7), with a deep median fovea. *Rostrum* a little longer than the pronotum, gradually narrowed from base to middle, moderately dilated at apex, rather strongly curved, with a shallow depression between the base and the head; dorsum with irregular shallow confluent punctures and three low narrow sinuous carinae that unite at base, and a sulcus above the scrobes. *Antennae* piceous; funicle with the two basal joints equal, 3 longer than 4, 4-7 moniliform, 7 not broader than 6. *Prothorax* a little longer than broad, parallel-sided from base to middle, then narrowing to the deep collar-like apical constriction, the apical margin gently arcuate dorsally, the gular margin deeply sinuate, the postocular lobes distinct; dorsum moderately convex longitudinally, highest at the middle, uneven, very rugose, with unevenly separated granular elevations and a broad high rugose median carina that does not reach base or apex. *Scutellum* almost semicircular, smooth, bare, impunctate. *Elytra* wider than the prothorax (13 : 10), parallel to beyond middle, with obtusely angulate posterior calli, the apices separately acuminate; the rows of large separated punctures mostly irregular on the disk and sometimes transversely confluent here and there; the intervals very irregular and uneven, interval 1 with a single row of distant depressed granules, 3 with a low subgranulate elongate elevation on the basal fourth (often interrupted), a similar short elevation at the middle and another at the top of the declivity, 5 with several small distant granular tubercles, and some smaller ones on 7. *Legs* as in *bigutticollis*, sp. n.

Length 10-12 mm., *breadth* 3.7-4.5 mm.

N.E. BURMA: Kambaiti, 7000 ft., 2♂ 2♀, iv-vi. 1934 (type); Sadon, 4000 ft., 1♀, vi-vii. 1934.

Dyscerus asper sp. n.

♂♀. *Derm* dull black, with sparse pale yellowish setae; pronotum without markings; elytra with a small spot of denser setae (sometimes absent) at one-third from base on interval 2, another slightly larger and a little further back on 6, and an indefinite patch on the declivity—these markings usually made more distinct by a covering of yellow powder.

Head with rugose confluent punctures and sparse setae; frons much narrower than the base of the rostrum (3 : 5), with an indistinct shallow median fovea. *Rostrum* a little longer than the pronotum (8 : 7), very slightly narrowed from base to beyond middle, moderately dilated at apex, regularly curved, with a shallow depression between the base and the head; dorsum with a fine straight median carina and a lower more sinuous one on each side, the interspaces with irregular shallow confluent punctures, and a shallow sulcus above the scrobes. *Antennae* piceous; funicle with the two basal joints equal, 3-7 equal and moniliform, 7 not wider than 6. *Prothorax* a little broader than long, almost parallel-sided in the basal fourth, then narrowing rather rapidly with a gentle curve to the apex, which is only shallowly constricted, the apical margin gently arcuate dorsally, with feeble postocular lobes, the gular margin distinctly sinuate; dorsum slightly convex longitudinally, fairly closely set with small rounded granules of unequal size and with an abbreviated narrow median carina. *Scutellum* almost round, prominent, very convex, obsoletely punctate, with a few fine setae. *Elytra* much wider than the prothorax (16 : 11), parallel to beyond middle, with obtuse posterior calli, the apices each with a short sharp process; the shallow striae with large unequal punctures that are somewhat irregular on

the disk ; the intervals not wider than the punctures, sinuous, uneven, with irregular small low granules that often form small groups, intervals 3 and 5 partly higher than the others, 3 having a short granulate costa near the base. *Legs* piceous, rugosely punctate throughout, with sparse narrow curved whitish scales and fine recumbent yellow setae ; all the tibiae incurved at apex and distinctly bisinuate on the lower edge.

Length 8.0–10.5 mm., breadth 3–4 mm.

N.E. BURMA : Kambaiti, 7000 ft., 10♂ 10♀, v–vi. 1934.

Dyscerus roratus sp. n.

♀. Derm dull black to red-brown, unevenly mottled with groups of small yellowish setiform scales.

Head with coarse shallow confluent punctures ; frons two-thirds the width of the base of the rostrum, without any median fova. *Rostrum* longer than the pronotum (11 : 8), almost parallel-sided from the base to the scrobes and rather strongly widened apically, regularly curved, with a very shallow depression between the base and the frons ; dorsum very finely punctate on the disk, rather more strongly at the sides, with three narrow impunctate lines, the median one becoming subcarinate at the base with a shallow depression on each side of it, the lateral areas with a single shallow sulcus. *Antennae* piceous ; funicle with joint 1 distinctly longer than 2, 3–7 moniliform, 7 very slightly wider than 6. *Prothorax* very nearly as long as broad, parallel-sided in the basal third or half, then narrowing with a slight curve to the apex, which is very shallowly constricted, the apical margin gently arcuate, the gular margin sinuate, without postocular lobes ; dorsum flat longitudinally, unevenly set with low shiny granules, the interstices being clothed with setiform scales, and with a low narrow sinuous median carina that nearly reaches both base and apex. *Scutellum* ovate, flat, impunctate, bare. *Elytra* wider than the base of the prothorax (3 : 2), parallel for two-thirds of their length, the posterior calli much reduced and inconspicuous, the apices jointly rounded and without any sharp processes ; the rows of large subquadrate punctures mostly rather irregular, the narrow sinuous intervals all of the same height and bearing a row of flattened granules, these being smaller, more convex and more numerous near the base. *Legs* red-brown, with the knees black, and with numerous yellow setae ; femora closely punctate except on the thickened part ; anterior pairs of tibiae slightly incurved apically, and shallowly bisinuate internally, the hind pair almost straight.

Length 10–11 mm., breadth 3.5–4.1 mm.

N.E. BURMA : Kambaiti, 7000 ft., 2♀, vi. 1934.

Dyscerus bigutticollis sp. n.

♂♀. Derm rather dull black, with small spots formed of yellowish scales ; pronotum with a spot on each side behind the middle ; elytra with three spots on interval 2 (at one-third from base, behind middle and at top of declivity), a curved oblique macular band before middle from stria 10 to stria 5 or 3, and additional spots on the lateral intervals behind middle.

Head globular, bare, with small dense punctures ; frons more than half as wide as the base of the rostrum (4 : 7), with a deep median fovea. *Rostrum* a little shorter than the pronotum, parallel-sided from the base to the scrobes, moderately dilated at apex, regularly curved, with a very shallow depression between the base and the frons ; dorsum with small dense confluent punctures and three low narrow carinae that unite at the base, and with two shallow

punctate sulci laterally. *Antennae* black; funicle with the two basal joints equal, 3-7 moniliform, subequal, 7 not broader than 6. *Prothorax* as long as broad, slightly rounded laterally, widest at or behind middle, deeply constricted near apex, the apical margin feebly arcuate dorsally, the gular margin sinuate, without postocular lobes; dorsum almost flat longitudinally, with large confluent punctures behind the subapical constriction and much smaller ones in front, the narrow intervals unevenly raised and a short broad flattened median carina about middle. *Scutellum* subtriangular, bare, shiny, convex. *Elytra* wider than the base of the prothorax (16 : 11), parallel for two-thirds of their length, with large obtuse posterior calli, the apices separately rounded; the rows of large foveae often irregular and variable in shape, the intervals sinuous and as narrow as the septa between the foveae, intervals 3 and 5 being partly higher than the others. *Legs* slender, black, with very sparse fine whitish setae; femora finely punctate on the basal half, almost impunctate on the dilated part, and rugose at the apex; all the tibiae incurved at the apex and distinctly bisinuate on the lower edge.

Length 9.5-11.5 mm., breadth 3.5-4.5 mm.

N.E. BURMA: Kambaiti, 7000 ft., 8♂ 2♀, iv-vi. 1934.

Dyscerus cognatus sp. n.

♂♀. Derm rather shiny black, with markings formed of pale yellow setiform scales; pronotum with a few sparse scales, without spots; elytra with a deeply bisinuate narrow ill-defined macular band at about one-third from base, a transverse one across the top of the declivity as far as interval 5, and some indefinite spots on the apical area.³

Closely allied to *D. bigutticollis* sp. n., the description of which applies to it except as regards the two prothoracic spots and the following characters:—*Head* with the frons half as wide as the base of the rostrum. *Rostrum* slightly widening at the immediate base; the three fine dorsal carinae with two fairly regular rows of much larger punctures between them, usually with minute punctures among them. *Prothorax* parallel-sided in the basal half, then narrowing with a slight curve to the broad shallow apical constriction; the dorsal punctures as large or larger but with their margins narrower and more raised, the median carina narrower and extending from the middle almost to the apex. *Legs* with the tibiae less incurved at the apex and much more shallowly bisinuate on the lower edge.

Length 10.0-11.5 mm., breadth 3.7-4.4 mm.

N.E. BURMA: Kambaiti, 7000 ft., 6♂ 1♀, vi-viii. 1934.

Dyscerus caligatus sp. n.

♂♀. Derm dull black, almost bare, with only very sparse short pale setae and a few small spots formed by the aggregation of a few narrow pale scales, being the remains of the typical pattern in this genus: prothorax with a small sublateral spot on each side a little behind the middle and another in the middle of the base; elytra with a very small spot at one-third from the base on intervals 2 and 10, a larger one a little behind them on 6, small ones at the beginning of the declivity on 2, 7 and 9, and a large one near the apex.

Head with rugose confluent punctures; frons two-thirds as wide as the base of the rostrum, with a shallow median fovea (obsolete in ♂). *Rostrum* as long as the pronotum in ♂, a little longer in ♀, parallel-sided from the base to the scrobes and rather broadly widened at the apex, almost porrect at the base and curving

strongly downwards apically, the base separated from the frons; dorsum closely and coarsely punctate in ♂ without definite carinae, the punctures smaller in ♀ and with traces of fine narrow carinae, there being only one shallow lateral sulcus. *Antennae* red-brown, comparatively stout; funicle with joint 1 longer than 2, 3-7 moniliform, 5-7 shorter and transverse, 7 rather broader than 6. *Prothorax* very nearly as long as broad, strongly rounded laterally, widest at a little behind the middle, shallowly constricted at apex, the apical margin subtruncate dorsally, the gular margin deeply sinuate, the postocular lobes feeble; dorsum fairly closely set with rugose uneven opaque granules and with a short narrow median carina on the anterior half and a smooth irregular tubercle on each side of it. *Scutellum* shield-shaped, bare, opaque, with a shallow median impression. *Elytra* at the shoulders only slightly wider than the broadest part of the prothorax, subparallel to beyond the middle, with low obtuse posterior calli, the apices separately rounded; the large round punctures in fairly regular rows, the spaces between them being mostly much greater than their diameters; the intervals not wider than the punctures, rather irregular, each with a row of very small shiny granules that are more numerous on intervals 3 and 5, which are slightly higher than the others. *Legs* rather stout, with sparse pale setae, red, with the knees, front tibiae (except partly in the middle), and the tarsi (except joint 4), blackish; tibiae incurved at apex and distinctly bisinuate below, the front pair with a very small mucro.

Length 5-7 mm., breadth 1.9-2.4 mm.

N.E BURMA: Kambaiti, 7000 ft., 1♂ 2♀, v. 1934.

Dyscerus latipes sp. n.

♀. Derm opaque, piceous, the apical collar of the prothorax red-brown, with sparse yellowish setiform scales, some collected together in small groups, but the only conspicuous spots being a round one on interval 6 of the elytra at a little before the middle and a much larger oblong one behind the posterior callus.

Head finely shagreened with some very minute sparse shiny granules; frons comparatively broad, five-sixths the width of the base of the rostrum, without any media fovea. *Rostrum* a little longer than the pronotum, narrowing very slightly from the base to the scrobes and widening at the apex, moderately curved and forming an angle with the frons at the base; dorsum with rather large shallow confluent punctures, a narrow median carina near the base only, and a distinct lateral sulcus. *Antennae* red-brown; funicle with joint 1 longer than 2, 3-7 moniliform and subequal, 7 slightly broader than 6. *Prothorax* somewhat transverse (5:6), moderately rounded laterally, widest at about the middle, shallowly constricted at the apex, the apical margin truncate dorsally, the gular margin sinuate, the postocular lobes obsolescent; dorsum closely set with small shagreened granules of unequal height and a short narrow median carina, the apical area sculptured like the head. *Scutellum* shield-shaped, somewhat raised, bare, uneven. *Elytra* at the shoulders broader than the prothorax (4:3), parallel for two-thirds of their length, with prominent obtuse posterior calli, the apices separately produced into a short sharp process; dorsum somewhat flattened on the disk, as far as interval 5 with regular rows of deep round separated punctures; the intervals rather uneven, 3, 5 and 7 a little higher than the others and with numerous low shiny granules. *Legs* red-brown, with sparse pale setae; tibiae strongly compressed and laminately dilated, especially on the

basal half, being there about as wide as the broadest part of the femora, the dorsal margin highest near the base, rapidly narrowing and incurved at the apex, the lower edge deeply bisinuate.

Length 5.5 mm., *breadth* 2 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1♀, vi. 1934.

A very striking species on account of its small size and very abnormal tibiae.

Dyscerus clathratus Pasc.—Kambaiti, 2♂ 1♀, iv-v. 1934.

KEY TO BURMESE *Dyscerus*.

- 1 (22). Tibiae normal.
- 2 (3). Head elongate, rostrum without any lateral sulcus, apical margin of prosternum not sinuate *malaisei* sp. n.
- 3 (2). Head globular, rostrum with a lateral sulcus, apical margin of prosternum sinuate
- 4 (5). Antennal club a little longer than the funicle *longiclavis* Mshl.
- 5 (4). Antennal club much shorter than the funicle.
- 6 (21). Elytra at the shoulders much wider than the broadest part of the prothorax.
- 7 (8). Front tibiae with a distinct triangular mucro; rows of punctures on the elytra quite regular throughout *posticus* sp. n.
- 8 (7). Front tibiae not mucronate.
- 9 (16). Elytra each with a short sharp apical process.
- 10 (11). Elytra with perfectly regular rows of small punctures; pronotum rugosely punctate *ordinatus* sp. n.
- 11 (10). Elytra with large, more or less irregular punctures; pronotum granulate.
- 12 (13). Funicle with joint 1 longer than 2; prothorax widest at middle, not constricted at apex *clathratus* Pasc.
- 13 (12). Funicle with joints 1 and 2 equal; prothorax widest behind middle, constricted at apex.
- 14 (15). Prothorax with coarse granular elevations and a broad rugosely-punctate median carina, deeply constricted at apex; elytral spots formed of narrow scales *direptus* sp. n.
- 15 (14). Prothorax with small close shiny granules and a narrow impunctate carina, shallowly constricted at apex; elytra with a general clothing of sparse yellow setae *asper* sp. n.
- 16 (9). Elytra without apical processes.
- 17 (18). Frons without any median fovea; funicle with joint 1 longer than 2; elytra with moderately large punctures and a uniform mottling of scales; legs red-brown with numerous yellow setae *roratus* sp. n.
- (17). Frons with a deep fovea; funicle with the two basal joints equal; elytra with very large foveae and a few scale spots forming a pattern; legs black with very sparse setae.
- 18
- 19 (20). Rostrum dorsally with fine confluent punctation; prothorax deeply constricted at apex and with a spot of yellowish scales on each side behind the middle *bigutticollis* sp. n.
- 20 (19). Rostrum with a row of larger separated punctures on each side of the median carina; prothorax shallowly constricted at apex and without any spots *cognatus* sp. n.

- 21 (6). Elytra at the shoulders only slightly wider than the broadest part of the prothorax; legs red, with the knees, front tibiae and tarsi blackish; length 5-7 mm. *caligatus* sp. n.
- 22 (1). All the tibiae dilated and sublunate, especially the hind pair; length 5.5 mm. *latipes* sp. n.

In addition to the foregoing species Faust has also recorded from Burma (*Ann. Mus. Stor. nat. Genova*, 60, 1895: 230) *D. notatus* Pasc. (Java and Borneo) and *D. bispinulus* Desbr., but in both cases the identification is open to doubt. Moreover, Dr. Malaise also took single specimens of four other species of *Dyscerus*, all found at Kambaiti, in May, 1934.

***Kobuso binodosus* sp. n.**

♂♀. Derm black, thinly clothed with brownish setiform scales.

Head with coarse shallow subconfluent punctation; frons strongly convex transversely, with a small median fovea. *Rostrum* of ♂ nearly straight, as long as the pronotum, gradually widening at apex, with four dorsal rows of coarse, longitudinally confluent punctures and a deep sulcus above the scrobes from base to beyond middle; rostrum of ♀ slightly longer, with the punctures much smaller and not confluent. *Antennae* with joint 2 of the funicle a little longer than broad, nearly as long as 1. *Prothorax* as long as broad, in ♂, parallel-sided in the basal third, then narrowing to apex, with a very shallow subapical constriction; in ♀, widest at base, gradually narrowing anteriorly, without any constriction; bisinuate at base, the dorsal apical margin arcuate; dorsum slightly convex longitudinally, with numerous small convex non-contiguous granules and a fine median carina; the granules somewhat larger and fewer in ♀. *Scutellum* semi-circular, raised, smooth in ♂, with fine rugulose punctures in ♀. *Elytra* widest at the slightly prominent shoulders, gradually narrowing behind, jointly rounded at apex, the posterior calli forming a sharp conical tubercle in ♂, less developed in ♀; the striae with large subquadrate punctures, those in striae 3-6 slightly irregular; the septa between the striae as broad as or broader than the intervals and sometimes uniting laterally to form low transverse wrinkles; the intervals narrow, more or less undulate, with small sparse flattened granules, interval 3 slightly more raised in ♂. *Legs* shallowly rugulose, with sparse pale setae; joint 2 of hind tarsi forming an equilateral triangle.

Length 10-11 mm., breadth 4.5 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1♂ (type), 20. vi. 1934, 1♀, 4-8. vi. 1934.

The only known Indian species, *K. crassus* Mshl. 1936, is a much broader insect; the frons is less convex; the antennae have joint 2 of the funicle transverse and much shorter than 1; the elytra have the discal punctures quite regular, the tubercle near the base of interval 3 is much lower, and the subapical calli are normal and obtuse; joint 2 of the hind tarsi is transverse and broadly truncate at the base.

***Niphades malaisei* sp. n.**

♂♀. Derm dull black; pronotum with a narrow median line of grey scales; elytra with the whole of the posterior declivity and a very indefinite large patch round each shoulder covered with dense brownish grey scales.

Head with dense coarse punctures and sparse brown setae; frons a little broader than the base of the rostrum, without any median puncture. *Rostrum* shorter than the pronotum, only slightly curved, gradually dilated at apex, with more or less confluent coarse punctures that are not in regular rows; that of ♀ a little longer and more shiny. *Antennae* with joint 1 of the funicle longer than 2,

3-7 transverse. *Prothorax* as long as broad, moderately rounded laterally, widest near or behind middle, not constricted at apex, feebly bisinuate at base, the apex gently arcuate; dorsum closely set throughout with large granules and with a fine abbreviated median carina. *Elytra* broadly suboblong, parallel for three-fourths of their length, nearly twice as broad at the roundly rectangular shoulders as the base of the prothorax, shallowly trisinate at the base, jointly rounded at the apex; dorsum moderately convex longitudinally, the shallow striae with punctures that are comparatively small and regular near the suture and larger and more irregular laterally, but all greatly diminishing apically; interval 3 with five rather large tubercles that are variable in shape and not always symmetrically placed, and 5 with five or six smaller tubercles, the last being the largest and forming the subapical callus; all the tubercles with an apical tuft of very short stout setae. *Legs* black, with fairly dense brown scaling and short suberect setae, the femora with a broad pale ring; corbels of hind tibiae only slightly longer than the apical width of the tibia.

Length 8-9 mm., breadth 3.5-4.1 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1♂ 3♀, vi. 1934.

Nearly allied to *N. granicollis* Fst., which differs in having the rostrum much more broadly dilated at the apex, with the punctures in regular rows; antennae with joint 2 of the funicle equal to 1; prothorax without any trace of a median carina, with a longitudinal strip on each side devoid of granules, and the apical margin strongly arcuate and overhanging the head; the corbels of the hind tibiae nearly twice as long as the apical width of the tibia.

Niphades debilis sp. n.

♀. Allied to *N. malaisei*, but much smaller and with the tubercles and colour pattern much less pronounced, the shoulder patches on the elytra being very faint. The description of *malaisei* applies to it except in the following particulars:—

Rostrum much more slender, not dilated at apex, the irregular punctures finer. *Elytra* ovate, parallel for only half their length, much more narrowed behind, the punctures in the lateral rows similar to those near the suture, the tubercles on intervals 3 and 5 much smaller and flatter, 5 without any apical tubercle, the preapical callus being almost obsolete; all the setae (including those on the pronotum) short and erect, whereas in *malaisei* they are all recumbent, except those on the tubercles on the elytra.

Length 6.5-7.0 mm., breadth 2.5-2.7 mm.

N.E. BURMA: Kambaiti, 7000 ft., 2♀, vi. 1934.

Niphades alni Mshl.—Kambaiti, 2♂, v-vi.

AMPHIALODES gen. n.

Head with the frons at its narrowest much wider than the base of the rostrum; eyes broadly ovate, not more convex than the head, rather coarsely faceted, of a shining silvery colour. *Rostrum* comparatively narrow, elongate; scrobes passing rapidly beneath the rostrum at about the middle; mandibles with very short blunt teeth. *Antennae* with the scape straight, slender and abruptly clavate, not reaching the eye; funicle a little shorter than the scape, joint 1 much broader than 2, 7 transverse. *Prothorax* as long as broad, truncate at the base, the apical margin arcuate dorsally, the postocular lobes moderate; prosternum excavated in front of the coxae, the gular margin deeply sinuate. *Scutellum*

concealed. *Elytra* convex, broadly ovate, more or less acuminate behind, jointly truncate at base, without any humeral calli. *Legs* long, slender; femora moderately clavate, with a small sharp tooth; tibiae straight, with a sharp uncus and no mucro; claws free, simple. *Sternum* with the front coxae as widely separated as the middle pair, the prosternal process smooth and bare; metasternum as long as a middle coxa, the metepisternal suture entirely obliterated. *Venter* with the intercoxal process about as wide as a hind coxa, which is transversely elongate; ventrite 2 much longer than 3 and 4.

Genotype: *Amphialodes acuminatus*, sp. n.

The only near ally of this genus is *Amphialus* Pasc., which at present is known only from Ceylon. The latter differs in the following characters: the head has the frons slightly narrower than the base of the rostrum, and the eyes are finely faceted and black; the prothorax is transverse; scutellum distinct; front tibiae more or less bisinuate on the lower edge and the front coxae contiguous; metasternum much shorter than a middle coxa; and ventrite 2 is not longer than 3 and 4.

Amphialodes acuminatus sp. n.

♂♀. Derm chocolate-brown, opaque with very sparse pale yellowish scales; prothorax with three very indefinite stripes of sparse scales; elytra with an irregular band of scales across the declivity and sparse groups of scales elsewhere.

Head with separated coarse punctures and sparse brown scales; frons with a shallow median impression. *Rostrum* of ♂ rather strongly curved, a little shorter than the pronotum, parallel-sided and subcylindrical from base to antennae and there irregularly punctate and with subrecumbent transverse scales, the apical area wider, bare, smooth and with very shallow punctures; rostrum of ♀ slightly longer, more gradually widened at the apex, the strong punctures confined to the basal half, the scales fewer and narrower. *Antennae* with joint 1 of the funicle about as long as 2 but more than twice as wide, 2-7 widening distally, 3 as long as broad, the rest more or less transverse. *Prothorax* moderately rounded laterally, widest at middle, narrower at apex than at base but not constricted; dorsum feebly convex longitudinally, with strong separated punctures leaving an indefinite impunctate median line on the basal two-thirds; two small groups of erect brown scales on the apical margin and a few similar scales on the disk. *Elytra* broadly ovate (4:3), widest before the middle, rapidly acuminate behind and jointly rounded at apex; dorsal outline rising steeply from the base, then almost flat to beyond middle, and less steeply declivous behind; the impressed striae containing rather large deep punctures which become smaller behind; intervals broader than the striae, somewhat convex, smooth and impunctate, interval 3 with an obtuse elevation near the base and a larger one at the top of the declivity, 5 with two much smaller elevations, one near the base and one at about the middle, all these bearing suberect brown scales, and between the two tubercle on 3 are one or two small tufts of similar scales. *Legs* with sparse recumbent narrow pale scales.

Length 4.0-4.5 mm., breadth 2.0-2.2 mm.

N.E. BURMA: Kambaiti, 6600 ft., 1♂ 1♀, vi. 1934.

Amphialodes graniger sp. n.

♂. Nearly allied to, though larger than, the preceding species, the description of which applies to it except in the following particulars:—

The sparse scaling more generally distributed, without any definite band across the declivity of the elytra.

Rostrum more rugosely punctate. *Antennae* with joint 1 narrower and not so globular. *Prothorax* more closely and somewhat rugosely punctate, with a low smooth median carina on the apical half only. *Elytra* more narrowly ovate and much less acuminate behind, the basal margin raised into an obtuse smooth costa; the dorsal outline rising much less steeply at the base and with the apical declivity steeper; the punctures much larger, as wide as the intervals, and between the punctures a small shiny granule; interval 3 with two similar tubercles, but none on 5, without the prominent tufts of erect scales.

Length 5 mm., breadth 2.2 mm.

N.E. BURMA: Kambaiti, 6600 ft., 1 ♂. vi. 1934.

Euthycus sp.—Kambaiti, ♂, v.

Euthycus sp.—Kambaiti, 1 ♂, vi.

Genus?—Kambaiti, 1 ex., iv.

Genus?—Kambaiti, 1 ex., vi.

Subfamily PISSODINÆ

Carcilia granicollis sp. n.

♀. Derm black to piceous, dull, thinly clothed with minute setae.

Head with fine dense confluent punctures. *Rostrum* rapidly narrowing from the base to the scrobes, then gradually widening again to the apex, shiny, densely punctate at the base, the punctures becoming much sparser anteriorly. *Antennae* inserted behind the middle of the rostrum (♀), red-brown, the club black; funicle with joint 1 a little longer than 2. *Prothorax* a little broader than long (9:11), rounded laterally, widest behind the middle, not constricted at the apex, subtruncate at the base; dorsum somewhat convex longitudinally, with close reticulate punctures, the narrow intervals bearing small low granules, both punctures and granules becoming larger laterally. *Elytra* only a little wider at the roundly rectangular shoulders than the prothorax, very gradually widening to beyond the middle, and broadly rounded behind; the striae containing rather large deep punctures varying in size and becoming much smaller near the apex, where the striae are very deep; the intervals flat varying in width, transversely rugulose and becoming definitely granulate towards the base. *Legs* short, stout, coarsely and rugosely punctate, black, with the tarsi red-brown; middle tibiae with the upper end of the corbel produced into a sharp triangular tooth. *Underside* rather closely punctate and with bifid to quadrifid setae on the metasternum and first ventrite; ventrite 5 with the apical half shiny, almost impunctate, nearly bare and depressed on each side.

Length 7–10 mm., breadth 2.7–4.0 mm.

N.E. BURMA: Sadon, 4000 ft., 1 ♀, vi–vii. 1934 (*Dr. Malaise*). ASSAM: Naga Hills, 1 ♀ (*Doherty* type).

Type in the British Museum.

Closely allied to the Japanese genotype, *C. strigicollis* Roel., in which however the pronotum has an obtuse elevation in the middle near the base and a broad shallow constriction at the apex; the striae on the elytra are narrower with much smaller shallower punctures, and the intervals proportionately broader; the apical part of ventrite 5 in the female has a group of long erect setae in the middle.

Subfamily ERIRRHININÆ.

Echinocnemus adustus Chev.—Tenasserim, Mekane, 90 km. E. of Moulmein, 200 m., 7 ♂ 3 ♀, xi.; Siam, Medaw, Burma frontier, 1 ♂, xi.

Echinocnemus roelofsi Fst.—Moulmein, 1 ♀, xi.

Bagous sp.—S. Shan States, S. end of Inle Lake, 900 m., 1 ♂, ix.

Bagous sp.—Washaung, ca. 200 m., 20 km. E. of Myitkyina, 1 ♀, vii.

Smicronyx sp.—Myitkyina, 175 m., 1 ♂, vii.

Subfamily EUGNOMINAE.

Ixalma asperula Fst.—Kambaiti, 2 ♀, v-vi.

Ixalma 3 spp.—Kambaiti, 3 specimens, v-vi.

Subfamily NANOPHYINAE.

Nanophyes nigrifulus Boh.—Myitkyina, 175 m., 2 ♂, iii.

Nanophyes sp.—Washaung, 20 m. E. of Myitkyina, 1 ♂, vii.

Subfamily APIONINAE.

Apion 2 spp.—Kambaiti, 2 ♀, iv-vi.

Apion sp.—Punkaung, between Sadon and Myitkyina, 1 ♂, vii.

Apion sp.—S. Shan States, Inle Lake, 1 ♂, ix.

Subfamily ATTELABINAE.

Euscelophilus burmanus sp. n.

♂♀. Derm black (except the inflexed margins of the elytra which are dark blue), not very shiny; head and pronotum with sparse golden pubescence; elytra almost bare on the basal half, with a small indefinite golden spot on the suture at one-fourth from the base, the apical half with a large common irregular X-shaped mark of grey pubescence (silvery in some lights); underside with rather sparse grey pubescence, which is denser in the middle of the metasternum, the sides of which bear golden pubescence.

Head only slightly longer than its basal width, finely rugosely punctate, with a small elevation in the middle bearing a narrow median carina and a shallow median stria behind it, and a large depression behind each eye; frons as broad as the base of the rostrum, flat, with fan-like carinulae; eyes moderately prominent. *Rostrum* longer than broad, coarsely punctate, with the antennae inserted close to the base. *Antennae* black; the scape equal to joint 2 of the funicle, which is longer than 1, the others progressively diminishing distally, 4 and 5 as long as broad, 6 and 7 transverse, 7 the broadest. *Prothorax* transverse (8 : 11), moderately rounded laterally, widest near the base, with a broad shallow constriction at base and apex; dorsum having in the middle of the disk a very large abruptly raised, punctate tubercle divided longitudinally by a broad impunctate sulcus; the areas on each side of this tubercle with fine dense punctures and two shallow impressions, the apical area more sparsely punctate, and the basal area transversely carinate. *Scutellum* transverse, trapezoidal, broadest at the base, rugose. *Elytra* subquadrate, rather longer than their width at the obtusely projecting shoulders (6 : 5), parallel from behind the shoulders nearly to the apex, the posterior declivity vertical and appearing broadly subtruncate from above, the actual apices separately rounded; dorsum almost flat as far as interval 5, with a small rounded shiny tubercle on each side of the scutellum and irregular rows of rather large shallow punctures, the intervals narrow and sinuous, 3 and 5 being slightly more raised and 9 subcarinate. *Legs* short and stout, black, with sparse golden setae; femora with a small sharp blue tooth and also a small tooth on each side

of the tibial socket ; front tibiae with two rows of denticles on the lower edge. *Pygidium* smooth, with fine sparse punctures, erect pale setae and a median stria.

Length 4 mm., breadth 2.2 mm.

N.E. BURMA : Kambaiti, 7000 ft., 3♂ 1♀, iv-v. 1934.

Judging by the description, *E. gibbicollis* Schilsky, from Peking, must be nearly allied to the present species. But the former differs in having the antennae, tibiae and tarsi reddish ; the rostrum is very short, broader than long ; the large tubercle on the pronotum is not divided by a sulcus ; and the elytra have before the apex three elevations, of which the middle one is the largest.

Trachelolabus burmanensis Voss.—Kambaiti, 7000 ft., 10♂ 9♀, iv-vi.

Paramecolabus feae Fst.—S. Shan States, Taunggyi, 5000 ft., 1♀, viii-ix.

Paramecolabus sp.—Kambaiti, 1♀, iv.

Euops championi Voss.—Kambaiti, 1♀, iii.

Euops peguensis Voss.—Kambaiti, 1♂, v.

Euops 2 spp.—Kambaiti, 1♂ 1♀, iv.

Euops nigricollis sp. n.

♂♀. Derm shining blue or greenish blue above and below, except the disk of the pronotum which is black.

Head with sparse irregular punctures, the eyes very narrowly separated, longer than the temples and not exceeding them laterally. *Rostrum* almost impunctate dorsally. *Prothorax* transverse, rounded laterally, widest at the base, without any basal or apical constriction ; dorsum smooth and shiny, with sparse minute punctures, the lateral punctures much coarser, the basal depression punctate and transversely wrinkled. *Scutellum* transverse, suboblong, with the hind margin gently arcuate, quite smooth and impunctate. *Elytra* subquadrate, a little longer than broad, parallel from the roundly rectangular shoulders to well behind the middle, broadly rounded behind ; the striae not impressed at the base, fine behind the middle, broad and deep at the apex, the punctures in them moderately strong and diminishing behind, mostly separated by their own diameters or more in ♀, closer in ♂ ; the intervals broader than the striae, flat, with a single row of fine punctures. *Legs* without a femoral tooth ; front tibiae of ♂ simply curved, those of ♀ bisinuate on the lower edge.

Length 3.0-3.2 mm., breadth 1.7-1.8 mm.

N.E. BURMA : Kambaiti, 7000 ft., 1♂ 1♀, iv. 1934.

Closely resembles in general facies the Japanese *phaedonius* Sharp, which, however, has the pronotum much more strongly punctate and with a transverse impression ; the scutellum is quadrate ; the front tibiae are more slender, and less deeply bisinuate in the female.

Hoplapoderus bistrispinosus Fst.—S. Shan States, Taunggyi, 1500 m., 1♀, viii-ix.

Hoplapoderus hystrix F., var. *echinatus*, Gyll.—40 km. E. of Taunggyi, 1♂, ix-x ;

Sadon, 1200 m., 1♂, vi-vii.

H. hystrix var. *orientalis* Voss.—Sadon, 2♂ 2♀, vi-vii.

H. hystrix var. *caliginosus* Fst.—Taunggyi, 2♂ 3♀, viii-ix ; 40 km. E. of Taunggyi,

1♂, ix-x.

Hoplapoderus breviceps Voss.—Kambaiti, 2000 m., 2♂ 3♀, v-vi.

Hoplapoderus gemmosus Jek.—Taunggyi, 1♀, viii-ix ; Inle Lake, 900 m., 5♂ 1♀,

ix (1♂ entirely black) ; Moulmein, 1♀, xi.

Paroplapoderus malaisei sp. n.

♂♀. Derm black, with orange-yellow markings; head and the basal half of the rostrum black above, the remainder orange; prothorax with a large irregular lateral orange spot, a small triangular one in the middle of the base (sometimes transverse), and a variable spot on the front margin of the pleurae (sometimes absent); scutellum black; elytra orange, with the following black markings: a large patch covering the whole shoulder (but not reaching the lateral margin) and curving inwards at one-fourth from the base as far as interval 3, a large oblong lateral patch at about the middle between interval 5 and the margin, a transverse spot immediately behind this, a broad sublunate band close to the apical margin, a sutural spot at the base, and a spot covering the large median tubercle; underside rarely entirely black, usually with an orange spot on the metasternum just behind the middle coxae, the lateral margin of the venter broadly orange enclosing a longitudinal row of three round black spots, the basal one large, the other two smaller; pygidium orange with two large black spots uniting at the base.

Head with a deep median sulcus from the frons to the base of the head and a transverse stria behind the eyes; frons rugose, with irregular longitudinal striae and a few coarse punctures; vertex more shiny, with sparse minute punctures and faint striolae. *Rostrum* transverse, with a broad median sulcus on the basal half, the apical half with strong separated punctures. *Antennae* stout, orange; funicle with joint 1 almost globular, 2 as long as broad but narrower than any of the others, 3 and 4 longer than broad, 5-7 transverse; club with the two basal joints transverse. *Prothorax* transverse, almost semicircular, apart from the very short apical collar which is constricted at the base; dorsum coarsely and unevenly plicate, with a shallow depression on each side of the disk behind the middle and a narrow median sulcus which becomes much broader and deeper at the base. *Scutellum* broadly sublunate, rugulose, with the apical margin sinuate in the middle. *Elytra* with the sides sinuate in the basal half and broadly rounded behind the middle, the shoulders projecting laterally in a small sharp angle; dorsum with somewhat irregular rows of large shallow punctures, the narrow intervals rugulose on the disk, shiny and finely punctate laterally, each elytron with an oblique row of three conical black tubercles from the shoulder to the middle, the one above the shoulder the smallest and bluntest, the one near the suture sharply pointed and much the largest. *Legs* yellow, the femora with a broad brown subapical ring; tibiae finely denticulate on the lower edge.

Length 5.5-7.0 mm., *breadth* 3-4 mm.

N.E. BURMA: Kambaiti, 7000 ft., 6♂ 2♀, iv-vi. 1934.

The general colouring is very similar to that of the Chinese *vitticeps* Jek., but that the species may be readily distinguished by the tubercles on the elytra, the humeral one being almost obsolete, and the large sutural one is broadly rounded instead of sharply conical. Structurally *malaisei* is nearer to the Indian *lefroyi* Mshl., which, however, has very different colouring, the elytra being brown on the basal half and yellow apically, and the head has only a fine median stria.

Tomapoderus cyclops Fst.—S. Shan States, 40 km. E. of Taunggyi, 1♂, ix-x.

Apoderus opacus sp. n.

♂♀. Derm dull black, bare above; mesepimera and metepisterna with sparse pale setae, forming a dense whitish spot at both ends of the former and at the apical end only of the latter.

NOVIT. ZOOL., 42, 3. 1948.

Head of ♂ longer than the pronotum, subconical, deeply constricted at the base, with the sides nearly straight, transversely wrinkled on the vertex with a distinct median stria, the frons wider than the length of an eye, coarsely striolate longitudinally, the eyes prominent; head of ♀ broader, more rounded laterally, the vertex shiny with only obsolescent wrinkles and the median stria disappearing in front, the eyes less prominent. *Rostrum* stout, as long as broad, with a deep stria between the antennae. *Antennae* with joint 2 of the funicle shorter than 1 and longer than 3, 3-5 subequal and as long as broad, 6 and 7 transverse; joint 2 of the club as long as broad. *Prothorax* subconical, a little broader than long, moderately rounded laterally, the apical collar not constricted at its base, its anterior margin shallowly sinuate, the dorsum rugulose. *Scutellum* trapezoidal, transverse. *Elytra* very nearly as broad as long, parallel for three-fourths of their length, the striae perceptible only with difficulty (except near the apex) owing to the dense uniform rugulose punctation. *Legs* with a long sharp femoral tooth; tibiae with a strong dorsal carina between two sulci, the front pair curved inwards at the apex in ♂, straight in ♀.

Length 4.5 mm., breadth 2 mm.

N.E. BURMA: Sadon, 4000 ft., 1♂, vi-vii. 1934 (type); Kambaiti, 7000 ft., 1♀, iv. 1934.

In Voss's key (*Stettin. ent. Ztg.* 88, 1927: 2) this species runs down to the Sumatran *corporea* Voss; the latter differs however in having no median stria on the head; the width of the frons is less than the length of an eye; joint 2 of the funicle is longer than 1; and the apical collar of the prothorax is deeply constricted.

***Apoderus discalis* sp. n.**

♂♀. Body testaceous, bare; head and rostrum red-brown, turning to blackish beneath; prothorax with a broad black lateral stripe; elytra dark red-brown, turning to black at the base, with a large common testaceous band extending from near the base to the middle and laterally as far as stria 5, its posterior margin having a deep indentation on interval 3.

Head of ♂ longer than the pronotum (4 : 3), subconical, with the sides straight; frons much wider than the length of an eye, impunctate, with two short divergent striae; vertex smooth, shiny, with only a faint indication of a median stria; eyes moderately convex; head of ♀, a little shorter and slightly more convex. *Rostrum* slightly longer than broad, almost impunctate above, with a broad shallow sulcus between the antennae. *Antennae* testaceous; joint 1 of the funicle bulbous, 4 usually slightly longer than any other, 7 slightly transverse; club with joint 2 longer than broad. *Prothorax* about as long as broad, subconical, with the sides straight, smooth and shiny above, with only a faint trace of a median stria. *Scutellum* transverse, trapezoidal, with two small indentations in the middle of the hind margin. *Elytra* rather longer than broad (6 : 5), shallowly sinuate behind the shoulders, widest behind the middle, with a broad depression covering the same area as the pale marking on the basal half and a small shiny black tubercle on each side of the scutellum; the rows of punctures moderately strong on the basal half and becoming extremely fine posteriorly; interval 5 costate basally. *Legs* testaceous, with the apical half of the hind femora black. *Metasternum* of ♂ with a deep median sulcus having a small sharp overhanging granule on each side of it, the sulcus continued more narrowly between the middle coxae.

Length 5.5-6.0 mm., breadth 2.3-2.5 mm.

N.E. BURMA: Kambaiti, 7000 ft., 2♂ 2♀, iv-v. 1934.

Nearly allied to *carbonicolor* Mot. and *praecllens* Sharp, which have the general body colour and the four anterior femora black; the head is shorter and more convex; the elytra lack the tubercles on each side of the scutellum; and on the male metasternum there are two obtuse tubercles between the median coxae (instead of the sharp granules behind them).

Sharp (*Trans. ent. Soc. Lond.* 1889: 46) states that these two tubercles are on the mesosternum, which is erroneous. This draws attention to a character in the Attelabinae that has not previously been noticed. In other Curculionidae, when the middle coxae are separated, the space between them is occupied partly by a backward process of the mesosternum and partly by a forward process from the metasternum. These normally meet in the middle, but sometimes the mesosternal process occupies the whole area and rarely may even extend behind the coxae. But in the Attelabinae the intercoxal area is occupied entirely by the metasternum. There is, however, one exception, namely, the more primitive Tropical American genus *Pilolabus* Jekel, which in this respect resembles the Rhynchitinae; moreover Voss has already pointed out (*Stettin. ent. Ztg.* 85, 1925: 19) that in this genus the structure of the tibiae agrees with that found in the same subfamily.

Sharp (*l.c.*) describes in *praecllens* some striking secondary male characters, but these also occur in *carbonicolor*, with which he was not acquainted, and I can find no reliable differences between the species; *praecllens* must therefore sink as a synonym.

Apoderus atronitens sp. n.

♂♀. Derm very shiny black, the underside of the head, the rostrum (except the blackish mouthparts), the legs and antennae entirely, the sides and apex of the venter, and the whole pygidium, yellow.

Head quite similar in the two sexes, only slightly longer than the width across the eyes, which are moderately convex, the whole vertex and frons shiny and impunctate, with only a faint median stria on the former, the frons much wider than the length of an eye. *Rostrum* a little longer than broad, only slightly narrowed at the base and gradually widening to the apex, with a broad sulcus between the antennae, the apical part with fine sparse punctures. *Antennae* with joint 1 of the funicle longer than any of the others, 2 shorter than 3 and equal to 4, 5-7 transverse; club with joint 1 a little longer than broad, 2 transverse. *Prothorax* transverse (5:7), subconical with the sides gently rounded, the shiny dorsum entirely impunctate, without definite impressions but with a fine shallow median stria. *Scutellum* broadly lunate, shiny and impunctate, the apical margin arcuate. *Elytra* nearly parallel-sided, with a small sharp angle at the shoulders; the discal punctures small and becoming much finer behind, the lateral punctures much larger, the intervals broad, flat and impunctate. *Legs* with the tibiae slender, straight and finely serrate on the lower edge.

Length 5.0-6.5 mm., breadth 2.5-3.5 mm.

N.E. BURMA: Kambaiti, 7000 ft., 28♂ 14♀, iv-vi. 1934.

Very closely allied to the genus *Phymatapoderus* Voss, the only essential structural difference being that in that genus all the species have a boss-like tubercle in the middle of each elytron. Voss placed this genus in the tribe Hoplapoderini, which is primarily distinguished from the Apoderini by the shape of the head. On this character *Phymatapoderus* certainly belongs to the Apoderini and cannot be regarded as more than a subgenus of *Apoderus*; the five species at present known are extremely closely related and might well prove eventually to be only local races of a single species.

- Apoderus notatus* F.—Myitkyina, 175 m., 1♂, iii; S. Shan States, Taunggyi, 1♂ 2♀, viii-ix.
- Apoderus blandus* Fst.—Siam, Medaw, Burma frontier, 1♂, xi.
- Phymatapoderus elongatipes* Voss.—Kambaiti, 4♂ 3♀, v-vi; Sadon, 1200 m., 3♂ 2♀, vi-vii; S. Shan States, Taunggyi, 1500 m., 2♂ 2♀, viii-ix.
- Centrocorynus rufulus* Voss.—Sadon, 1♀, vi-vii; Taunggyi, 4♂ 4♀, viii-ix; Tenasserim, Sukli, 75 km. E. of Moulmein, 600 m., 1♂, x.
- Centrocorynus scutellaris* Gyll.—Kambaiti, 1♂, v; Punkaung, between Sadon and Myitkyina, 1♂, vii.
- Centrocorynus propinquus* Voss.—Punkaung, 1♂ 1♀, vii; Sadon, 1♀, vi-vii.
- Cycnotrachelus flavonotatus* Voss.—S. Shan States, Pekong, 900 m., 1♂, x; Sulki, 600 m., 75 km. E. of Moulmein, 1♀, x.
- Cycnotrachelus* sp.—Kambaiti, 1♂, iv.

***Paracycnotrachelus nigrigenibus* sp. n.**

♂♀. Derm red-brown; head with the extreme base and a large transverse frontal patch, the scutellum, and the apex of the femora, black; the mesepimera and metepimera with the usual pale pubescence.

Head of ♂ three times as long as the width across the eyes,* the cylindrical basal part being less than one-third of the total length, faintly striolate transversely on the posterior two-thirds; frons broader than the length of an eye, the two deep frontal sulci almost parallel; eyes moderately convex; head of ♀ much shorter and broader, 1.8 times as long as the width across the eyes, subconical, without any distinct cylindrical portion at the base. *Rostrum* twice as long as broad, with three sulci on the basal half. *Antennae* of ♂ testaceous; scape a little shorter than joint 2 of the funicle, which is equal to or shorter than 3, 4 longer than 3; club with joints 1 and 2 equal, 4 sharply pointed but without any curved process; of ♀, with the scape longer than 2 of the funicle, 2-4 subequal, club with joint 1 longer than 2. *Prothorax* as long as broad, conical, with sides straight, the apical margin only shallowly sinuate and without any subapical constriction, but with a deep round fovea in the middle of the apical collar; dorsum shiny and impunctate, not rising up abruptly in front (as in *cygneus* F.) but almost on a level with the elytra (as in *insularis* Fst.), the apical collar sunk below the level of the disk, especially in ♀. *Scutellum* three times as broad as long, trapezoidal, the truncate apex less than half as wide as the base. *Elytra* longer than broad, parallel for a short distance, then widening to behind the middle; the shallow striae with strong punctures to beyond the middle and becoming much finer apically, striae 5 and 6 somewhat irregular near the middle; the intervals broad, slightly convex, impunctate, 3 and 5 a little more raised near the base. *Legs* rather slender; front tibiae slightly curved inwards at apex in ♂, straight in ♀. *Pygidium* black, with small separated punctures and very short erect pale setae.

Length 7.0-8.5 mm., breadth ♂ 2.5-2.7. ♀ 3.0-3.2 mm.

N.E. BURMA: Kambaiti, 7000 ft., 6♂ 4♀, iii-vi. 1934.

In Voss's key to this genus (*Stett. ent. Zeit.* 90, 1929: p. 130) the male comes nearest to *insularis* Fst., but that species lacks the black markings; the antennal club is fuscous and has a short curved apical process; the eyes are much more convex and slightly longer than the width of the frons; striae 5 and 6 on the elytra are quite regular; the metepimera are much broader and ovate (linear in *nigrigenibus*).

* Voss appears to omit the cylindrical basal portion in measuring the length of the head in this genus.

The female more closely resembles that of *montanus* Jek., in which, however, the apical collar of the prothorax is cylindrical, bears no median fovea and has the front margin very deeply sinuate; the scutellum is not trapezoidal, but lunate, the hind margin being broadly arcuate; the punctures on the elytra are much smaller and striae 5 and 6 regular.

Paratrachelophorus erosus sp. n.

♂♀. Derm dark red-brown; a broad frontal band on the head, the scutellum, the apical part of the pygidium, the third tarsal joint and the apices of the other joints, black; sternum with the following markings of golden pubescence: a small spot in the posterior lateral angle of the metasternum, a larger spot at the apex of the metepimera, and a narrow stripe on the mesepimera.

♂. *Head* and rostrum nearly as long as the rest of the body; the cylindrical posterior part of the head twice as long as the subconical anterior part, the former finely transversely striolate above and below, and a large deep fovea on the hind margin of the black frontal band. *Rostrum* elongate (7 : 3), with two shallow sulci from the base to the antennae, which are inserted near the apex. *Antennae* elongate, red-brown, with the scape and the apex of the funicular joints black; funicle with the apex of joints 2-6 forming a knoblike projection externally, 1 much the shortest, 2 much the longest being one and a half times as long as 3, 7 much longer than 1 and clothed like the club. *Prothorax* twice as long as its basal width, abruptly sloping upwards in front, transversely striolate above and with transverse carinae beneath; the apical collar not constricted, almost parallel-sided, with a deep median fovea. *Scutellum* trapezoidal, the apical margin shallowly sinuate. *Elytra* one and one third times as broad as long, only slightly widened behind the middle; dorsum with a broad shallow transverse impression at one-fourth from the base and with rows of large subquadrate foveolae, which do not diminish behind, the intervals very narrow and sinuous, no wider than the septa between the foveolae, impunctate. *Legs* as in *P. brachmanus* Voss. *Sternum* with the metepisterna impunctate, except for two or three punctures near the upper margin anteriorly and a few in the lower inner angle.

Length 17.0-18.5 mm., breadth 3.5 mm.

♀. *Head* about twice as long as the width across the eyes, without any definite cylindrical part at the base, the sides almost straight. *Rostrum* not quite twice as long as broad, the antennae inserted at the middle. *Antennae* much shorter, with the funicular joints 2-7 distinctly clavate but not produced outwards, 2 only slightly longer than 3. *Prothorax* horizontal, as long as its basal width, conical, with the sides quite straight, the dorsum more finely striolate, the underside without any transverse carinae. *Abdomen* with an angular projection on each side of the pygidium arising from near the lateral margin of the fifth ventrite, the pygidium itself with a small tubercle in the middle of its apical margin.

Length 10.0-11.0 mm., breadth 3.5-3.8 mm.

N.E. BURMA: Kambaiti, 7000 ft., 4♂ 4♀, iv-v. 1934.

Differs from all the four previously described species in its coarsely foveolate elytra and in the tubercle on the pygidium of the female.

Paratrachelophorus sp.—Kambaiti, 1♂, vi.

Paratrachelophorus brachmanus Voss.—Kambaiti, 9♂ 7♀, iv-vi; Sadou, 4♂ 5♀, vi-vii.

Subfamily RHYNCHITINAE

Deporaus semiruber sp. n.

♂♀. Black, with the apex of the rostrum reddish and the elytra entirely bright red.

Head deeply constricted at the base, with dense strong punctures throughout and fine subrecumbent white setae, the temples parallel and about as long as an eye; frons as wide as the base of the rostrum, with a short median sulcus, eyes moderately convex. *Rostrum* about as long as the pronotum, with the apical margin simple and a strongly punctate sulcus on each side from base to apex; a little shorter and stouter in ♂. *Antennae* of ♀ black, short; joint 1 of the funicle nearly as long as the short scape, 2 longer, 3 a little shorter than 1, 4 and 5 a little longer than broad, 6 as long as broad, 7 transverse; club short and comparatively stout, the two basal joints as long as broad; antennae of ♂ with the funicular joints a little shorter. *Prothorax* as long as broad, slightly rounded laterally, shallowly constricted at the apex, widest behind the middle, the base gently arcuate, the apex not marginate; dorsum densely and evenly punctate in ♂, without any median stria, the punctures smaller and less dense in ♀, the subrecumbent fine whitish setae longer and denser in ♂. *Scutellum* small, subquadrate, black. *Elytra* with the sides straight and gradually diverging from the shoulders to two-thirds, the rather deep striae with strong punctures, striae 9 and 10 uniting only at the apex; the intervals somewhat convex and with a row of distinct punctures, the subrecumbent pale setae much shorter than those on the pronotum. *Legs* entirely black; front and hind tibiae straight, the middle pair somewhat curved; joint 1 of the hind tarsi as long as 2 and 3.

Length 3.0 mm., *breadth* 1.3 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1♂ 1♀, v-vi, 1934.

Apparently most nearly resembling the Chinese *bicolor* Voss, which has the same colouring but differs, according to the very brief preliminary description (*Stettin. ent. Ztg.* 99, 1938: 106) available, in having the prothorax strongly conical, the apex being about half the width of the base, whereas in *semiruber* it is four-fifths the width.

Deporaus sp.—S. Shan States, Taunggyi, 5000 ft., 1♀, viii-ix.

Deporaus sp.—Sadon, 4000 ft., 1♂, vi-vii.

Deporaus spp.—Kambaiti, five specimens of five different species, vi.

Eugnampus rufipennis sp. n.

♀. Body entirely black, except the elytra which are red with a brown marginal stripe extending indefinitely inwards to interval 9, but not reaching the base or the apex.

Head with strong separated punctures which become obliquely confluent on the frons, the temples parallel. *Rostrum* shorter than the pronotum, widening at base and apex, dorsally with two continuous punctate sulci, the interspace impunctate, broad at the apex and regularly narrowing to a sharp point at the base. *Antennae* inserted at a little behind the middle of the rostrum, brown with the articulations pale; scape much longer than joint 1 of the funicle and equal to 2, 2-6 subequal, 7 shorter. *Prothorax* longer than broad, gently rounded laterally, widest beyond the middle, with a broad shallow apical constriction; dorsum with rather large subreticulate punctures and a very narrow abbreviated median carina, set with numerous erect and suberect pale setae. *Scutellum* triangular, red, sparsely setose. *Elytra* parallel to two-thirds, with a common

transverse depression at one-fourth from the base ; the shallow striae with strong punctures, striae 9 and 10 uniting close to the apex ; the intervals slightly convex, with a row of small distant punctures and numerous erect and suberect pale setae of various lengths. *Legs* black, with long erect setae.

Length 4.6–5.0 mm., *breadth* 1.5–1.7 mm.

N.E. BURMA : Kambaiti, 7000 ft., 2♀, vi. 1934.

The only Indo-Burmese species known as yet with uniform red elytra.

***Eugnamptus pardalis* sp. n.**

♂. Head, rostrum and prothorax bronze ; elytra pale yellowish brown with numerous, more or less confluent, dark brown spots, except in the subbasal depression, and a short dark stripe at about the middle of interval 4.

Head rugosely punctate, with suberect pale setae, the temples slightly converging behind, the narrow frons with a very deep short sulcus, the eyes very large. *Rostrum* shorter than the pronotum, almost parallel-sided at the base and widening apically, with rugose confluent punctation dorsally and a narrow median carina on the basal half. *Antennae* inserted at the middle of the rostrum, brown, with the articulations pale ; scape longer than joint 1 of the funicle and equal to 2, which is a little longer than 3, 3–6 equal, 7 slightly shorter. *Prothorax* longer than broad, narrowing slightly from the base to one-fourth, then parallel sided to the broad shallow apical constriction ; dorsum with fine subreticulate punctation, which becomes transversely confluent at the apex, whereas towards the base the punctures are less close, a short median stria and behind it a broad shallow impression, and on each side just behind the apical constriction a small low shiny tubercle ; the setae rather long, whitish and subrecumbent. *Scutellum* bronze, trapezoidal, widest at the base and truncate at the apex. *Elytra* parallel from the shoulders to beyond the middle, then widening slightly near the apex, each with a broad shallow oblique depression at about one-fourth from the base ; the striae with close small punctures and the intervals with dense irregular punctures of about the same size as those in the striae, so that the latter appear to be confused in parts, striae 9 and 10 coalescing near the apex. *Legs* brown, the femora testaceous on the basal half and the tibiae with a broad testaceous band in the middle.

Length 4.5 mm., *breadth* 1.5 mm.

N.E. BURMA : Kambaiti, 4♂, iv–v. 1934.

The colouring, combined with the unusual sculpture of the pronotum, will distinguish this species.

***Eugnamptus pannosus* sp. n.**

♂♀. Dark brown, with the head blue-black.

Head of ♀ with comparatively large separated punctures, the temples parallel ; frons with either a very short shallow stria (type) or a deeper stria that extends back to the top of the vertex ; head of ♂ with smaller punctures, much larger eyes, and much narrower frons with a deep short sulcus. *Rostrum* of ♀ a little shorter than the pronotum (6 : 7), widening at base and apex, the basal half with two strongly punctate sulci dorsally, the anterior part with irregular confluent punctures laterally, the impunctate median area narrowing to a point at the base ; rostrum of ♂ much shorter (4 : 7), parallel-sided at the base, the anterior half with fine close punctures in the middle only. *Antennae* inserted at the middle of the rostrum (♂) or a little behind it (♀), brown to fuscous, the club black with the last joint wholly or partly yellow ; scape much longer than joint 1 of the funicle and equal to 2, 3–6 subequal, 7 shorter. *Prothorax* longer than

broad, parallel-sided in ♂ to the shallow apical constriction, very slightly widening to two-thirds in ♀; dorsum with large close punctures and an abbreviated median stria, with sparse erect pale setae. *Scutellum* trapezoidal, widest at the base, with a few fine punctures. *Elytra* parallel to beyond middle and slightly widening behind, with a broad shallow transverse depression at one-fourth from the base; the shallow striae with large close punctures, the intervals slightly convex with a series of transverse impressions, especially on the apical half, with numerous erect pale setae of varying lengths. *Legs* uniform dark brown; ♂ with the usual mucro on the middle tibiae only.

Length 3.7–4.4 mm., breadth 1.2–1.5 mm.

N.E. BURMA: Kambaiti, 1♂ 2♀, v–vi. 1934.

***Eugnamptus furvus* sp. n.**

♀. Very closely allied to the preceding species, *E. pannosus*, sp.n., and differing only as follows:—

Head with the punctures much finer and more sparse; frons with or without a fine short median stria. *Rostrum* more slender, with finer punctures that are not confluent. *Elytra* with the intervals flat, each with a row of small distant punctures without any transverse impressions. *Legs* pale brown.

Length 4.0–4.5 mm., breadth 1.5 mm.

N.E. BURMA: Kambaiti, 3♀, v. 1934.

Eugnamptus spp.—Kambaiti, seven specimens of seven different species, v–vi.

Rhynchites subplumbeus Voss.—Kambaiti, 4♂ 1♀, iv–v.

Rhynchites ? *coarctus* Voss.—Kambaiti, 1♂ 1♀, iv–vi.

Rhynchites spp.—Kambaiti, three specimens of three different species, iv–vi.

Rhynchites sp.—Sadon, 1200 m., one specimen, vi–vii.

Rhynchites sp.—Inle Lake, one specimen, ix.

Rhynchites sp.—40 km. E. of Taunggyi, one specimen, ix–x.

Subfamily BALANININAE.

***Balaninus pumilus* sp. n.**

♂♀. Derm rather shiny black, the upperside with fuscous setae and markings formed of rather sparse white setae; prothorax with a broad white lateral stripe enclosing two indefinite black spots (sometimes confluent longitudinally) and a few white setae along the median line; elytra with a narrow basal band reaching the shiny humeral callus, another common bisinuate macular band behind the middle reaching interval 8 when fully developed, these bands united by a narrow sutural stripe (normally only two setae wide) and with scattered white setae between them on the disk, interval 5 usually with a short stripe on the basal third, and variable white setae around the apex; underside with dense white scales on the prosternum and along the sides of the rest of the body, the scales elsewhere much sparser.

Head with the frons as wide as the base of the rostrum, with sparse white setae. *Rostrum* strongly curved and about as long as the head and pronotum in both sexes, with the scrobes lateral; rostrum of ♂ (in lateral view) arising from the upper half of the eye, with four punctate striae on the basal part; that of ♀ arising from the middle of the eye, with two dorsal rows of punctures and a very fine lateral stria. *Antennae* inserted at (♀) or beyond (♂) the middle of the rostrum, red-brown, with the club fuscous; funicle with joints 1 and 2 equal, the distal joints all slightly longer than broad. *Prothorax* somewhat transverse

(5 : 6), greatly rounded laterally, widest at about the middle, not constricted at the apex, without postocular lobes ; dorsum with close reticulate punctation and no median carina. *Scutellum* without any sulcus on each side of it, transverse, rugulose, bare or with a few pale setae. *Elytra* with the lateral margins not sinuate, separately rounded at the apex, the suture not depressed and without raised interlocked setae apically. *Legs* comparatively short, black, with the tarsi piceous, thinly clothed with white setae ; femora with a small sharp tooth, the hind pair not exceeding the elytra ; tibiae almost straight, with a small mucro. *Pygidium* of ♂ with a deep median sulcus.

Length 1.8–2.0 mm., breadth 1.0 mm.

N.E. BURMA : Kambaiti, 7000 ft., 8♂ 3♀, v. 1934.

Very closely related to the European *B. crux* F., in which however the white dorsal markings are formed of elongate truncate scales, the sutural stripe on the elytra is much broader (six scales wide), the narrow lateral stripe on the pronotum is widely separated from the pleural scaling, the prothorax is more transverse and shallowly constricted at the apex, joint 1 of the funicle is longer than 2 and the club smaller, and the male has no sulcus on the pygidium.

Balaninus spp.—Kambaiti, six specimens of six different species, v–vi.

Balaninus sp.—Sadon, 1200 m., 1♀, vi–vii.

Balaninus sp.—Taunggyi, 1♀, viii–ix.

Subfamily ANTHONOMINAE.

COPIDORRHINUS gen. n.

Head elongate, subconical, temples about as long as the eyes, which are large and closely approximated above. *Rostrum* short, stout, almost straight, longer than broad, its depth about equal to its width, the dorsum in the basal half strongly tectiform ; scrobes narrow, straight, subtransverse, passing downwards in front of the eyes. *Antennae* inserted at about the middle of the rostrum ; scape clavate, much shorter than the funicle, exceeding the front margin of the eye ; funicle 7-jointed, the club elongate, loose, with the joints separated. *Prothorax* nearly as long as broad, with the disk raised into a high elevation, the apical margin truncate and very oblique laterally, the basal margin fitting closely to the elytra. *Scutellum* conspicuous. *Elytra* oblong, with obliquely rounded shoulders, separately rounded at the apex, which entirely conceals the pygidium, stria 10 disappearing behind the middle. *Legs* with the femora feebly clavate, without any tooth ; tibiae straight, without any uncus or mucro, the hind corbels dorsal in position ; front coxae narrowly separated, the median pair as widely separated as the hind pair ; tarsal claws appendiculate. *Sternum* with the prosternum very short in front of the coxae ; mesosternum rather steeply declivous ; metasternum somewhat tumid, much longer than a mid coxa, the metepisterna rather wide, almost parallel-sided behind the basal dilatation and broadly truncate at the apex, the hind coxae remote from the elytra. *Venter* with the intercoxal process ogival, much narrower than a hind coxa, ventrite 2 not soldered to 1 and hardly longer than 3, the intermediate ventrites angulate laterally.

Genotype : *Copidorrhinus bivittatus* sp.n.

The nearest ally of this genus is *Demimaea* Pasc., which differs as follows :—*Head* globose, rostrum not compressed dorsally, antennal club small and compact, elytra much shorter and subtriangular, front coxae contiguous, tibiae uncinatae, femora with a small tooth, and the intermediate ventrites not angulate laterally.

Copidorrhinus bivittatus sp. n.

♀. Derm dark brown, with black setae and markings of grey or yellowish setae; head with a large patch of sparse pale setae behind the lower half of the eyes; prothorax with similar setae in the basal angles and on the pleurae; elytra with a common trisinate pale band (interrupted by the striae) before the middle and a similar common curved band across the top of the declivity, an elongate spot on interval 5 being in front of the others.

Head with strong close punctures, the temples longer than an eye; frons elongate, only as wide as the narrowest part of the antennal scape, parallel-sided for most of its length; eyes large, broadly ovate, slightly projecting beyond the temples. *Rostrum* stout, longer than broad (3 : 2), gradually widening from base to apex; dorsum with the compressed basal half with large shallow punctures and rising into a sharp carina in the middle, the anterior part almost flat, shiny and nearly impunctate. *Antennae* testaceous; funicle with joint 1 much thicker and somewhat longer than 2; 3-5 longer than broad, 6 and 7 moniliform, 6 as long as broad, 7 transverse; the large club as long as joints 2-7 of the funicle, its two basal joints subequal and transverse. *Prothorax* transverse (7 : 8), narrowing with a slight curve from the base to two-thirds and the sides there broadly and deeply sinuate, then widening slightly to the apex, the base feebly bisinuate, with the basal angles rounded; dorsum raised into a large high obtuse elevation beyond the middle, the elevation itself with dense small punctures, those on the subapical part much larger, the basal third almost impunctate but opaque. *Scutellum* much longer than broad, with dense pale setae. *Elytra* parallel-sided from the shoulders to beyond the middle and broadly rounded behind, with an indefinite shallow transverse impression at one-fourth from the base between striae 1 and 4, and a deep common transverse depression on the declivity behind the obtuse posterior calli; the striae broad and deeply incised, with deep subquadrate punctures; the intervals about as broad as the striae, flat, finely rugulose, the setae (both black and pale) rather dense and appressed. *Legs* dark brown, with dense shallow punctures and recumbent setae, the tarsi testaceous.

Length 3.5-4.5 mm., breadth 1.5-2.0 mm.

N.E. BURMA: Kambaiti 7000 ft., 2♀, vi. 1934.

Demimaea sp.—Kambaiti, 1♂ 1♀, iv-v. 1934. It is not certain whether these are sexes of one species or belong to two different species.

APINODES gen. n.

Head subglobose, frons a little narrower than the base of the rostrum, eyes slightly more convex than the temples. *Rostrum* long and slender, with the antennae inserted at not more than one-fourth from the apex in both sexes; scrobes oblique, rapidly passing beneath the rostrum. *Antennae* elongate, slender; scape longer than the funicle, abruptly clavate; funicle with seven joints; club fusiform. *Elytra* subovate, much wider at the roundly rectangular shoulders than the base of the prothorax, covering the pygidium at the apex, with ten striae, stria 10 being complete, and without posterior calli. *Legs* long and slender; femora moderately clavate, with a small tooth; tibiae almost straight, not uncinata, with a minute mucro in ♂ but not in ♀; hind tarsi with joint 1 longer than 2 and 3, 3 deeply bilobate, the claws appendiculate; front coxae subconical and contiguous. *Sternum* with the prosternum not excavated; mesosternum with the side-pieces not fused, the intercoxal process much narrower

than a coxa, truncate at apex ; metasternum between the coxae not shorter than a median coxa, with a transverse row of three foveae in the middle of the base. *Venter* with the intercoxal process ogival, about as wide as a coxa ; ventrite 1 not fused with 2 in the middle.

Genotype : *Apionodes longipes* sp.n.

The *Apion*-like species on which this genus is based has affinities with *Anthonomus*, but the latter differs *inter alia* in having the prosternum much shorter in front of the coxae, the scrobes on the rostrum are entirely lateral in position, and the tarsal claws are toothed and not appendiculate.

Apionodes longipes sp. n.

♂♀. Derm rather shiny black to piceous, with sparse recumbent white setae ; underside with much shorter and sparser setae, which at the sides of the sternum are replaced by narrow white scales, these being densest along the metepisterna.

Head with deep separated punctures and sparse recumbent setae ; frons without any median fovea but with two erect setae beside each eye. *Rostrum* of ♂ a little longer than the head and pronotum (9 : 8), gently curved, narrowing very slightly from the base to the antennae and somewhat broader in the apical part ; dorsum opaque, with a smooth median carina and two narrower ones on each side ; the lower margin of the scrobe finely crenulated and with a sparse row of fine erect setae ; rostrum of ♀ a little longer, with the antennae inserted slightly further from the apex, and without the crenulation and setae along the scrobe. *Antennae* testaceous brown, the scape paler, with sparse short fine erect setae ; funicle with joint 1 a little longer and thicker than 2, 3 slightly longer than broad, the rest moniliform and subequal, not widening distally. *Prothorax* as long as broad, parallel-sided to three-fourths from the base, then narrowing to the apex, truncate at base and apex, the basal angles right angles ; dorsum feebly convex longitudinally, with strong close punctures that are often transversely confluent at the sides and an obtuse median carina that reaches neither base nor apex, a transverse row of four pale erect setae along the apical margin and four more set in a square in the middle of the disk. *Elytra* widest at the prominent shoulders, which are smooth and shiny, and gradually narrowing behind to the obtusely acuminate apex, with a broad shallow depression from stria 1 to 4 at one-fourth from the base ; the rather deep striae with close punctures, the intervals as broad as the punctures, rather convex, smooth and shiny, the alternate ones with a row of four or five widely spaced stiff erect white setae. *Legs* flavous, with a broad blackish band on the femora and sparse short recumbent white setae ; femora with the tooth small and sharp, that on the front pair minute.

Length 2.7–2.9 mm., breadth 1.0–1.1 mm.

N.E. BURMA : Kambaiti 7000 ft., 3♂ 4♀, iv–vi. 1934.

Sphinxis sp.—Kambaiti, one specimen, iv.

Rhynchaenus spp.—Kambaiti, two specimens of different species, iv.

Genus ?—Kambaiti, two specimens of different genera, iv–v.

Subfamily CIONINAE.

Cionus obesus albopunctatus Auriv.—Sadon, 1200 m., 1♂, vi–vii

Subfamily PRIONOMERINAE.

Ochyromera sericea sp. n.

♀. Derm red-brown, rather thinly clothed with short recumbent fulvous pubescence, through which the derm is visible, with scattered groups of paler hairs, the pubescence lying in different directions, largely oblique or transverse on the elytra.

Head subglobular, not constricted behind the eyes, with small dense strong punctures and sparse pubescence; frons three-fifths the width of the rostrum, with a rather large shallow glabrous median fovea; eyes gently convex, longer than the temples. *Rostrum* long, slender, curved; longer than the head and prothorax (4 : 3), gradually widening from the antennae (inserted at five-eighths from base) to the apex; the basal part with coarse confluent punctures, a narrow median carina and a short one on each side, the apical area with fine separated punctures, and a short deep stria between the antennae. *Antennae* red-brown, the club fuscous; scape a little longer than the funicle, which has joint 1 much longer than 2 (3 : 2), 4-7 subequal, as long as or slightly longer than broad. *Prothorax* transverse (2 : 3), rounded laterally, widest at a little behind the middle, with a broad constricted apical collar; dorsum feebly convex longitudinally, finely rugulose, with small low granules that are rather unevenly distributed and an ill-defined smooth median line. *Scutellum* slightly raised, suboblong, with dense grey pubescence. *Elytra* very slightly narrowed behind the broad rounded-rectangular shoulders, thence parallel to beyond the middle, separately rounded at the apex; dorsum somewhat flattened on the disk in the basal half, with a shallow common transverse impression as far as stria 4 at the basal fourth, with rows of small deep punctures of varying sizes that do not diminish behind; the intervals broader than the punctures, somewhat uneven, with an irregular row of small low shiny granules, intervals 3 and 5 with a low granular elevation not far from the base and another behind the middle, the posterior callus on interval 5 sharply conical and bearing a low tuft of fulvous setae, with a deep impression behind the callus. *Legs* red-brown, with macular groups of recumbent yellow setae and sparse stiffer subrecumbent dark setae; front tibiae broadly and roundly dilated near the apex, the inner apical angle rounded off.

Length 5.5 mm., breadth 2.4 mm.

N.E. BURMA: Kambaiti, 7000 ft., 2♀, v-vi. 1934.

Ochyromera brevicornis sp. n.

♂♀. Derm black, the elytra becoming red-brown towards the base; prothorax unevenly clothed with recumbent yellow setae, with a bare median stripe; elytra with much denser similar setae and a broad common dark band before the middle on which the setae are much sparser.

Head subglobular, not constricted, with coarse subreticulate punctures and sparse setae; frons five-sevenths of the width of the rostrum, with a rather large shallow median fovea; eyes moderately convex, but not exceeding the line of the temples. *Rostrum* rather stout, slightly shorter than the head and pronotum in ♂ and slightly longer in ♀, very gradually widening from base to apex in ♂, in ♀ parallel-sided to beyond the antennae and then slightly widening to the apex; with coarse confluent punctures in ♂, a median carina that becomes narrower and sinuous at the base; and with two narrow sinuous carinae on each side; the punctures less confluent in ♀, the lateral carinae less distinct and the median one not nearly reaching the base. *Antennae* short, red-brown with the club fuscous; funicle a little shorter than the scape, with joint 1 somewhat longer than 2, 3-7

transverse, especially 6 and 7, which are twice as broad as long and disk-like. *Prothorax* transverse (11 : 13), rounded laterally, widest behind the middle, with a broad constricted collar; dorsum gently convex longitudinally, with coarse reticulate punctures, the interspaces being very narrow. *Scutellum* triangular, with close shallow punctures and sparse setae. *Elytra* parallel from the broad roundly-rectangular shoulders to beyond the middle, the apices separately rounded; dorsum sloping steeply forwards at the base, there being a deep impression within the shoulder on stria 5 and interval 1 being still more deeply depressed on the basal fourth, so that there is a low obtuse elevation between striae 1 and 5, the posterior calli forming large rounded tubercles covered with dense setae, and the broad rounded shoulders projecting very slightly laterally; the narrow indistinct striae containing small deep separated punctures, the intervals with a row of shining granules, those on 3, 5, 7 smaller and more numerous, those on 2, 4, 6 larger and widely separated, each granule bearing a puncture containing a short stiff suberect black seta. *Legs* red-brown, the knees and front tibiae blackish, the tarsi honey-brown, the yellow setae long and rather sparse; front tibiae rugose, curved, widening from the base to three-fourths, where there is on the lower edge a long, sharp spine, the inner apical angle rounded off in ♂ but forming a sharp right-angle in ♀.

Length 5.3–6.0 mm, *breadth* 2.3–2.5 mm.

N.E. BURMA : Kambaiti, 7000 ft., 1 ♂ 2 ♀, vi. 1934.

***Ochyromera cognata* sp. n.**

♂. Very similar superficially to *O. brevicornis*, sp. n., but the elytra considerably longer in proportion; derm red-brown, the clothing similar, except that the dark band on the elytra is less distinct.

Structure similar except as follows:—*Head* with frons four-sevenths of the width of the rostrum; eyes somewhat less convex. *Rostrum* with the lateral carinae less distinct. *Antennae* with the two basal joints of the funicle equal, 3 and 4 longer than broad, 5 and 6 as long as broad, 7 transverse. *Prothorax* with the spaces between the punctures appreciably broader. *Elytra* sloping much less steeply at the base and the three basal depressions much shallower; the granules on the intervals much flatter and with smaller setigerous punctures, those on intervals 3, 5, 7 larger and much fewer. *Legs* entirely red-brown; front tibiae with the dorsal edge forming a flat regular curve, the lower edge broadly dilated at a little beyond the middle into a large sharp rectangular tooth, the inner apical angle rounded off.

Length 6.0 mm., *breadth* 2.5 mm.

N.E. BURMA : Kambaiti, 7000 ft., 1 ♂, v. 1934.

***Ochyromera coronata* sp. n.**

♀. Derm red-brown, with rather thin uniform pale brown recumbent pubescence on the elytra, the middle of the prothorax almost bare, the sides and pleurae with dense longer pubescence.

Head elongate, subconical, with coarse reticulate punctures; frons five-sevenths of the width of the rostrum, with a shallow median depression; eyes almost flat, about as long as their distance from the prothorax. *Rostrum* straight, elongate, shorter than the head and prothorax (8 : 9), parallel-sided from the base to beyond the antennae, then slightly widening to the apex, with coarse longitudinal punctures, without any carinae. *Antennae* honey-brown; funicle much shorter than the scape (3 : 4), joint 1 longer than 2, 3 longer than broad, 4 and 5 as long as broad, 6 and 7 transverse, 7 broader than the others. *Prothorax*

very nearly as long as broad, strongly but unevenly rounded laterally, widest at one-fourth from the base, with a broad apical collar and a basal constriction; dorsum very rugose, the disk bearing a coronet of six conical tubercles arranged in a circle, and in front of this a short longitudinal carina on each side of the apical collar. *Scutellum* with a deep sulcus on each side, subtriangular, rugulose, sparsely setose, with a shallow impression down the middle. *Elytra* with the shoulders obtusely projecting laterally, parallel thence to beyond the middle, with the apices separately rounded; the dorsum rather steeply declivous at the base, the striae with small close punctures; interval 3 with a densely pubescent low curved costa at the base, close behind it on 5 a small obtuse tubercle, a large tubercle on 4 at about the middle, and the posterior callus large and conical, all the intervals with unevenly distributed small granules, those on 8 larger and those on 6 larger still, the granules bearing short subrecumbent pale setae. *Legs* red-brown, with fairly close recumbent yellow setae; front tibiae gently curved on the upper edge, the lower edge with a broad sharp acute-angled tooth at three-fifths from the base, the inner apical angle sharply produced.

Length 6.5 mm., *breadth* 2.8 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1♀, vi. 1934.

Ochyromera sp.—S. Shan States, Taunggyi, 1500 m., 1♂, viii-ix.

KEY TO BURMESE SPECIES OF *Ochyromera*.

- 1 (6). Head subglobular, temples shorter than an eye; rostrum curved; scutellum without a sulcus on each side; prothorax without dorsal tubercles.
- 2 (3). Front tibiae roundly dilated near apex, without any tooth on the lower edge; elytra with a small conical tubercle at the middle of interval 3, the posterior calli sharply conical . . . *sericea* sp. n.
- 3 (2). Front tibiae with a sharp tooth on the lower edge; elytra without a tubercle on interval 3, the posterior calli obtusely rounded.
- 4 (5). Front tibiae with a narrow spine-like tooth on the lower edge at three-fourths from base; funicle with joint 1 longer than 2, the distal joints very short and disk-like . . . *brevicornis* sp. n.
- 5 (4). Front tibiae with a broad rectangular tooth at two-thirds from base; funicle with the two basal joints equal, the distal ones bead-like . . . *cognata* sp. n.
- 6 (1). Head subconical, temples as long as an eye; rostrum straight; scutellum with a deep sulcus on each side; prothorax with a ring of six conical tubercles on the disk . . . *coronata* sp. n.

Endaeus signatus sp. n.

♂. Derm dark red-brown, with the following black markings on the elytra: a broad dentate oblique band starting at one-third from the base on intervals 5-7 and ending at the top of the declivity on intervals 2-3; a sub-basal marking on intervals 3-5, the part on 3 much longer than the others, but that on 5 sometimes uniting with the band behind; and a spot at the apical junction of intervals 4-6; metasternum and venter mainly blackish.

Head not constricted behind the eyes, with fine close punctures and rather sparse pubescence; frons two-thirds the width of the rostrum, with a small median fovea; eyes moderately convex. *Rostrum* shorter than the pronotum (6:7), very stout, curved, parallel-sided in the basal half and somewhat broader

beyond the antennae, with fine longitudinally confluent punctation and a low narrow median carina. *Antennae* red-brown; funicle not widening distally, joint 1 as long as but much thicker than 2, 3-7 transverse, moniliform and subequal. *Prothorax* transverse (7:10), strongly rounded laterally, widest at the middle, not or very shallowly constricted at the apex, which is much narrower than the subtruncate base; dorsum with dense fine punctation and remote larger punctures, and with fine transverse recumbent pubescence and sparse short suberect setae, there being a row of these projecting over the front margin. *Elytra* broadly ovate, very slightly widened beyond the middle, broadly rounded behind, with the apices separately rounded, the posterior calli obsolescent; the striae with small separated punctures that hardly diminish behind, the intervals rather shiny, feebly convex, with thin pubescence and a row of minute granules, each bearing a short stiff suberect yellow seta. *Legs* red-brown, sparsely pubescent; front femora with a large triangular tooth with a row of stiff erect setae beyond it, the tooth on the other pairs rather smaller; front tibiae deeply sinuate on the basal half, the wider apical part carinate on its lower edge. *Venter* with ventrites 2 and 3 somewhat angulate laterally.

Length 3.5-4.0 mm., breadth 1.6-1.7 mm.

N.E. BURMA: Kambaiti, 7000 ft., 5♂, iv-vi. 1934.

Differs from the previously described Oriental species in its colouring and, especially, in having seven joints in the funicle instead of six.

Endaeus sp.—Kambaiti, 1♀, vi.

Endaeus sp.—Kambaiti, 1♀, iv.

Subfamily ACICNEMIDINAE

Acicnemis spp.—Kambaiti, two specimens of different species, iv-vi.

METRACHODES gen. n.

The species described below appeared to be congeneric with *Trachodes acutangulus* Heller 1908, from India, but as the genus was founded by Germar on an Alaskan species, *plinooides* Germ.,* the generic allocation seemed somewhat dubious. A comparison of Germar's species with the five available Old World species (*hispidus* L., *hystrix* Gyll., *oblongus* Reitt., *ovatus* Reitt., and *acutangulus* Hllr.) has shown that they are not even closely related. The following are some of the salient differences.

In *Trachodes* the front coxae are contiguous and the femora are unarmed; the antennal scrobes are visible laterally right up to the base and the antennae are inserted at one-third from the apex of the rostrum; and the elytra have stria 10 complete.

In the other species the front coxae are separated and the femora bear a strong tooth; the antennal scrobes pass rapidly beneath the rostrum and the antennae are inserted behind the middle; and stria 10 is much abbreviated.

The affinities of typical *Trachodes* are clearly with the small wingless Hylobiinae, to which it should be transferred. On the other hand, the Old World species belong to the subfamily Acicnemidinae; indeed, I am unable to find any character by which to distinguish *oblongus* from *Acicnemis*, in which it should now be included, and this also applies to *Trachodes clongatus* Reitt., judging from the description. The other species mentioned have a different facies, the elytra being much shorter and broader, without any true humeral calli, the scutellum is concealed, and they have no functional wings.

* This is an error; the genotype was *hispidus* L., so that *Metrachodes* falls as a synonym of *Trachodes*. G.A.K.M.

A new genus *Metrachodes* is therefore proposed for them, with the genotype *Trachodes hispidus* L. Pascoe erected the genus *Semelima* for a wingless species of *Acicnemis* from Borneo; but this differs from *Metrachodes* in its elongate facies, the hind tibiae extend beyond the apex of the elytra, and joint 2 of the tarsi is longer than 3. Whereas in *Metrachodes* the hind tibiae do not exceed the elytra, and joints 2 and 3 of the tarsi are equal.

This segregation of the species of "*Trachodes*" into two different subfamilies necessitates the abolition of the subfamily Trachodinae. The only other genus included in it in the *Catalogus Coleopt.* is *Ancylocnemis* Mshl., which should be transferred to the Acicnemidinae.

***Metrachodes albicollis* sp. n.**

♀. Derm dull black; prothorax densely covered above and below with yellowish white scales, except for a large subquadrate black patch in the middle of the base; elytra with fuscous scaling, a pale humeral patch which extends backwards for a short distance on interval 7, and an ill-defined pale subapical band, and with tufts of erect black scales.

Head with dense whitish scaling; frons much narrower than the base of the rostrum, with a single erect scale by each eye and a deep median fovea. *Rostrum* a little longer than the pronotum, parallel-sided from the base to the antennae, there rather abruptly narrowed and then gradually widening again to the apex, the basal part with dense whitish scaling, the apical part bare, shiny and with sparse minute punctures. *Antennae* red-brown, with the club black, inserted a little behind the middle of the rostrum (♀); funicle with joint 1 as long as but much thicker than 2, 3-5 transverse and subequal, 6 and 7 as long as broad; club rather broadly ovate. *Prothorax* about as long as broad, strongly rounded laterally, widest at the middle, constricted at the base, which is only slightly wider than the apex and truncate, the basal angles right angles, the apical margin slightly arcuate, the postocular lobes feeble; dorsum strongly convex longitudinally, highest at the middle, lower at the base than at the apex, the large deep punctures concealed by the dense scaling, except in the quadrate basal black patch, with a transverse row of four tufts of erect scale-like setae at a little in front of the middle and two similar tufts on the apical margin. *Elytra* broadly ovate, widest before the middle, rapidly narrowing behind to the obtusely acuminate apex, without any humeral or posterior calli; the somewhat irregular striae with very large punctures basally, which diminish greatly behind; the intervals rather sinuous and uneven, the alternate ones with an irregular row of erect scale-like setae, usually two or three together, and a much larger tuft before the middle on interval 3 containing 10-12 setae. *Legs* red-brown, with the distal half of the femora blackish; the strongly clavate femora with a small sharp tooth on the posterior pairs and a longer one on the front pair; tibiae comparatively slender, shallowly bisinuate on the lower edge (without any angular projection), with a very small apical mucro; joint 3 of the tarsi not truly bilobate, the apical margin being only shallowly sinuate.

Length 2.6 mm., breadth 1.1 mm.

N.E. BURMA: Kambaiti, 7000 ft., 2♀, iv-vi. 1934.

Subfamily ALCIDODINAE.

***Alcidodes artivittis* sp. n.**

♂♀. Derm rather shiny black, sparsely clothed with short yellowish setae, some of which are bifid or trifid; prothorax with five narrow stripes of plumose

scales varying from whitish to fulvous, three dorsal, the others on the pleurae, the median stripe not narrower than the others ; elytra with the following markings formed of similar scales : a round spot on interval 3 at one-fourth from the base, an oblique narrow stripe running from stria 9 at one-fourth from the base to stria 5 at a little before the middle, an exactly parallel stripe behind this from stria 9 to stria 1 at the top of the declivity (these stripes partly broken by the striae), a longitudinal stripe on interval 3 starting just behind the previous one and reaching the apex, where it joins a stripe of about the same length on interval 9 ; underside with sparse yellowish plumose scales which are denser at the sides of the sternum and form four rows of very indefinite spots on the venter.

Head densely punctate, sometimes with a small median fovea. *Rostrum* long and slender, slightly curved, subcylindrical, a little widened at the apex and at the insertion of the antennae (at middle in ♀, beyond in ♂), with dense small punctures on the basal half ; length in ♂ one and a half times the median line of the pronotum, in ♀ nearly twice the pronotum. *Prothorax* somewhat transverse, widest at the base, subconical, with the sides gently rounded, very shallowly constricted near the apex, the dorsal apical margin truncate, the postocular lobes moderate ; dorsum flat longitudinally, with small separated granules of unequal sizes. *Scutellum* not enclosed, small, oval, shiny. *Elytra* elongate, a little wider at the shoulders than the prothorax, parallel to near the middle, then gradually narrowing behind, with a broad shallow transverse depression near the base ; the shallow striae with rather large close subquadrate punctures, which are as broad as the narrow rugulose intervals. *Legs* rather long and slender, black, with yellowish setae ; femora with a small sharp denticulate tooth ; tibiae straight, the front pair sharply angulated before the middle, the hind pair with the corbel ascending the dorsal edge. *Sternum* with the front intercoxal space about one-fourth the width of the median one.

Length 7.0-8.0 mm., breadth 2.5-3.0 mm.

UPPER BURMA : Nam Tamai, 4000 ft., 1♀, viii. 1938 (*R. Kaulback*—type) ; Kambaiti, 7000 ft., 1♀, v. 1934 ; Sadon, 4000 ft., 1♂, vi-vii. 1934 (*Dr. R. Malaise*). INDIA : N. Manipur, 1♀, 1889 (*Doherty*).

Type in the British Museum, cotypes in the Stockholm Museum.

Nearly allied to *A. westermanni* Boh., which has all the stripes much broader and less regular ; the pronotum bears punctures bordered by lunate granules ; the elytra are broader and much less narrowed behind, the punctures in the striae smaller and narrower than the intervals ; and the femora have a fringe of suberect setae on the lower edge.

***Alcidodes basipennis* sp. n.**

♂♀. Derm black, opaque ; prothorax with five narrow stripes of fulvous scales, three being dorsal and the others on the pleurae ; elytra with the following pale yellowish markings : a spot on interval 3 at one-third from the base, a very oblique narrow band from interval 9 at one-third from the base to about the middle of 4, and a similar but much less oblique band near the top of the declivity, which is often straight but usually somewhat bisinuate and runs from interval 9 to the suture ; underside with the following fulvous marks : a broad oblique stripe on the metasternum, a spot at the base of the metepisternum, and lateral spots on the ventrites ; all the scales plumose.

Head densely punctate, bare, usually with a smooth median spot in place of a fovea. *Rostrum* of ♂ long and slender, one and a half times the length of the

pronotum, closely and strongly punctate from the base to the antennae (at one-third from the apex) and more finely beyond, only slightly widened at the apex; rostrum of ♀ longer (nearly twice the pronotum), rather more slender, more widened at the apex, with the antennae at a little beyond the middle. *Prothorax* transverse (7:10), subconical, widest at the base, rapidly narrowing with a slight curve to the very shallowly constricted apex, the dorsal apical margin truncate, the postocular lobes slight; dorsum flat longitudinally, with small separated granules of various sizes, the spaces between the fulvous stripes almost bare. *Scutellum* not enclosed, very small, bare. *Elytra* wider than the prothorax, widest at the shoulders and very gradually narrowing posteriorly, the sutural area to interval 3 more or less flattened from the base to two-thirds, the basal margin from the suture to interval 4 raised into a rather broad flat strigose elevation; the striae with rather large deep punctures, many of the septa between them being somewhat raised and uniting laterally with those in adjoining striae to form short transverse ridges, so that the whole surface appears uneven; the intervals irregular, convex and rugulose. *Legs* rather long, black, with very short sparse pale setae; femora rugosely punctate, with a sharp crenulate tooth; tibiae with the corbels ascending the dorsal edge, the front tibiae rather deeply bisinuate on the lower edge, but the submedian projection rounded, not angulate.

Length 7.2-9.0 mm., breadth 2.7-3.5 mm.

N.E. BURMA: Kambaiti, 7000 ft., 23♂ 17♀, iv-vi. 1934.

The allied species, *scenicus* Fst. and *artivittis* sp.n., may both be distinguished by the absence on the elytra of the elevation at the base and the transverse ridges on the disk; further they both have a white stripe on the apical part of interval 3.

Alcidodes trigonophorus Mshl.—Kambaiti, 4♂ 6♀, iv-v.

Alcidodes westermanni Boh.—Sadon, 1200 m., 1♀, vi-vii.

Alcidodes decursus Pasc.—Sadon, 1♂, vi-vii.

Alcidodes pectoralis Boh.—Sadon, 1♀, vi-vii.

Alcidodes affaber Auriv.—Punkaung, between Sadon and Myitkyina, 1♀, vii.

Alcidodes frenatus Fst.—Inle Lake, 900 m., 1♀, xi.

Alcidodes sp.—Kambaiti, 1♂, v.

Subfamily CRYPTORRHYNCHINAE.

Desmidophorus hebes F. var. *aterrimus* Aur.—Moulmein, 3♂, xi; S. Shan States,

Inle Lake, S. end, 3000 ft., 1♂ 3♀, ix; 40 km. E. of Taunggyi, 1♂, ix-x.

It may be noted that *D. morbus* Pasc. (Siam) was erroneously sunk by Hubenthal (*Ent. Bl.* 13, 1917: 114) as a variety of *hebes*; it is really a very distinct species allied to *schenklingi* Hub. In the *Catalogus Coleopt.* the name is wrongly spelt *morphosus*.

Desmidophorus confucii Boh.—Washaung, 700 ft., 20 km. E. of Myitkyina, 2♂, vii.

Thisus burmanus sp. n.

♂♀. Derm dull black or piceous, with fairly dense grey or brownish scaling; the dorsal tufts formed of thick short blackish setae, except one at the top of the elytral declivity which is yellowish.

Head covered by the pronotum, with the frons transversely impressed. *Rostrum* as long as the pronotum, moderately stout, strongly curved, not dilated at the apex, but narrowing dorso-ventrally beyond the antennae, which are inserted at one-third from the apex ; the basal half rugose and densely squamose, the apical half shiny, bare and finely punctate. *Antennae* piceous to red-brown ; funicle widening distally, the two basal joints of equal length, 3-7 transverse, moniliform. *Prothorax* nearly as long as broad, widest at the base, narrowing very slightly with a feeble curve to the broad shallow apical constriction ; dorsum set with close deep subreticulate punctures, with the transverse row of four tufts at about the middle and two smaller ones at the strongly arcuate apical margin, which conceals the head. *Scutellum* small, convex, bare. *Elytra* much longer than broad (3 : 2), almost parallel from the prominent shoulders to beyond the middle, produced downwards at the apex in ♀ ; dorsum convex longitudinally, highest at the middle, very steeply declivous behind ; the shallow striae containing coarse punctures but more or less obscured by the small round convex scales ; the intervals broader than the striae, interval 1 with a row of short distant peg-like erect setae ; 3 with an elongate low elevation near the base, a shorter one at the middle, and a conical one at the top of the declivity, all these bearing tufts of erect peg-like setae ; 5 with a short basal elevation and three others which alternate with those on 3 and similarly tufted. *Legs* black or piceous with blackish scales and sparse short erect pale setae, the tarsi red ; femora with a rather broad triangular tooth ; tibiae bisinuate beneath and shallowly sinuate dorsally.

Length 3.5-4.0 mm., breadth 1.8-2.0 mm.

N.E. BURMA : Kambaiti, 7000 ft., 1♂ 1♀, v-vi. 1934.

The genotype, *T. biguttatus* Pasc. is a larger insect with much broader elytra (3 : 2.6) ; the prothorax is more transverse, much more convex longitudinally and does not conceal the head, and the tufts in the transverse row (not mentioned by Pascoe) are much lower and more diffuse ; the similar elevations on the elytra are much lower and inconspicuous ; the tooth on the femora is much smaller.

Thisus sp.—Kambaiti, 1♀, vi.

Thisus sp.—Kambaiti, 1♂, v.

YPSILEPIDUS gen. n.

Head concealed from above by the pronotum ; frons much wider than the rostrum ; eyes coarsely faceted. *Rostrum* about as long as the pronotum in both sexes, moderately curved, parallel-sided, not constricted at the base ; scrobes passing rapidly beneath the rostrum, not uniting at the base, their apices shortly visible from above ; mandibles decussate, strongly toothed. *Antennae* inserted at the apical third in ♂, a little further back in ♀ ; scape slender in the basal half, strongly and abruptly clavate ; funicle with joint 1 as long as but much thicker than 2 ; club pubescent, the sutures indistinct. *Prothorax* as long as broad, shallowly bisinuate at the base, the postocular lobes feeble. *Scutellum* concealed. *Elytra* rather short and broad, with the sides strongly rounded, without true shoulders, the posterior calli small and obtuse ; stria 10 abbreviated. *Wings* not functional. *Legs* rather slender ; femora clavate, with a small tooth ; tibiae not compressed, nearly straight, with a long uncus and no mucro ; tarsi with joint 2 transverse, shorter than 3, which is bilobate, the claws rather slender. *Sternum* with the pectoral furrow bare, not extending behind the front coxae, which are widely separated ; mesosternal process declivous, a little wider than

the prosternal; metasternum as long as a median coxa, the metepisterna indistinguishable. *Venter* with the intercoxal process broadly rounded; ventrite 2 as long as 1 and twice as long as 3 and 4, its basal margin rounded.

Genotype: *Ypsilepidus thisoides* sp.n.

Belongs to the group of genera round *Colobodes* Schönh. and most nearly resembles *Thisus* Pasc.; but from all these it may be distinguished by the absence of functional wings, of the scutellum, and of the metepisternal suture.

***Ypsilepidus thisoides* sp. n.**

♂♀. Derm red-brown, with uniform grey scales intermixed with particles of a brown substance which is probably a natural exudation; underside bare, shiny.

Rostrum of ♂ moderately stout, slightly widened at the apex, densely clothed from the base to the antennae with U-shaped or Y-shaped scales, which conceal the sculpture, the apical part bare, shiny, with very fine shallow punctures; rostrum of ♀ a little narrower, with the scaling restricted to the basal third. *Antennae* red-brown; funicle with joint 3 a little longer than broad, 4-7 moniliform, transverse, 7 the broadest. *Prothorax* as long as the unconstricted apex; dorsum with large deep close punctures, with an abbreviated smooth median line, but the sculpture more or less hidden by V-shaped scales and brown exudation; at about the middle a transverse row of four tufts of stout erect rod-like setae and two other tufts on the apical margin. *Elytra* (5:4) strongly rounded laterally, widest at about the middle; the dorsal outline sloping steeply at the base, flat in the middle, and steeply declivous behind; the striae with rather large deep punctures but normally covered by scaling; interval 3 with a tubercle near the base, a much smaller one not far behind it, a much larger one at the top of the declivity, and a small one on the declivity; interval 5 with a small sub-basal tubercle (on a level with that on 3), another at the middle, and a third on the declivity; all these tubercles are covered by a tuft of stout erect peg-like brown setae; the scales are all U-shaped or Y-shaped. *Legs* black, with narrow pale scales, some of which are suberect, tarsi red-brown. *Underside* with very sparse punctures.

Length 3.6-4.0 mm., breadth 2.0-2.2 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1♂ 1♀, vi. 1934.

The form of the scales is very unusual, and it seems possible they have been developed to keep in place the brown substance (presumably an exudation) that occurs among them, which may serve a procrryptic purpose.

Ocoblodes sp.—Kambaiti, 1♀, vi.

Tadius erirrhinoides Pasc.—Rangoon, 1♂ 1♀, xii; Siam, Medaw (Burma frontier), 1♀, xi.

***Mecistocerus guttatus* sp. n.**

♂♀. Derm rather dull black; prothorax with a rather narrow irregular sublateral stripe of fulvous scales and with variable paler scaling on each side of the median carina; elytra with blackish scaling and numerous variable fulvous spots; underside with sparse isolated small pale scales, and a small spot in the hind angles of ventrites 2-4.

Head with fine punctation laterally, the frons almost impunctate in the middle with a broad deep median sulcus that encroaches on the vertex. *Rostrum* longer than the pronotum, deeply constricted at the base, with the usual coarse

basal punctures and short median carina, the punctate area being only slightly more extensive in ♂, in which however, the base is squamose, being bare in ♀. *Antennae* inserted at the middle of the rostrum (♀) or at three-eighths from the apex (♂), dark red-brown to blackish; funicle rather densely pubescent, joints 1 and 2 equal, 3-5 longer than broad, 6 and 7 subglobular or transverse. *Prothorax* nearly as long as broad, subparallel-sided almost to the middle, then narrowing in a curve to the comparatively narrow apical constriction; dorsum only slightly convex longitudinally, with rather large deep reticulate punctures (somewhat larger on the pleurae) and a shiny carina that reaches from the base almost to the apex, the narrow interspaces with fine sparse punctures, without conspicuous setae. *Scutellum* trapezoidal, convex, bare, shiny. *Elytra* broad, parallel from the roundly rectangular shoulders to the middle, the posterior calli distinct, the apex not produced downwards in ♀; the shallow striae with rather shallow subquadrate separated punctures that contain no scale and are greatly diminished behind; the intervals broader than the punctures, comparatively smooth, interval 3 not costate near the base, the setae very short and appressed. *Legs*, including the tarsi, black; femora with black scaling and sparse short pale recumbent scale-like setae, the posterior pairs with a pale subapical dorsal patch, the tooth large and triangular; tibiae black, with the apical half pale on the posterior pairs, feebly bisinuate beneath, the external apical angle of the hind pair rounded. *Metasternum* with large shallow reticulate punctures laterally, shiny and almost impunctate in the middle with a complete shallow median sulcus.

Length 8.5-12.0 mm., *breadth* 3.5-5.1 mm.

N.E. BURMA: Kambaiti, 7000 ft., 2♂ 8♀, vi. 1934.

This unusually large species is characterised by the broad shiny impunctate area in the middle of the metasternum.

***Mecistocerus latisetis* sp. n.**

♂♀. Derm black, with almost uniform dense brown scaling; underside with sparse small pale scales, one in each puncture.

Head densely squamose, with a comparatively small deep frontal fovea. *Rostrum* longer than the pronotum (5 : 4), rather slender, constricted at the base, rugosely punctate and tricarinate in the basal half and rather densely squamose near the base. *Antennae* inserted at about the middle of the rostrum (♀) or a little beyond it (♂), red-brown; funicle sparsely pubescent, the two basal joints equal, 3-5 longer than broad, 6 and 7 globular or slightly transverse. *Prothorax* nearly as long as broad, parallel-sided in the basal half, then narrowing in a curve to the broad shallow apical constriction; dorsum gently convex longitudinally, the small dense punctures almost entirely concealed by scaling, without any smooth median line or carina, and unevenly set with very thick short suberect setae. *Scutellum* small, somewhat transverse, convex, with a few minute setae. *Elytra* broad, parallel from the roundly rectangular shoulders to about one-third, the posterior calli distinct, the apex not produced downwards in ♀; the elongate separated punctures partly concealed by scaling, diminishing behind and each containing a yellowish scale; the intervals broader than the punctures, flat, with a row of very broad triangular truncate squamiform setae, which are either black or yellow, interval 3 not elevated at the base. *Legs* slender, black, the tarsi red-brown, with dense uniform light-brown scaling; femora with a triangular tooth; tibiae almost straight, the outer apical angle of the hind pair

rectangular, the hind unci of ♂ with a small tooth on the dorsal edge. *Metasternum* laterally opaque and with rather small separated punctures, in the middle, shiny, with much smaller punctures and a complete median sulcus.

Length 6.0–6.5 mm., *breadth* 2.6–3.0 mm.

N.E. BURMA : Kambaiti, 7000 ft., 1♂ 1♀, v–vi. 1934.

Readily distinguished by the unusually broad fan-like setae on the elytra.

Mecistocerus nubilus sp. n.

♂♀. Derm black ; elytra densely squamose, mottled with black, brown and grey ; scaling much less dense on the prothorax owing to the narrow spaces between the punctures ; underside with sparse small pale scales.

Head densely squamose, with a very large bare triangular frontal fovea, which is broad in front and narrows to a point behind. *Rostrum* of ♀ longer than the pronotum (5 : 4), constricted at the base, with four shallow punctate sulci and a narrow median carina on the basal third ; that of ♂ rugosely punctate to beyond the middle and with three narrow sinuous carinae. *Antennae* inserted at about the middle of the rostrum in ♀ and at one-third from the apex in ♂, entirely red-brown ; funicle thinly pubescent, the two basal joints equal, 3 and 4 longer than broad, 5 as long as broad, 6 and 7 more or less transverse. *Prothorax* as long as broad in ♂, transverse (4 : 5) in ♀, parallel-sided in the basal third, then narrowing in a curve to the shallow apical constriction ; dorsum only slightly convex longitudinally, with large deep reticulate punctures (those on the pleurae similar), the narrow interspaces of which are squamose, the scales on the disk being mostly black, with an irregular narrow pale stripe on each side, the very short setae recumbent and inconspicuous, except near the apex where they are suberect. *Scutellum* trapezoidal, widest behind, with an impression in the middle of the anterior margin, bare, shiny. *Elytra* rather broad, parallel from the roundly rectangular shoulders to beyond the middle, the posterior calli distinct, the apex not produced downwards in ♀ ; the shallow striae with deep round punctures that are partly overlapped by scaling, being separated by at least their own length in ♀ but closer in ♂, and diminishing greatly behind ; the intervals broader than the punctures, even, except towards the base where they tend to be subgranulate, interval 3 slightly raised near the base, the suberect scale-like setae very short. *Legs* black, with the tarsi red-brown ; femora with a rather large triangular tooth, the scaling pale basally, black towards the apex with pale setae and a large subapical dorsal pale patch, but in smaller specimens the scaling may be almost entirely pale ; tibiae with black scales on the basal half and pale apically, the external apical angle of the hind pair rounded. *Metasternum* opaque and with very large shallow punctures laterally, shiny and with smaller punctures in the middle, and with a complete median sulcus.

Length 5.5–9.5 mm., *breadth* 2.0–4.0 mm.

N.E. BURMA : Kambaiti, 7000 ft., 2♂ 7♀, v–vi. 1934.

The nearest ally is *corticeus* Fst., which is a broader insect with the shoulders of the elytra more sloping and the sides slightly rounded, and interval 3 is not elevated near the base ; the funicle of the antennae is densely pubescent and thus appears much thicker ; the venter is much more densely squamose, the scales being dark brown in the middle of ventrites 3 and 4 and pale elsewhere, while in the middle of 1 and 2 the punctures are very large and close, whereas in *nubilus* they are here very small and sparse.

Mecistocerus integrirostris sp. n.

♀. Derm rather shiny black to piceous, with the apex of the rostrum and the apical margin of the prothorax red-brown; prothorax with a narrow median stripe of yellowish scales on the basal two-thirds and sparse scales laterally which sometimes form an indefinite stripe; elytra with irregular broken bands of yellowish scales; underside with only a minute narrow scale in each puncture.

Head with dense small punctures, the frons without any sulcus or fovea. *Rostrum* not constricted laterally at the base, which is punctured like the head, the lateral areas opaque on the basal half, the disk being shiny and sparsely punctate. *Antennae* inserted well beyond the middle (♀), the scape and the basal funicular joint honey-brown, the remainder more or less fuscous; funicle not pubescent, joint 1 much longer than 2, the rest bead-like, 7 strongly transverse. *Prothorax* nearly as long as broad, moderately rounded laterally, widest at a little behind the middle, broadly but shallowly constricted at the apex; dorsum longitudinally convex on the basal half, with dense deep reticulate punctation (similar to that on the pleurae) and a very short median carina, the punctures on the disk containing a recumbent scale. *Scutellum* round, opaque, rugulose. *Elytra* rather narrow, parallel to beyond the middle, produced downwards at the apex in ♀; the striae with close quadrate punctures that almost disappear apically; the intervals mostly a little narrower than the striae, rugulose, minutely granulate towards the base, with a row of suberect spatulate setae, interval 3 with an elongate granular elevation near the base and much smaller ones adjoining it on 4 and 5. *Legs* black to piceous, with uniform sparse pale scales, the tarsi paler; femora with rather large close shallow punctures and a small sharp tooth; tibiae almost straight, the front pair very shallowly sinuate on the dorsal edge, the corbels of the hind pair with the outer angles slightly projecting. *Metasternum* with comparatively small dense punctures and with only a narrow median sulcus on the posterior half.

Length 3.0-4.0 mm., breadth 1.0-1.5 mm.

N.E. BURMA: Kambaiti, 7000 ft., 5♀, v-vi. 1934.

This small species differs from all those hitherto recorded from Burma in having the rostrum unconstricted at the base and joint 1 of the funicle distinctly longer than 2.

Mecistocerus cariniceps sp. n.

♂♀. Derm dull black; prothorax with a transverse patch of fulvous scales on each side of the front margin; elytra with a broad irregular (sometimes macular) band of fulvous scales across the top of the declivity, the anterior part with variable spots of similar scales; underside with an oblong scale in each puncture.

Head rugosely punctate, with an irregular median carina, the frons with only a small median puncture. *Rostrum* a little longer than the pronotum (7:6), strongly constricted at the base; dorsum of ♂ with four broad, coarsely punctate sulci from the base to beyond the middle separated by three narrow carinae, the sulci shorter and narrower in ♀ and the interspaces broader. *Antennae* inserted at a little beyond the middle of the rostrum in ♀, at two-thirds from the base in ♂, red-brown; funicle thinly pubescent, the two basal joints equal, 3-6 longer than broad, 7 as long as broad. *Prothorax* very nearly as long as broad, parallel-sided from the base to the middle, then narrowing in a curve to the rather deep apical constriction; dorsum gently convex longitudinally, with large deep honeycomb punctures (those on the pleurae smaller and shallower), the narrow

interspaces tending to run together in sinuous oblique lines, and with a rather strong sinuous median carina; most of the punctures with an oblong suberect scale. *Scutellum* nearly round, bare and shiny. *Elytra* elongate, parallel from the roundly rectangular shoulders to two-thirds, the posterior calli low but distinct, the apex not produced downwards in ♀; the shallow striae with deep punctures that diminish behind and are separated by about their own length, each puncture containing a recumbent scale and most of the discal ones with their anterior margin subgranulate; the intervals as broad as the punctures on the basal half and much broader behind, finely rugulose and with a row of suberect scale-like setae, intervals 3 and 5 with a low granulate elevation near the base. *Legs* black, with the tarsi red-brown; femora with a large triangular tooth, front pair with dense fulvous scales except at the apex which is dark brown, posterior pairs with mixed fulvous and brown scales and a broad fulvous band; tibiae almost straight, the basal half with brown, the apical half with pale scales, the corbels of the hind pair obliquely rounded externally. *Metasternum* opaque and reticulately punctured laterally, shiny in the middle, with small distant punctures and only a narrow sulcus in the middle of the apical half.

Length 6.0–8.0 mm., *breadth* 2.3–3.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1 ♂ 5 ♀, v–vi. 1934.

Distinguished from the other Burmese species by the sculpture of the head and the granules in front of the punctures on the elytra. Superficially it most resembles *M. subcylindricus* Fst., but the latter differs also in having a longer and more smooth prothorax, the shoulders of the elytra are narrower and more sloping, the legs are shorter and much thicker, and the metasternum is equally coarsely punctate throughout.

Mecistocerus spp.—Kambaiti, seven specimens of seven different species, v–vi.

Mecistocerus sp.—Sadon, 1 ♀, vi–vii.

***Rhadinomerus stricticollis* sp. n.**

♀. Derm dull black; prothorax with some fulvous scaling between the bare granules; elytra with irregular tufts and short transverse bands of short suberect oblong fulvous scales.

Head bare on the vertex, with coarse shallow punctures; frons opaque, shallowly rugulose, with sparse scales and a deep median sulcus that extends on to the base of the rostrum, and a deep furrow adjoining the eyes. *Rostrum* about as long as the pronotum, deeply constricted at the base, with four punctate sulci on the basal half, the median space narrowing to a point before reaching the base. *Antennae* inserted at the middle of the rostrum, red-brown; funicle pubescent, joint 1 as long as but much thicker than 2, 3 and 4 subequal and longer than broad, 5 as long as broad, 6 and 7 transverse. *Prothorax* as long as broad, rounded laterally, widest at the middle, strongly constricted near the apex, the constriction continued deeply across the disk, truncate at the base; dorsum strongly convex, highest behind the middle, coarsely punctate, with the intervals partly subgranulate, there being a low median carina on the anterior half, with a large granule on each side of it close behind the constriction; scaling confined to the punctures, with sparse short suberect clavate setae. *Scutellum* very small, bare. *Elytra* ovate, with the shoulders reduced and obliquely rounded, the posterior calli small; the separated punctures rather large, subquadrate, partly filled with scaling and diminishing behind, the rows being somewhat irregular in parts, the interspaces in the rows as long as or longer than the punctures and

often bearing large flattened granules ; the intervals rather irregular, sinuous and subgranulate in parts, interval 3 being slightly higher than the others and raised at the base into a large elongate granular tubercle. *Legs* with fairly dense elongate brown scales ; femora with only a small tooth that is partly obscured by scales ; tibiae straight. *Underside* : metasternum depressed in the middle but without any median sulcus, set with large contiguous punctures, each containing a short scale ; ventrite 1 with large separated punctures, 2-4 impunctate.

Length 7.0 mm., breadth 3.0 mm.

N.E. BURMA : Kambaiti, 7000 ft., 2♀, v-vi. 1934.

Most nearly allied to the Sumatran, *Berosiris pauper* Pascoe, which is a *Rhadinomerus*, and the sloping shoulders of the elytra in both species suggest that they may be incapable of flight. *R. pauper* lacks the very deep subapical constriction of the prothorax, which is simply punctate, without any trace of granules or median carina ; the frontal sulcus does not extend on to the rostrum ; and the metasternum has a deep median furrow.

The deep subapical constriction of the pronotum distinguishes this species from all its known congeners.

Rhadinomerus impar sp. n.

♂♀. Derm rather shiny black or pieceous ; prothorax with the sides and pleurae rather thinly clothed with yellowish scales, the disk dark with an indefinite pale median stripe ; elytra variegated with yellowish scales which tend to form irregular broken transverse bands.

Head closely punctate, without any frontal fovea or sulcus. *Rostrum* a little longer than the pronotum, constricted at the base, confluent punctate to beyond the middle in ♂ and with three narrow carinae ; in ♀ punctate only to the middle and with the carinae less distinct. *Antennae* inserted at a little beyond the middle in ♀ and at about one-third from the apex in ♂, with the scape and joint 1 of the funicle flavous, the rest red-brown ; funicle not pubescent, joint 1 slightly longer and much thicker than 2, the rest bead-like and transverse. *Prothorax* a little broader than long, moderately rounded laterally, widest behind the middle, with a broad shallow apical constriction ; dorsum slightly convex longitudinally in the basal half, with a broad shallow depression apically, and with dense small reticulate punctures, without any smooth median line, the scale-like setae (mostly black) obliquely raised and some projecting over the apical margin. *Scutellum* round, bare, opaque. *Elytra* oblong-ovate, rather broad (9 : 5.5), parallel from the prominent shoulders to well beyond the middle, the subapical depressions distinct ; the striae containing close subquadrate punctures (partly obscured by scaling) that diminish behind, the larger punctures with a minute shiny granule on each side ; the intervals as broad as the striae on the basal half and broader behind, bearing small granules and a row of suberect scale-like setae (some black, some yellowish), interval 3 with an elongate granular tubercle near the base, a much smaller one adjoining it on 4, and a trace of one on 5. *Legs* pieceous, with the tarsi flavous, thinly clothed with uniform grey scaling ; the femoral tooth very small and sharp ; tibiae straight, the uncus quite straight in ♂, somewhat curved in ♀. *Underside* : metasternum densely punctate, without any fovea or sulcus ; ventrites 1 and 2 with small separated punctures, 3 and 4 opaque, impunctate.

Length 3.0-5.0 mm., breadth 1.1-2.0 mm.

N.E. BURMA : Kambaiti, 7000 ft., 3♂ 4♀, v-vi. 1934.

Rhadinomerus favicollis sp. n.

♂♀. Derm black; prothorax with scattered suberect spatulate pale setae (probably one in each puncture normally); elytra irregularly variegated with black and fulvous to yellowish bands or patches of scales.

Head coarsely punctate, with a few erect scales near the eyes, frons with a minutely punctate smooth median area including a broad deep sulcus. *Rostrum* as long as the pronotum, constricted at the base, coarsely punctate and tricarinate basally, the median carina distinct in ♀, almost obliterated in ♂. *Antennae* inserted at slightly beyond the middle in ♀ and at about one-third from the apex in ♂, red-brown; funicle not pubescent, joints 3 and 4 as long as broad and subequal, 5-7 transverse and bead-like. *Prothorax* a little broader than long, almost parallel-sided to beyond middle in ♂, slightly rounded in ♀, broadly and shallowly constricted at apex; dorsum longitudinally convex basally and depressed in front, closely set with deep subreticulate punctures, like a shallow honeycomb, with a very narrow abbreviated median carina. *Scutellum* round, bare, shiny. *Elytra* elongate, parallel from the roundly rectangular shoulders to the middle, the subapical calli well-marked in ♀, less so in ♂; the striae with small close subquadrate punctures that diminish behind; the intervals broader than the striae, rugulose, with a row of suberect scale-like setae (black or yellowish), interval 3 with a short elevation near the base and a shorter one on 5. *Legs* black or piceous, the tarsi paler; femora with a small stout tooth, thinly squamose and with a pale subapical band; tibiae with the basal half dark, the apical half with pale scaling, the lower edge shallowly bisinuate, corbels of the hind pair with the outer angle rectangular and slightly projecting. *Underside*: metasternum opaque and densely punctate, except in the middle where it is shiny with separated punctures, without any median fovea or sulcus; ventrites 1 and 2 with small sparse punctures, 3 and 4 almost impunctate.

Length 4.5-5.2 mm., *breadth* 1.2-2.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1 ♂ 2 ♀, v-vi. 1934.

Rhadinomerus furcatipes sp. n.

♂♀. Derm rather shiny black with scattered sparse groups of narrow yellowish scales.

Head with strong close punctures, the frons with a large deep median fovea. *Rostrum* slightly longer than the pronotum, constricted at the base, with coarse confluent punctation on the basal half and a smooth median line. *Antennae* red-brown; funicle not pubescent, joints 3 and 4 subequal and slightly longer than broad, 5-7 transverse. *Prothorax* slightly broader than long, rounded laterally, widest behind the middle, broadly constricted at the apex; dorsum longitudinally convex basally and depressed in front, with rather large reticulate punctures and a fine short median carina, with sparse narrow elongate clavate scales. *Scutellum* rounded, rugulose and setose. *Elytra* oblong-ovate, parallel from the roundly rectangular shoulders to the middle, more narrowed apically than in the two preceding species, especially in ♂, the posterior calli feeble in ♀, a little more prominent in ♂; the striae with small close punctures that diminish behind; the intervals broader than the striae, slightly convex, shagreened, with a row of suberect scale-like setae, interval 3 with a short basal elevation and a much smaller one on 5. *Legs* black, evenly covered with sparse pale scales, the tarsi red-brown; femoral tooth small on the hind pair, more or less rudimentary on the anterior pairs; tibiae straight, exterior angle of corbels rounded, the mucro

on the posterior pairs straight and bifurcate in ♂, simple and curved in ♀. *Underside*: metasternum opaque and closely punctate laterally, shiny and with more distant punctures in the middle, there being a fairly impunctate area in the middle of the base, with a shallow median depression, but no fovea or sulcus; all the ventrites with separated strong punctures.

Length 4.7–5.0 mm., *breadth* 1.7–2.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., 2♂ 1♀, vi. 1934.

Rhadinomerus spp.—Kambaiti, five specimens of five different species, v–vi.

KEY TO THE BURMESE SPECIES OF *Rhadinomerus*.

- 1 (2). Apical area of prothorax separated off by a deep sulcus; elytra with obliquely sloping shoulders *stricticollis* sp.n.
- 2 (1). Apical area of pronotum simply depressed; elytra with prominent, roundly rectangular shoulders.
- 3 (4). Prothorax widest in front of the middle, without a median carina; elytra with dense yellowish scaling *contemptus* Fst.
- 4 (3). Prothorax widest at or behind the middle; pale scales on elytra forming spots or irregular bands.
- 5 (6). Prothorax coarsely granulato-punctate, without a median carina, widest at middle; intervals on elytra narrower than the punctures; metasternum coarsely punctate throughout, with a median fovea at base and apex; ventrite 1 with a row of very large punctures along the whole base *granulicollis* Fst.
- 6 (5). Prothorax not granulate, with a short median carina (except *impar*, sp. n.); intervals on elytra not narrower than the punctures; metasternum without median foveae; ventrite 1 without a basal row of very large punctures.
- 7 (8). Frons without a fovea or sulcus; pronotum without a median carina *impar* sp.n.
- 8 (7). Frons with a deep fovea or sulcus; pronotum with a short median carina.
- 9 (12). Setae on upperside scale-like and suberect; intervals on elytra not granulate; interval 3 with a short elevation near base.
- 10 (11). Frons with a deep sulcus; scutellum bare, shiny; femora with a pale subapical band; hind tibiae with the outer angle of the corbel rectangular and slightly projecting, uncus on posterior pairs of ♂ normal *favicollis* sp.n.
- 11 (10). Frons with a deep fovea; scutellum rugulose, setose; femora uniformly squamose; hind tibiae with the outer angle of the corbel rounded, uncus on posterior pairs of ♂ bifurcate *furcatipes* sp.n.
- 12 (9). Setae on upperside hair-like and erect; intervals on elytra finely granulate, interval 3 without a basal elevation *conciliatus* Fst.

The characters of *R. contemptus* and *conciliatus* have been drawn from the descriptions only.

***Rhadinopus tecticollis* sp. n.**

♂♀. Derm black, variegated with dense pale brown, black and whitish scales without any definite pattern; underside with a broad suberect whitish scale in each puncture.

Head with pale brown and whitish scales and behind each eye a large patch of short erect black peg-like scales; frons in front about as wide as the rostrum

near the base and rather rapidly narrowed behind, with a small fovea. *Rostrum* with the antennae inserted at about one-third from the base in both sexes; the basal area with coarse confluent punctation and a smooth median carina that does not ascend the frons; the anterior part with very sparse fine punctures in ♀, these being distinctly larger in ♂. *Antennae* red-brown, with joint 2 of the funicle a little longer than 1, 3 somewhat longer than broad and equal to 4, 5-7 subequal and bead-like; club broadly ovate in one aspect, somewhat compressed in the other. *Prothorax* nearly twice as broad as long, widest close to the base and there gently rounded, then narrowing rapidly to the apex, which is shallowly constricted; dorsum raised in the middle of the disk into a tectiform ridge, with a complete narrow median carina, the deep pentagonal punctures with their interspaces rather broader than usual and opaque; the paler scales broad and recumbent, the black ones erect and peg-like. *Scutellum* nearly round, squamose, its cavity as long as broad. *Elytra* comparatively short and very broadly ovate, with only a small subapical impression and no posterior calli; the deep striae with large punctures, which are partly concealed by scaling, the intervals a little broader than the striae, flat and not carinate even posteriorly, except interval 9, interval 1 with a smooth line along the sutural edge; scales dense, smaller than those on the pronotum, all the intervals with a row of numerous suberect scale-like setae, the punctures in the striae containing a long narrow scale. *Legs* with fairly dense brown and whitish scales; femora convex on the dorsal edge, with a very small second tooth; tibiae with the sharply carinate dorsal edge only slightly curved and for the greater part parallel with the lower edge.

Length 5.0-5.5 mm., *breadth* 3.0-3.2 mm.

BURMA: Tenasserim, Malvedaung, 1000 ft., 30 km. S. of Ye, 2♂ 1♀, xi. 1934.

Distinguished from all the previously described species by the tectiform pronotum and the second femoral tooth.

***Rhadinopus indutus* sp. n.**

♂♀. Derm piceous, with dense pale fawn-coloured scaling above and a few tufts of black peg-like setae; underside with small isolated recumbent pale scales.

Head rugosely punctate, with a small recumbent scale in each puncture; frons rapidly narrowing posteriorly, with a small fovea. *Rostrum* with the antennae inserted at two-fifths from the apex in both sexes; dorsum rugosely punctate on the basal half in ♂, on the basal third in ♀. *Antennae* red-brown, with the two basal joints of the funicle subequal, 3 longer than 4, 5-7 subequal and a little longer than broad; club somewhat compressed. *Prothorax* nearly twice as broad as long, widest at the base, rapidly narrowing to the apex with the sides slightly curved, shallowly constricted at the apex, which is half as wide as the base; dorsum flat along the median line, with large dense punctures and a narrow sinuous median carina, the punctures partly hidden by large flat scales; across the middle a row of four small tufts, each containing three or four erect stout peglike black setae, and two longer and denser tufts on the apical margin. *Scutellum* with a small median tubercle. *Elytra* triangular, widest at the shoulders and rapidly narrowing to the apex with the sides slightly curved, with a distinct subapical constriction and well-marked posterior calli; the punctate striae concealed beneath the broad overlapping scales; the intervals flat, broader than the striae, interval 3 slightly higher than the others with a row of three or four tufts of erect peg-like black setae, 9 costate at the apex only, 1 with a smooth line along the sutural edge, 5 and 7 with a row of distant erect scale-like pale

setae. *Legs* with fairly dense, pale fawn scaling; femora nearly straight on the dorsal edge, with only one small tooth beneath; tibiae with the upper and lower edges parallel and without any external angulation at the apex.

Length 3·8–4·0 mm., *breadth* 2·0–2·1 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1♂ 1♀, v–vi. 1934.

From the previously described species of the genus *indutus* differs in its small size, more triangular elytra with their flat intervals and concealed striae, the tuberculate scutellum, entirely bare pectoral channel, etc.

Rhadinopus sp.—Kambaiti, 1♀, vi.

Rhadinopus sp.—Myitkyina, 1♂, vii.

Rhadinopus sp.—Tenasserim, Mekane, 90 km. E. of Moulmein, 200 m., 1♂, xi.

Zeugenia histrionica Pasc.—Mekane, 1♀, xi.

Zeugenia sp.—Kambaiti, 1♀, vi.

Orochlesis spp.—Mekane, two specimens of different species, xi.

Cryptorrhynchus sp.—S. Shan States, Inle Lake, 1♀, ix.

Cryptorrhynchus sp.—40 km. E. of Taunggyi, 1♂, ix–x.

Genus? (*Cryptorrhynchinae*)—four specimens of three different genera, Kambaiti, v–vi, and Washaung, vii.

LEPIDARCUS gen. n.

Head convex, not hidden by the pronotum; frons narrower than the rostrum between the antennae; eyes coarsely faceted. *Rostrum* roundly dilated near the base and constricted at the actual base; scrobes passing beneath the rostrum basally and there dilated. *Antennae* inserted at a little beyond the middle of the rostrum in both sexes; scape about as long as the funicle, clavate; funicle with joints 1 and 2 equal; club elongate, widest beyond the middle, segmented. *Prothorax* transverse, bisinuate at the base, the apical margin arcuate, the postocular lobes distinct. *Scutellum* exposed, squamose. *Elytra* much wider at the shoulders than the prothorax, with ten complete striae, the subapical calli prominent. *Legs* short, slender; femora only slightly clavate, not sulcate beneath, with a small tooth, the hind pair not exceeding the subapical calli on the elytra; tibiae not compressed, straight, with a strong uncus and no mucro; tarsi with joint 2 longer than broad, as long as 3, the claws slender. *Sternum* with the pectoral furrow bare, the mesosternal cavity horseshoe-shaped, much higher than the metasternum, overhanging at the apex, reaching the middle of the median coxae; metasternum longer than a median coxa. *Venter* with the intercoxal process narrow, sharply acuminate; posterior margin of ventrite 1 quite straight, 2 longer than 3 but shorter than 3 and 4.

Genotype: *Lepidarcus malaisei* sp. n.

This genus comes nearest to the Papuan *Hyparinus* Pasc., in which however the mesosternal receptacle is on a level with the metasternum and reaches the hind margin of the median coxae; the intercoxal process of the venter is broad and forms an obtuse angle; the femora exceed the elytra and the tibiae are strongly compressed; the antennae are inserted far behind the middle of the rostrum, and joint 2 of the funicle is longer than 1.

Lepidarcus malaisei sp. n.

♂♀. Derm black; upperside with dense fawn scaling; pronotum with two indefinite darker discal stripes from the median tufts to the base; elytra with a more or less diamond-shaped large common blackish area, extending to stria 4 in the middle and narrowing to stria 1 at the base and to stria 2 at the top of the

declivity, being sometimes invaded by fawn scales; metasternum and the basal ventrite with isolated fawn scales in the punctures, the remainder being almost bare.

Head with the rugose punctures entirely concealed by the dense overlapping concave scales. *Rostrum* as long as the pronotum, rather strongly curved, the basal half with large subreticulate punctures and a smooth median line, the apical half smooth with sparse small punctures; rostrum of ♀ similar, except that the apical half is a little narrower with smaller closer punctures. *Antennae* honey-brown; funicle with joints 3 and 4 subequal and slightly longer than broad, 5-7 transverse, moniliform, 7 being the widest. *Prothorax* transverse (5:6), widest at the middle, narrowing slightly to the base, much more so in front, shallowly constricted at the apex; dorsum with a broad shallow median longitudinal depression, a transverse row beyond the middle of four tufts of stout erect scales (the median ones larger) and two more at the apex, the whole punctation concealed by very large overlapping flat scales, much larger than those on the elytra. *Scutellum* densely squamose. *Elytra* parallel from the roundly rectangular shoulders to beyond the middle; the dorsal outline rising shortly from the base, then flat to the top of the declivity, which slopes steeply to the apex; the rows of large deep punctures (each containing a narrow scale) completely hidden by large overlapping scales, except near the suture; interval 2 with three erect tufts of dense black scales, near the base, at the middle and at the top of the declivity, interval 4 with two tufts in between those on 2, other intervals with a row of very short erect scale-like setae. *Legs* with the femora black, the tibiae and tarsi red-brown; femora with dense grey scaling, with two dorsal black spots, a large median and a smaller subapical one; tibiae with grey scaling and the apical half black dorsally.

Length 5.0-5.5 mm., *breadth* 2.0-2.2 mm.

N.E. BURMA: Kambaiti, 7000 ft., 4♂ 1♀, v-vi. 1934.

Lepidarcus sp.—Kambaiti, 1♂, v.

Subfamily LOBOTRACHELINAE.

Genus LOBOTRACHELUS Schönh.

The small weevils of this genus appear to be numerous in the Old World Tropics, and as they are difficult to discriminate, it has seemed advisable to describe here all the Burmese species of which adequate material is available and to supply a key which may facilitate their identification.

Faust (*Ann. Mus. Stor. nat. Genova*, 1895, 34: 294) recorded nine species from Burma, but the occurrence of one of these (*angulatus* Mot.) seems dubious; of the remainder four are known to me from the description only: *ineptus* Gyll., *leucaspis* Fst., *ruficornis* Mot., and *ingratus* Fst., and of these only *leucaspis* is included in the key. Dr. Malaise found six new species, and five more are described from the British Museum collection. Thus twenty-one species have now been recorded, of which eighteen appear in the key, and there are eight additional species of which I have seen single specimens only.

KEY TO THE BURMESE SPECIES OF *Lobotrachelus*.

- 1 (4). Clothing of elytra consisting entirely or mostly of scales.
- 2 (3). Dorsal scaling pale grey; elytra each with three large round black spots (the discal one sometimes indistinct); legs very long and slender, hind femora exceeding the elytra by almost half their length; rostrum of ♀ with a few scales at base only and a row of fine erect hairs on each side *sexnotatus* sp. n.

- 3 (2). Elytra with an indefinite pattern of pale brown and white scales ; legs much shorter, femora broad, the hind pair only shortly exceeding the elytra ; rostrum of ♀ squamose nearly to apex, without erect hairs *lepidotus* sp. n.
- 4 (1). Clothing of elytra consisting entirely of setae, or very rarely (*frenatus*) with a few markings of narrow scales.
- 5 (8). Tooth on front femora forming a broad lamina.
- 6 (7). Elytra with markings of white setae but no white scales ; pronotum without a white band at base and apex *laminatipes* sp. n.
- 7 (6). Elytra with markings of narrow white scales : a sutural stripe, a long stripe on interval 5, a lateral patch before middle ; pronotum with a white band at base and apex *frenatus* sp. n.
- 8 (5). Teeth on front femora in the form of a simple spine, or more or less obsolete.
- 9 (14). Front femora with two teeth.
- 10 (13). Teeth on front femora placed one behind the other but not in alignment.
- 11 (12). Elytra clothed with dark setae except for a basal band of white setae on intervals 1-4 ; tarsi testaceous *bidens* sp. n., ♂♀
- 12 (11). Elytra with rather dense uniform grey setae ; tarsi black
plumbeus Mot., ♂
- 13 (10). Teeth on front femora placed side by side *plumbeus* Mot., ♀
- 14 (9). Front femora with a single tooth or none.
- 15 (22). Scutellum entirely concealed by the median basal lobe of the pronotum ; many intervals on the elytra with only a single row of setae.
- 16 (17). Ventrite 5 of ♂ with a deep round bare punctate depression occupying nearly the whole surface, each side with an angulate projection bearing a tuft of dense setae ; rostrum of ♀ very long, as long as the elytra ; antennae with the scape and joint 1 of the funicle testaceous, the rest black *morosus* Fst.
- 17 (16). Ventrite 5 of ♂ without any depression or projections, closely squamose ; rostrum of ♀ much shorter than the elytra ; antennae entirely testaceous.
- 18 (21). Rostrum forming a distinct angle with the frons ; elytra without bands of white setae ; tibiae wholly or partly red.
- 19 (20). Rostrum and all the tibiae red ; prothorax with a fairly large patch of white scales in the anterior and posterior angles
rufitibiis sp. n.
- 20 (19). Rostrum black, with the extreme apex red ; tibiae black, the anterior pairs red on the apical third, the hind pair only at the apex ; prothorax with only a fringe of single white scales in the hind angles and no white scales in the anterior ones *parvus* sp. n.
- 21 (18). Dorsal outline of the rostrum forming a continuous line with the frons ; elytra with a basal and postmedian band of sparse whitish setae ; tibiae black *asperulus* Fst.
- 22 (15). Scutellum visible behind the prothoracic lobe ; intervals on elytra with two or more rows of setae or none.

- 23 (28). Front femora with the tooth absent or rudimentary.
- 24 (27). Pronotum only slightly convex longitudinally in the middle line, the discal punctures comparatively large, much wider than the intervals between them.
- 25 (26). Upper surface mostly clothed with long coarse grey setae ; suture of elytra with a complete stripe of intercrossed grey setae ; rostrum of ♂ not deeper at the antennae than near the base
- 26 (25). Upper surface mostly clothed with short dark setae, with scattered groups of sparse whitish setae ; suture of elytra without such a stripe ; rostrum of ♂ much deeper at the antennae than near the base *vacivus* sp. n., ♂.
- 27 (24). Pronotum strongly convex longitudinally, the discal punctures smaller than the intervals *simplicipes* sp. n., ♂♀.
- 28 (23). Front femora with a single sharp tooth.
- 29 (36). Disk of pronotum dull, with large shallow ocellated punctures, each containing a seta, the intervals narrower than the punctures.
- 30 (31). Basal lobe of pronotum clothed with sparse grey setae ; scutellum with dense whitish scales ; suture of elytra with a complete stripe of intercrossed grey setae *vacivus* sp. n., ♀.
- 31 (30). Basal lobe of pronotum with a patch of dense silvery-white scales ; scutellum bare or with dark setae ; suture of elytra without such a stripe.
- 32 (33). Vertex of head opaque ; upper edge of the area of white scales on the propleurae sinuate in the middle ; rostrum of ♂ not deeper at the antennae than at the base ; median area of metasternum and basal ventrite of ♂ with dense erect hairs . . . *subfasciatus* Mot.
- 33 (32). Vertex of head shiny ; upper edge of the white area on the propleurae quite straight ; rostrum of ♂ deeper at the antennae than at the base ; median area of metasternum and basal ventrite of ♂ with flat scales.
- 34 (35). Sides of prothorax curved *leucaspis* Fst.
- 35 (34). Sides of prothorax straight *urenae* Mshl.
- 36 (29). Disk of pronotum shiny, with small simple punctures without a seta, the intervals wider than the punctures.
- 37 (38). Elytra much broader at the shoulders than the prothorax, with the intervals rugulose and a common bisinuate band of sparse white setae behind the middle reaching stria 7 ; middle of metasternum with plumose scales *laportae* Mshl.
- 38 (37). Elytra only slightly broader at the shoulders than the prothorax, with the intervals smooth, and having behind the middle at most a few white setae on interval 3 ; middle of metasternum with simple recumbent setae *nudus* sp. n.

Lobotrachelus sexnotatus sp. n.

♂♀. Derm black, with dense pale grey scaling above and below ; pronotum with two round black spots in the middle of the disk (clothed with short brown setae), but these almost obliterated in ♂ ; elytra each with three large round black spots (clothed with brown setae), one on the humeral callus, another before the middle between striae 1 and 4 (sometimes partly obliterated), and the third on the declivity between striae 2 and 4.

Head with dense scaling, forming an erect crest along the frons, which is comparatively broad. *Rostrum* of ♂ as long as the pronotum, gradually widening in the apical half, porrect to the antennae (at two-sevenths from the apex) then curving downwards, much deeper at the antennae than at the base, compressed dorsally into a sharp high median carina and densely squamose throughout; rostrum of ♀ slightly longer, with the antennae a little further back, not deeper there than at the base, dorsum with scales only at the base and a row of short erect hairs on each side, the carina much less prominent. *Antennae* testaceous. *Prothorax* transverse (2 : 3), with the sides straight, the median basal lobe rather short, densely squamose, not carinate and not concealing the scutellum; dorsum moderately convex longitudinally, highest at the middle, with dense shallow ocellated punctures (concealed except in the discal spots) and no smooth median line. *Scutellum* exposed, squamose. *Elytra* with the fine striae largely obscured by the dense elongate scales, the broad intervals strongly rugulose. *Legs* unusually long and slender, the hind femora exceeding the elytra by nearly half their length, the front pair without a tooth or with a rudimentary one, the posterior pairs with a small sharp tooth.

Length 3.0–3.5 mm., breadth 1.5–1.7 mm.

N.E. BURMA : Kambaiti, 7000 ft., 1♂ 3♀, v. 1934.

Lobotrachelus lepidotus sp. n.

♀. Derm black to piceous, with more or less dense scaling forming an indefinite pattern; prothorax with the median lobe pure white, two large round dark spots in the middle of the base and two fainter ones in front of them, two indefinite whitish patches on each side of these, which either merge into the white on the pleurae or are separated from it by pale fawn-coloured scales; elytra with pale fawn scales, a subquadrate whitish patch at the base of intervals 1–3, an indefinite common arcuate dark band crossing the suture before the middle and extending up to the shoulder on each side, and behind this some variable short whitish stripes usually on intervals 3, 5 and 7; underside with dense whitish scales.

Head with dense fawn scales; frons forming a wide angle with the rostrum, a little broader than the apex of the scape, the scales suberect. *Rostrum* of ♀ elongate, as long as the pronotum (with the lobe), nearly straight, fairly closely squamose almost to the apex. *Antennae* inserted only a little beyond the middle of the rostrum, testaceous, elongate, all the joints longer than broad. *Prothorax* somewhat transverse (5 : 6), with the sides gently rounded, the basal lobe not carinate and partly concealing the scutellum; dorsum slightly convex longitudinally, with dense ocellated punctures (mostly concealed) and without any smooth median line. *Scutellum* squamose. *Elytra* with narrow striae containing a row of pale setae, the intervals rugosely punctate, the dark scales very narrow, the white ones the broadest. *Legs* piceous, with dense whitish scales, the tarsi paler; femora short and broad, with a sharp tooth, the hind pair only shortly exceeding the elytra.

Length 3.5 mm., breadth 1.5 mm.

BURMA, 3♀ (*A. K. Weld Downing*).

Type in the British Museum.

NOVIT. ZOOL., 42, 3. 1948.

Lobotrachelus laminatipes sp. n.

♂♀. Derm black to red-brown; prothorax dorsally with rather sparse whitish setae, becoming dark on the disk, the basal lobe with dense narrow white scales, the pleurae with a large irregular patch of broader white scales at base and apex (sometimes uniting in the middle); elytra with a nearly complete sutural stripe of interlocking white setae (but often much abbreviated), a broad common basal band of white setae extending to interval 5 or 6, a similar band behind the middle, extending in the typical form to interval 4 and narrowing outwards, but this may be more or less completely replaced by dark setae, whereas in southern (Tavoy) specimens it may extend broadly to interval 8; underside with dense white scales.

Head with shallow setigerous punctures which are denser behind the eyes; frons narrow, with short erect whitish setae. *Rostrum* of ♂ shorter than the pronotum (5:6), not dilated at the apex, of equal depth throughout, almost straight, with rather dense white scales, dorsum compressed into a sharp ridge on the basal half; rostrum of ♀ longer than the pronotum (7:6), a little narrower, bare except for a few pale setae at the base, with very fine sparse punctures and a less distinct median carina. *Antennae* testaceous, inserted at two-fifths from the apex of the rostrum in ♂ and a little further back in ♀. *Prothorax* transverse (2:3), with the sides straight, the basal lobe densely squamose, not carinate, partly concealing the scutellum; dorsum gently convex longitudinally, with dense shallow ocellated punctures and no smooth median line. *Scutellum* small, squamose. *Elytra* with deep, shallowly punctate striae, the intervals flat, shiny, with sparse minute granules and 2-3 rows of setae. *Legs* black, with stripes of white setae; front femora with the tooth expanded into a lamina about twice as long as deep, the distal end of which is sharply pointed and the proximal end rounded, the shape varying somewhat; posterior femora with the tooth normal and sharp, the hind pair shortly exceeding the elytra.

Length 2.0 mm., breadth 1.0 mm.

BURMA: Ruby Mines, 3♂ (*Doherty*-type); Tenasserim, Tavoy, 2♂ 1♀; Washaung, 20 km. E. of Myitkyina, 700 ft., 1♂ 1♀, vii. 1934 (*Dr. R. Malaise*); Momeit, 1♀ (*Doherty*).

Type in the British Museum.

Lobotrachelus frenatus sp. n.

♀. Derm black, with dark setae above and lines and bands of narrow white scales; pronotum with a narrow white band at the base and a slightly wider one just behind the apical margin, these joining up laterally with the broad white area on the pleurae; elytra without any basal band, but with a complete white sutural stripe and another on interval 5 that reaches neither base nor apex, a lateral white patch (divided by the striae) before the middle between stria 9 and the margin, and two or three lines of separate white scales along the apical margin; underside with dense white scales.

Head with sparse pale setae and shallow punctures; frons with two rows of narrow suberect white scales. *Rostrum* of ♀ about as long as the pronotum, bare except for a row of fine recumbent setae on each side, with sparse fine punctures and a narrow median carina. *Antennae* inserted at a little beyond the middle of the rostrum, testaceous. *Prothorax* transverse (3:4), with the sides straight, the basal lobe squamose but not covering the scutellum; dorsum gently convex longitudinally, with dense ocellated punctures without any smooth median line.

Scutellum squamose. *Elytra* with deep, shallowly punctate striae, the flat intervals shallowly rugulose and with two rows of setae. *Legs* as in *L. laminatipes* sp. n.

Length 2.0 mm., breadth 1.0 mm.

BURMA : Ruby Mines, 1♀ (*Doherty*).

Type in the British Museum.

Lobotrachelus bidens sp. n.

♂♀. Derm black, clothed above mainly with short dark setae ; prothorax with a narrow band across the base formed of narrow white scales, these being denser on the basal lobe, and the pleurae with a broad stripe of broader white scales, the upper edge of which is sinuate ; elytra with a broad common basal band of white on intervals 1-4, usually projecting further backwards on interval 1 ; underside with dense white scales.

Head with fine shallow punctures and sparse dark setae ; frons of ♂ with the usual crest of erect white scales, which is reduced to a few setae in ♀. *Rostrum* of ♂ a little longer than the pronotum, slightly curved, a little deeper at the antennae (one-third from the apex) than near the base, the dorsum compressed into a sharp median ridge and densely clothed with white scales nearly to the apex ; rostrum of ♀ somewhat longer and more slender, of equal depth throughout and entirely devoid of scales. *Antennae* testaceous. *Prothorax* transverse (2 : 3), with the sides straight, the basal lobe only partly covering the scutellum ; dorsum gently convex longitudinally, with dense shallow ocellated punctures and no smooth median line. *Scutellum* squamose. *Elytra* with deep, shallowly punctate striae, the intervals slightly convex, with numerous granules and 2-3 rows of setae. *Legs* black, with stripes of long white setae, the tarsi testaceous ; front femora with two small teeth, one behind the other but not in the same line, the posterior tooth at or behind the middle of the femur.

Length 1.7-2.0 mm., breadth 0.7-1.0 mm.

BURMA : Karen Mts., 1♂ (*Doherty*-type) ; Ruby Mines, 5000-7000 ft., 1♂ (*Doherty*) ; Kambaiti, 7000 ft., 2♀, vi. 1934 (*Dr. R. Malaise*).

Type in the British Museum.

Lobotrachelus plumbeus Mot.—Kambaiti, 4♂ 10♀, v-vi.

Neither Motchulsky nor Faust mentions the curious sexual dimorphism in the teeth of the front femora.

Lobotrachelus rufitibiis sp. n.

♂♀. Derm black ; prothorax with sparse yellowish setae, a small spot of narrow white scales on the median basal lobe and longer spots at the apex and base of the pleurae ; elytra with lines of pale yellowish setae and a complete sutural stripe of intercrossing white setae ; underside with dense white scaling.

Head of ♂ with numerous fine yellowish setae, that of ♀ bare, shiny and impunctate dorsally ; frons narrow, with two lines of suberect yellowish setae. *Rostrum* of ♂ shorter than the pronotum (4 : 5), red, with a fine median carina, two median lines of narrow white scales on the basal three-fifths and pale setae on each side ; rostrum of ♀ longer than the pronotum (6 : 5), more slender, widening at the apex, with only sparse setae and no scales. *Antennae* testaceous. *Prothorax* transverse (5 : 7), with the sides straight, the basal lobe concealing the scutellum ; dorsum convex longitudinally in ♂ and highest behind the middle, almost flat in ♀, with very shallow ocellated punctures and no smooth median line. *Scutellum*

concealed. *Elytra* with deep, shallowly punctate striae, the intervals flat, finely and sparsely subgranulate, many of them bearing (wholly or partly) only a single row of setae and double rows elsewhere, the setae being rather stouter in ♂. *Legs* with lines of white setae, the femora black, the tibiae and tarsi red; all the femora with a small sharp tooth.

Length 1.9 mm., *breadth* 1.0 mm.

BURMA: Tenasserim, Tavoy, 1 ♂ 1 ♀ (*Doherty*).

Type in the British Museum.

It seems probable that this species is the same as that tentatively attributed to *angulatus* Mot., by Faust (*Ann. Mus. Stor. nat. Genova*, 1895, 34: 295), but Motchulsky's species was described from a high altitude in Ceylon, and its occurrence in Burma seems very unlikely.

Lobotrachelus parvus sp. n.

♀. *Derm* black, with sparse grey setae; *prothorax* with only a fringe of single white scales in the posterior angles and no scales on the median lobe or in the anterior angles; *elytra* with lines of grey setae (mostly forming single rows on the intervals) and a complete sutural stripe of interlocking grey setae; *underside* with dense whitish scaling.

Structurally very close to *L. rufitibiis*, sp. n., the description of which applies to it, except as follows: *Head* of ♀ somewhat more punctate on the vertex. *Rostrum* black, red only at the extreme apex. *Prothorax* more transverse (5:8), more sloping in front. *Legs* with the tibiae black, the anterior pairs red on the apical third, the hind pair at the apex only.

Length 2.0 mm., *breadth* 1.0 mm.

BURMA: 2 ♀ (*A. K. Weld Downing*).

Lobotrachelus simplicipes sp. n.

♂♀. *Derm* black, with numerous short black setae and a few sparse longer white setae; *prothorax* with a spot on each side of the front margin formed of separated white setae, a similar pair behind the middle, and behind these a pair of transverse spots on the hind margin, a few white setae on the median lobe, and the pleurae in ♂ with separated grey scales throughout with a denser band along the basal margin, in ♀ with black setae and only a spot of whitish scales in the basal angle; *elytra* with the following markings of sparse whitish setae: a quadrate spot behind the scutellum, a small spot at the base of interval 3, an abbreviated stripe (may be much reduced or absent) on 5 and 7, and a few isolated setae elsewhere; *underside* with fairly dense whitish scales.

Head with dense whitish scales on the frons in ♂ and blackish ones in ♀. *Rostrum* of ♂ longer than the pronotum (4:3), straight from the base to the antennae (three-eighths from the apex) then strongly deflected, much deeper at the antennae than at the base, the dorsum compressed into a sharp median ridge, with sparse narrow whitish scales; *rostrum* of ♀ longer (5:3), regularly curved, not deeper at the antennae (inserted at the middle), the dorsum not compressed, with a low median carina and bare of scales. *Antennae* testaceous. *Prothorax* transverse (2:3), with the sides almost straight from the base to near the apex and there feebly sinuate, the basal lobe leaving the scutellum fully exposed; *dorsum* nearly flat longitudinally, with dense shallow punctures and no smooth median line. *Scutellum* densely squamose. *Elytra* with deep, shallowly punctate striae, the broad intervals flat and finely rugulose, with three-four rows

of dark setae but only two white setae where these are present. *Legs* black, the tarsi reddish; femora of ♂ with whitish setae, the front pair without a tooth, the others with the tooth very small or rudimentary; femora of ♀ with black setae and only a dorsal patch of whitish setae on the posterior pairs, the tooth on the posterior pairs small, that on the front pair rudimentary.

Length 2.4–1.0 mm., *breadth* 2.6–1.1 mm.

N.E. BURMA: Kambaiti, 7000 ft., 4♂ 2♀, vi. 1934.

Lobotrachelus vacivus sp. n.

♂♀. Derm black, with thin grey scaling above, the elytra with a large subquadrate patch of dark setae before the middle between striae 1 and 4 and a similar one on the declivity; prothorax with dense greyish white scales on the pleurae, the upper edge of the patch being ill-defined; underside with dense whitish scales.

Head with dense whitish scales on the frons in ♂ and darker ones in ♀. *Rostrum* of ♂ a little shorter than the pronotum, gently and regularly curved, not deeper at the antennae than at the base, the dorsum not compressed, with fairly dense whitish scales almost to the apex; rostrum of ♀ slightly longer and more slender, bare, shiny and impunctate. *Antennae* testaceous, those of ♀ inserted only slightly beyond the middle of the rostrum, those of ♂ at one-third from the apex. *Prothorax* transverse (7 : 10), with the sides very slightly rounded, the basal lobe not covering the scutellum; dorsum gently convex longitudinally, with dense shallow ocellated punctures without any smooth median line. *Scutellum* densely squamose, entirely exposed. *Elytra* with deep, shallowly punctate striae, the broad intervals gently convex, with minute low granules and two-four rows of setae. *Legs* black with lines of whitish setae, only the base of the tarsi reddish; front femora with the tooth rudimentary in ♂, fully developed in ♀, tooth on posterior pairs distinct in both sexes.

Length 2.5–2.7 mm., *breadth* 1.5–1.6 mm.

N.E. BURMA: Kambaiti, 7000 ft., 4♂ 3♀, v–vi. 1934.

Lobotrachelus convexicollis sp. n.

♂. Derm red-brown, with short dark setae; prothorax with a dense fringe of long white scales in the posterior angles and sparse whitish setae along the anterior margin of the pleurae, and narrow white scales on the basal lobe; elytra with a short stripe of whitish setae at the base of interval 3 and sometimes on 2 also, and a common band of similar setae behind the middle extending to interval 4, but no white setae along the apical margin; underside with separated whitish scales.

Head bare on the vertex, with rather sparse punctures, the frons very narrow, with a low ridge of dark scales. *Rostrum* of ♂ as long as the pronotum, stout, widening from near the base to the apex, not deeper at the antennae (inserted beyond the middle) than near the base; dorsum compressed on the basal half to form a sharp median ridge, with longitudinally confluent punctures and sparse pale setae. *Antennae* testaceous, unusually short and stout, joints 4–7 of the funicle being transverse. *Prothorax* transverse (2 : 3), with the sides straight; dorsum strongly convex longitudinally, with small simple punctures which are narrower than the intervals between them and with a transverse basal impression on each side, without any smooth median line. *Scutellum* partly covered by the pronotal lobe, bare. *Elytra* with deep striae, the intervals

flat and rugulose, with three-four rows of setae. *Legs* black, with the usual white setae, the tarsi red-brown; posterior pairs of femora with a small sharp tooth, the front pair without a tooth.

Length 2.3 mm., breadth 1.0 mm.

BURMA: Ruby Mines, 2♂ (*Doherty*).

Type in the British Museum.

Lobotrachelus urenae Mshl.—Sadon, 4000 ft., 1♂ 1♀, vi–vii. It is possible that this species may prove to be synonymous with *leucaspis*, Fst.

Lobotrachelus laportae Mshl.—Sadon, 1♂, vi–vii.

Lobotrachelus 5 spp.—Kambaiti, five specimens, iv–vi.

Lobotrachelus nudus sp. n.

♂♀. Derm black, almost devoid of setae above and without definite white markings; underside with rather thin grey scaling laterally and setae in the middle.

Head bare, with small separated punctures; frons with a low carina without scales. *Rostrum* of ♂ as long as the pronotum, gently curved, stout, not dilated apically, not deeper at the antennae (two-sevenths from the apex) than near the base; dorsum strongly convex transversely with a complete narrow median carina, bare, with punctures that are subconfluent longitudinally; rostrum of ♀ of the same length, more slender, nearly straight and more finely punctate. *Antennae* testaceous, rather short and stout, joints 4–7 of the funicle transverse. *Prothorax* transverse (3 : 4), gently rounded laterally, the basal lobe unusually short; dorsum gently convex longitudinally, sloping anteriorly, very shiny, with numerous small simple widely-spaced punctures and a smooth median line, entirely bare, except for a few short white setae on the basal lobe and a short fringe of single narrower white scales in the basal angles; pleurae with the punctures rather larger than those on the disk and bare except for a few white scales on the anterior margin. *Scutellum* entirely exposed, bare. *Elytra* unusually narrow at the shoulders, being there only a little wider than the prothorax, with deep remotely-punctate striae, the broad intervals flat, bare and impunctate, except for a few white setae at the base of intervals 2 and 3, a few on 2 behind the middle, and numerous punctures and minute dark setae throughout interval 1. *Legs* black, with sparse white setae, the tarsi red-brown; the tooth on the anterior pairs of femora comparatively long and sharp, that on the hind pair much smaller.

Length 2.5–3.0 mm., breadth 1.0–1.5 mm.

ASSAM: Manipur, 2♂ (*Doherty*-type). N.E. BURMA: Sadon, 4000 ft., 1♀, vi–vii, 1934 (*Dr. R. Malaise*).

Type in the British Museum.

Subfamily ZYGOPINAE.

• **Metialma suturella** sp. n.

♂♀. Derm black; prothorax with a rhomboidal patch of sparse narrow pale scales in the middle of the basal half, enclosing a median stripe of dense yellowish-white broader scales, the whole surrounded by four coalescing black spots, the lateral areas variegated with sparse narrow pale scales enclosing an ovate black spot at about the middle and a smaller one in front of it, the posterior angles with a spot of dense yellowish-white scales, the pleurae with dense uniform whitish

scales; scutellum with dense yellowish scales; elytra variegated with white, yellowish, brown and blackish, narrow scales, the suture with a stripe of dense yellowish scales from the base to beyond the middle, followed by a black spot and then an apical white one of about the same length; underside with dense whitish scaling, with a large quadrate black spot at the base of the metepisterna and a smaller one adjoining it on the metasternum, the usual black median area on the venter extending on to ventrite 2.

Rostrum of ♂ black on the basal half and red from the apex almost or quite to the antennae, the basal part unevenly clothed with rather dense whitish scales; rostrum of ♀ with the red area shorter, from the apex about half-way to the antennae, the scales on the basal half yellowish, narrower and much sparser; the basal part rugulose and five-carinate in both sexes. *Antennae* red, often rather darker distally, inserted somewhat beyond the middle of the rostrum in both sexes; funicle with joint 1 about as long as 2 and 3. *Prothorax* somewhat transverse, widest at the base and narrowing with a slight curve to the very shallow apical collar, which is much deeper dorsally, the basal angles rounded, without any smooth median line. *Elytra* oblong-ovate, gradually narrowing from the shoulders to near the apex and then abruptly narrowed; the transverse basal and apical impressions deep, the suture depressed in the basal third, and interval 2 strongly tilted inwards basally. *Legs* with a small sinuation on the front femora just beyond the tooth; tibiae with the apical half red, the front pair with the dorsal edge almost straight on the apical three-fourths. *Pygidium* with rather sparse fine setae and with whitish or yellowish scales on the lateral margins only, and a median carina in both sexes; ventrite 5 with a tuft of setae on each side.

Length 3.0–4.0 mm., breadth 1.5–2.0 mm.

N.E. BURMA: Kambaiti, 31♂ 16♀, iv–vi. 1934.

***Metialma mimica* sp. n.**

♂♀. Extremely close to *M. suturella*, sp. n., the description of which applies to it except in the following particulars:—*Rostrum* rather stouter and much more strongly curved, entirely black in both sexes, except for the red mandibles. *Antennae* with joint 2 of the funicle about as long as 1. *Prothorax* slightly more transverse, with the pale spot in the hind angles rather larger. *Legs* with the tooth on the front femora smaller and much less sharply pointed. *Pygidium* with dense yellowish scales and setae.

Length 4.0–4.5 mm., breadth 2.0–2.2 mm.

N.E. BURMA: Kambaiti, 7000 ft., 11♂ 15♀, v–vi. 1934.

Metialma saeva Fst.—Kambaiti, 11♂ 7♀, iv–vi; Sadon 1♂, vi–vii.

Metialma ignorata Fst.—Punkaung, between Sadon and Myikyina. 1♂, vii.

Metialma 7 spp.—Kambaiti, 7 exx., v–vii.

Metialma 2 spp.—Sadon, 2 exx, vi–vii.

Metialma sp.—Taunggyi, 1♀, viii–ix.

***Metialma cordata* sp. n.**

♂♀. Derm black; prothorax with the large spot in the middle of the basal half broadly ovate, formed of narrow yellowish scales and enclosing behind an obovate spot of much denser broader yellowish-white scales, the whole surrounded by four subrotund black spots that are sometimes separate but more usually fused together, the remaining surface with separated narrow light brown and

whitish scales enclosing an oval lateral black spot behind the middle and a smaller round one in front of it; scutellum with dense whitish or pale yellow scales; elytra with mixed white, yellowish and brown scales and variable indefinite dark spots, without any distinct sutural stripe, except for an elongate white spot at the apex and a much shorter black spot in front of it; underside with dense whitish or yellowish scales, with a black spot at the base of the metepisterna, and the median black spots on the venter extending on to ventrite 2 but often bearing scattered pale scales, especially in ♂.

Rostrum longer than the pronotum (10 : 7) in both sexes, red from the antennae to the apex (♂) or only narrowly at the apex (♀), rugulose and five-carinate from the base to the antennae in both sexes, and here with fairly dense whitish scaling in ♂ and with thinner grey or brownish scaling in ♀. *Antennae* entirely red, inserted well beyond the middle of the rostrum in both sexes; funicle with joint 1 slightly longer than 2. *Prothorax* somewhat transverse, broadest at the base, gradually narrowing to the middle with the sides straight, then curving in to the apex where there is a shallow collar, which is rather deeper dorsally, the basal angles rounded; the dorsum gently convex longitudinally, but in the centre of the disk the scales are convergently suberect, so that in lateral view the dorsum may appear to be subconical in the middle. *Elytra* strongly cordate, rapidly narrowing from the broad shoulders in an even curve to the apex, the transverse apical impression being very shallow and short and the posterior calli feeble, the transverse basal depression broad and distinct, the suture moderately depressed in the basal third and interval 2 somewhat tilted inwards basally. *Legs* without any sinuation beyond the tooth of the front femora; front tibiae strongly curved dorsally from the base nearly to the apex. *Pygidium* setose in the middle and with broader yellowish scales at the sides; a median carina on the basal half in ♂, which is more or less obsolete in ♀; ventrite 5 with a broad triangular projection on each side in ♂ only.

Length 3.0-3.5 mm., breadth 1.7-1.9 mm.

INDIA: Kumaon, Ranikhet, 6♂ 6♀ (*H. G. Champion*); Almora, Khaula, 4500 ft., 3♂ 3♀ (*H. G. C.-type*); Darjeeling, Gopaldhara, 3400-4700 ft., 12♂ 5♀, iv-vi. 1914, vi. 1916, x. 1917, iv-xi. 1918 (*H. Stevens*); Tista Valley, Gielle Khola, 600 ft., 1♀, vi. 1919 (*H. S.*).

BURMA: Kambaiti, 7000 ft., 3♂ 1♀, iii-v. 1934 (*Dr. R. Malaise*); Momeit, 1♂ (*Doherty*); Tenasserim, Tavoy, 2♀ (*Doherty*).

Metalma jejuna sp. n.

♂♀. Derm black, with fairly dense, irregularly mingled, white, yellow and dark brown scales; prothorax with a large circular spot of such scales in the middle of the basal half, partly enclosing behind a spot of much denser yellowish-white scales on the basal lobe; this circular spot surrounded by an almost bare black quadrifid area (formed by the fusion of four spots), the rest of the surface with variegated scales enclosing a small oval dark spot in the middle of the dorso-lateral margin, a small yellowish spot in the basal angles, the lower half of the pleurae with denser broader yellowish-white scales, and the scutellum with dense similar scales; elytra variegated throughout, without any definite sutural marking except an elongate whitish spot at the apex; metepisterna with a subquadrate dark spot on the basal third, the rest with dense whitish scaling; venter mostly with separated pale yellowish scales, the usual dark median area on ventrites 3 and 4 broad and extending on to 2.

Rostrum similar in the two sexes, only slightly longer in ♀, black with the apex narrowly red, rugosely punctate, five-carinate and sparsely squamose from the base to the antennae. *Antennae* inserted beyond the middle of the rostrum in both sexes, red with the club fuscous; funicle with joint 1 slightly longer than 2. *Prothorax* slightly transverse, widest at the base, narrowing with a slight curve to the apex, with a shallow apical collar which is deeper dorsally, the basal angles rounded, sometimes with a narrow irregular abbreviated smooth median line. *Elytra* rather oblong-ovate, narrowing gradually from the oblique shoulders, the transverse apical depression rather deep, the transverse basal depression broad and distinct, interval 1 depressed in the basal third and 2 tilted inwards there. *Legs* with a small sinuation on the front femora just beyond the tooth; front tibiae with the dorsal edge almost straight on the apical three-fourths. *Pygidium* with broader whitish scales laterally and a narrow setose area in the middle about the median carina, which is distinct in both sexes; ventrite 5 with a small tuft of setae on each side.

Length 4.5-5.0 mm., breadth 2.0-2.2 mm.

N.E. BURMA: Kambaiti, 7000 ft., 3♂ 2♀, v. 1934.

Closely allied to *M. saeva* Fst., but apart from the characters mentioned in the key, that species differs in having the spot in the middle of the pronotum elongate, the dark area round it having its outer margins straight and not lobate, and the suture is less depressed at the base.

***Metialma levirostris* sp. n.**

♂♀. Derm black, with pale brown and grey setiform scales intermixed; prothorax with a transverse black band on each side of the base, two small round black spots a little in front of the middle of the disk and a very indistinct one just behind and between them, a yellow to whitish spot in the basal angles, and an elongate spot of dense white scales in the middle of the base; scutellum with dense white scales; elytra with a small white sutural spot close to the apex and blackish scales before and behind it and a small elongate spot of dense white scales on the margin opposite the hind coxae; pygidium, metasternum and venter (except the usual black median area on ventrites 3 and 4) with dense white scales, and a quadrate black spot on the base of the metepisterna, the mesepimera with sparse light brown scales and a few white or yellowish scales in the upper angle.

Rostrum of ♂ a little longer than the pronotum (8:7), black, opaque and strongly punctate nearly to the apex, with three fine carinae and pale scales on the basal half; that of ♀ a little longer (9:7), smooth and shiny, almost impunctate and bare except close to the base, without any carinae. *Antennae* entirely red, inserted at (♂) or behind the middle of the rostrum (♀); joint 1 of the funicle as long as 2 and 3. *Prothorax* somewhat transverse, parallel-sided in the basal half, then rapidly narrowing in a curve to the apex, which is not constricted, the basal angles subrectangular; dorsum moderately convex longitudinally, highest at a little beyond the middle, only shallowly depressed at the apex, without any smooth median line. *Elytra* rather narrowly ovate or subelliptical, the shoulders being much less prominent than usual, the broad transverse basal impression shallow and sometimes obsolescent, the posterior calli distinct, interval 1 depressed only quite close to the scutellum, 2 flat near the base. *Legs* with the front femora sinuate on the lower edge just beyond the tooth; front tibiae strongly curved dorsally on the basal two-thirds. *Pygidium* densely clothed with

broad white scales in both sexes; ventrite 5 with a triangular projection on each side of the pygidium in ♂ and a narrower one in ♀.

Length 3.0–3.5 mm., *breadth* 1.4–1.5 mm.

INDIA: Manipur, 2♂ (*Doherty*-type).

BURMA: Kambaiti, 7000 ft., 1♂ 3♀ (*Dr. R. Malaise*); Ruby Mines, 1♂ 2♀ (*Doherty*).

Type in the British Museum.

This is the only species of the genus known at present in which the rostrum of the ♀ is smooth throughout.

KEY TO THE BURMESE SPECIES OF *Metialma*.

- 1 (14). Each elytron with a transverse depression at the apex and an obtuse callus in front of it; rostrum and tibiae never entirely red.
- 2 (3). Metepisterna without any blackish basal spot; elytra with a whitish sutural stripe from base to near middle; antennal club black *sacva* Fst.
- 3 (2). Metepisterna with a large subquadrate blackish spot at base.
- 4 (7). Elytra with a sutural stripe of dense yellowish scales from base to beyond middle; tibiae with the apical half red; antennal club red.
- 5 (6). Rostrum of ♂ red from apex nearly to antennae, that of ♀ red for only half that distance; pygidium sparsely setose with only a few whitish scales on the lateral margins *suturella* sp. n.
- 6 (5). Rostrum of both sexes stouter, more strongly curved, black with only the mandibles red; pygidium with dense yellowish scales and setae *mimica* sp. n.
- 7 (4). Elytra without any distinct sutural stripe; tibiae black, rarely with the extreme apex red.
- 8 (13). Antennae inserted beyond middle of rostrum in both sexes; rostrum of ♀ coarsely punctate and carinate from base to antennae; elytra without a spot of dense white scales on the lateral margin; apex of femora black.
- 9 (10). Front tibiae straight dorsally on the apical three-fourths; elytra oblong-ovate; antennal club fuscous; ventrite 5 of ♂ with the external angles not projecting beyond the pygidium *jejuna* sp. n.
- 10 (9). Front tibiae strongly curved; elytra more cordate; antennal club red; ventrite 5 of ♂ with the external angles projecting well beyond the pygidium.
- 11 (12). Elytra more abruptly narrowed at the apex, the blackish area on the suture in front of the apical white spot as long as or longer than the latter; rostrum of ♂ red at apex only; ventrite 5 of ♂ produced on each side into a narrow tufted process; pygidium of ♀ with a complete median carina; tarsal claws simple *ignorata* Fst.
- 12 (11). Elytra more regularly narrowed at apex in an even curve, the blackish subapical spot on the suture much shorter than the white apical spot; rostrum of ♂ red from antennae to apex; ventrite 5 of ♂ with a broad triangular process on each side; pygidium of ♀ with only a short carina at the base; claws with a minute basal tooth *cordata* sp. n.

- 13 (8). Antennae inserted at (♂) or behind (♀) middle of rostrum ; rostrum of ♀ smooth, without carinae, and simply punctate near base ; elytra with a spot of dense white scales on the margin opposite the hind coxae ; apex of femora red *levirostris* sp. n.
- 14 (1). Elytra without any apical depression or subapical callus ; rostrum and tibiae entirely red in both sexes ; metepisterna without any basal black spot ; ventrite 5 of ♀ with a small conical projection on each side (♂ unknown) *rufirostris* Fst.

Subfamily CEUTHORRHYNCHINAE.

Mecysmoderes armirufus sp. n.

♂♀. Derm dull black, the underside of the head, the sides and lower surface of the prothorax, and the shoulders of the elytra (broadly in ♀, more narrowly in ♂), red ; prothorax with the black discal area almost bare, the red lateral area thinly clothed with yellowish setiform scales, and the pleurae with a broad stripe of densely overlapping broader cream-coloured scales ; elytra with the black parts bare, the red shoulders with sparse yellowish setiform scales, and the edge of the suture with a single row of dense small broader whitish scales, which become more numerous and sparser beside the prothoracic spine and along the basal margin ; mesepisterna and mesepimera black with a narrow border of white scales ; metepisterna black with a posterior border of white scales and a large black area adjoining it on the metasternum, the rest of which is covered with dense white scales ; venter with dense white scales, except for a large round black area at the side of ventrites 1 and 2 ; pygidium black.

Head deeply depressed between the eyes, with large reticulate punctures and sparse pale setae. *Rostrum* of ♂ as long as the elytra along the suture, strongly curved, slender, bare, somewhat flattened and obsoletely punctate dorsally with a complete narrow median carina, the lateral areas tricarinate behind the antennae and with longitudinally confluent punctures in front ; rostrum of ♀ of the same width but very nearly as long as the whole body, and the median carina confined to the basal third. *Antennae* red, inserted at a little behind the middle of the rostrum (♂) or at about one-third from the base (♀) ; scape produced at its apex into a short transparent lamina, with two or three setae beside it ; funicle with joints 2 and 3 equal and very long, longer than 1 or than 4-6 together. *Prothorax* with the sides shallowly sinuate in the apical half (as seen from above), the anterior part of the dorsum being strongly compressed laterally, the apical margin arcuate dorsally, the basal spine two-sevenths the length of the suture of the elytra ; dorsum somewhat convex longitudinally, with strong reticulate punctures, a complete low median carina and a short carina on each side of it in the apical depression. *Elytra* about as broad as long, widest at the broadly rounded shoulders, jointly subtruncate at the apex, broadly depressed transversely at the base (but the basal margin not elevated) and with a shallow transverse depression behind the middle ; the narrow deep striae bare, with catenulate punctures ; the intervals about twice as broad as the striae, each with a single row of small granules, these being irregularly duplicated on interval 5, which is slightly higher than the others, intervals 8 and 10 broadly depressed behind the shoulders ; the granules bearing an inconspicuous recumbent dark seta. *Legs* black, with the front pair entirely and the tarsi of the posterior pairs, red ; femora rugosely punctate, with

sparse pale setae, the hind pair with a broad band of white scales; the dorsal fringe of the hind tibiae as long as the first tarsal joint. *Sternum* with the prosternal furrow twice as wide as the space between the front coxae; mesosternum not impressed.

Length 3.5-4.5 mm., breadth 2.5-3.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., 8♂ 6♀, iv-v. 1934.

Allied to *M. stylicornis* Mshl. 1934, which differs considerably in colour and scaling; further, the rostrum is much shorter, joint 3 of the funicle is much longer than 2, the granules on the elytra are numerous and irregular, the prosternal furrow is as wide as the space between the front coxae, etc.

Mecysmoderes levipes sp. n.

♂♀. Derm black, the rostrum (except the base) and the apical margins of the prothorax and elytra, red; prothorax with a few pale setae on the disk and an ill-defined curved lateral stripe formed of transverse pale setae, the prosternum with dense whitish scales; elytra rather thinly clothed with narrow dark scales, interval 1 with a velvety stripe of dense black scales beside the prothoracic spine and a much shorter whitish or yellowish spot immediately behind it, a small whitish spot at the base of interval 2 and a longer one at the base of 6, and sparse irregular narrow whitish scales scattered on the disk, interval 8 with a small spot of broad white scales behind the shoulder and a longer one at its apex; side-pieces of mesosternum black with a narrow margin of pale scales, metepisterna black with an apical band of pale scales, metasternum and venter with dense white scales, pygidium black.

Head with reticulate punctures and sparse pale setae; frons deeply depressed between the eyes. *Rostrum* a little longer than the head and pronotum (without the spine) in both sexes, with the antennae at the middle, the basal half with confluent punctures and three fine carinae, the apical half a little narrower with fine sparse punctures in ♂, impunctate in ♀. *Antennae* red; scape not produced at the apex but with two short setae; funicle with joints 1 and 3 equal, 2 a little longer, 4 and 5 longer than broad, 6 globular. *Prothorax* feebly rounded laterally, with a shallow apical collar (deeper dorsally), the apical margin angulate in the middle, the basal spine one-fourth the length of the suture; dorsum moderately convex longitudinally, with dense reticulate punctures, the margins of which tend to form irregular longitudinal carinulae, with a narrow median carina and a short carina on each side of it anteriorly. *Elytra* a little longer than broad, shallowly depressed at the base, the striae much narrower than the rugosely granulate flat intervals, which are of equal height. *Legs* with the femora edentate, black to piceous, the apices narrowly red, the basal two-thirds with sparse whitish setiform scales; tibiae and tarsi entirely red. *Sternum* with the prosternal furrow wider than the space between the front coxae; mesosternum not impressed.

Length 2.5 mm., breadth 1.5 mm.

N.E. BURMA: Kambaiti, 6♂ 10♀, v-vi. 1934.

Of the Indo-Burmese species with unarmed femora the nearest is *M. nigrorufus*, Mot., which apart from its colouring differs in having the frons very shallowly depressed; the pronotum is much less compressed anteriorly, without the lateral carinae; the elytra are much narrower at the shoulders, which are

obliquely rounded, and they are not depressed at the base, the margins of which are much more oblique ; and the mesosternum is impressed to receive the apex of the rostrum.

Mecysmoderes spp.—Kambaiti, 2♂ 1♀, v-vi.

Ceuthorrhynchus 2 spp.—Kambaiti, 1♂ 1♀, v.

Ceuthorrhynchus sp.—Sadon, 1♂, vi-vii.

Subfamily BARIDINAE.

Baris tumida sp. n.

♂. Derm dull black, bare.

Head separated from the rostrum by a distinct impression, with numerous shallow punctures but no median fovea. *Rostrum* as long as the pronotum, rather stout, strongly curved, not widened at the apex ; the lateral areas very coarsely and confluent punctate, with indications of two irregular carinae, the dorsum with uneven fine punctures which become a little larger at the base, without any median carina. *Antennae* inserted at about one-fourth from the apex of the rostrum, black, with the basal half of the scape red ; funicle widening distally, joint 1 slightly longer than 2 and 3, 4-7 transverse. *Prothorax* nearly as long as broad, parallel-sided from the base to the middle, then gradually narrowing to the deep abrupt subapical constriction, which is continued more shallowly across the disk, the apex truncate, the gular margin rather deeply sinuate in the middle ; dorsum rugosely sculptured with irregular strong curved ridges, with an abbreviated median carina and a large shallow impression on each side at about the middle. *Scutellum* small, almost round, smooth with two very shallow impressions, and tilted forwards. *Elytra* very rugose and uneven, subovate, with the sides sinuous (as seen from above), wider at the somewhat sloping shoulders than the base of the prothorax, and rather broadly truncate at the apex ; the deep striae partly sinuous and containing distant punctures ; the broad intervals very uneven and coarsely punctate, interval 3 with an elongate tubercle near the base and a similar one behind the middle, 4 with a smaller tubercle adjoining the former, 5 with a small tubercle behind the middle and a larger one on the declivity, a prominent subapical tubercle at the junction of intervals 3 and 8, and some small ones on 7 and 9. *Legs* black, with the tarsi red-brown ; femora coarsely punctate, with short recumbent pale setae ; tibiae not gradually widening distally, shallowly bisinuate on the lower edge, the front pair with a small mucro ; tarsi with joint 4 more dilated than usual.

Length 4.0 mm., *breadth* 1.7 mm.

N.E. BURMA : Kambaiti, 7000 ft., 2♂, v. 1934.

A very distinct species owing to the tuberculate elytra and carinulate pronotum.

Baris aspersa sp. n.

♂. Derm black to piceous ; prothorax with a lateral stripe of sparse narrow yellow scales on each side and a few scattered scales on the disk ; elytra with numerous scattered groups of a few narrow yellow scales, the largest being behind the middle on interval 3, at the base of which is a short stripe of dense scales ; underside bare, or with a minute pale seta in each puncture.

Rostrum about as long as the pronotum, stout, bent at the base, strongly curved dorsally, parallel-sided throughout, with coarse confluent punctures and an abbreviated smooth median line. *Antennae* inserted at one-fourth from the apex of the rostrum, piceous, except the narrow part of the scape which is red ;

funicle with joint 2 as long as broad, 3-7 strongly transverse. *Prothorax* transverse (8 : 11), widest at the base, narrowing from there to two-thirds, with the sides straight and the apical collar rather abruptly constricted, the base shallowly bisinuate; dorsum with strong separated punctures, which become larger laterally, without any smooth median line. *Scutellum* small, subtriangular, bare. *Elytra* broadly ovate, much wider at the sloping shoulders than the base of the prothorax; the deep narrow striae with indistinct distant punctures, except in the basal third of stria 1 and the basal fourth of 2 where the punctures are large and close, stria 10 disappearing behind the middle; the disk without impressions, the posterior calli obtusely prominent, the broad flat intervals with a rather irregular row of punctures, which are larger and closer on the basal half, becoming small and widely separated behind, those on 3, 5, 7 more or less duplicated. *Legs* red-brown, with small pale setae in the punctures; femora rather coarsely punctate; tibiae not widening distally, shallowly sulcate, the front pair not mucronate.

Length 3.5-4.0 mm., breadth 1.5-1.7 mm.

N.E. BURMA: Sadon, 4000 ft., 5♂, vi-vii. 1934.

A somewhat aberrant species owing to the undilated tibiae, the abbreviation of stria 10 on the elytra, the unequal punctation in striae 1 and 2, and the well-developed posterior calli.

Baris spp.—Kambaiti, six specimens of five species, iv-vi.

Baris spp.—Sadon, three specimens of three species, vi-vii.

Baris spp.—Taunggyi, two specimens of two species, viii-ix.

Baris sp.—Tenasserim, Sukli, one specimen, x.

***Baris blennus* sp. n.**

♂♀. Derm dull black, with dark recumbent setae and a row of distant narrow white scales on the alternate intervals of the elytra; underside with a small narrow white scale in each puncture.

Head smooth, with numerous small separated punctures. *Rostrum* a little longer than the head and pronotum in both sexes, opaque and with dense punctures throughout in ♂, more shiny and with rather smaller punctures in ♀; lower surface with a small median tooth near the base. *Antennae* piceous with the base of the funicle paler, inserted at one-sixth (♂) or one-fifth (♀) from the apex of the rostrum; funicle with joint 2 longer than broad, 3-7 transverse. *Prothorax* a little broader than long, parallel-sided from the base to the middle, then narrowing in a curve to the abrupt apical constriction, the base shallowly bisinuate; dorsum with dense confluent punctures, the intervals forming sinuous longitudinal ridges, with sparse narrow pale scales. *Scutellum* small, triangular, bare, with a median impression. *Elytra* broadly ovate, wider at the sloping shoulders than the prothorax, with a faint transverse impression at one-fourth from the base; the deep striae with very shallow distant punctures, stria 10 complete; the intervals broader than the striae, flat, with an irregular row of shallow punctures, most of which are nearly as wide as the interval, and each containing a recumbent brown seta, the single narrow white scales on the alternate intervals widely separated. *Legs* red-brown, with sparse short white setae; femora coarsely punctate; tibiae not widening distally. *Pygidium* of ♂ convex, with small separated punctures, that of ♀ depressed and rugosely punctate on the apical two-thirds.

Length 3.0-3.5 mm., breadth 1.2-1.5 mm.

N.E. BURMA: Kambaiti, 7000 ft., 11♂ 5♀, v-vi. 1934.

***Athesapeuta gyrosicollis* sp. n.**

♂. Derm black, the rostrum, antennae and legs red-brown; prothorax clothed with yellowish-white to pale yellow scales, with a large median area from the base to two-thirds apparently bare, but really sparsely covered with dark narrow inconspicuous scales except for an irregular median stripe of pale scales; elytra with a broad basal band of yellowish scales from interval 2 to 9 and an equally broad one behind the middle (leaving interval 1 bare), these being united in perfect specimens by rather sparser scales on intervals 5-9, and with sparse scales about the apex; underside with subcontiguous yellowish scales, which are much denser and overlapping on the mesepimera and metepisterna. The dorsal scales are easily abraded, so that the prothorax often appears to have only a broad lateral stripe on each side and the elytra only two widely separated bands.

Rostrum a little longer than the pronotum, rather strongly curved, sub-cylindrical, gradually widening from the antennae (inserted at one-fourth from apex) to the apex, with sparse small punctures, which form four dorsal lines and two less regular lateral ones on each side. *Antennae* with joint 1 of the funicle as long as 2+3+4, 5-7 transverse. *Prothorax* a little broader than long, widest close to the base and narrowing with a strong curve to the apical collar; dorsum convex longitudinally, highest behind the middle, the small punctures all longitudinally confluent, forming numerous curved ridges, which become somewhat coarser on the pleurae; the narrow oblong scales all lie transversely and do not overlap. *Scutellum* transverse, suboblong, broadly depressed in the middle, and bare or with a few short setae. *Elytra* a little wider at the sloping shoulders than the base of the prothorax and gradually narrowing thence to the broadly rounded apex; the dorsum without impressions but with deep impunctate striae that show through the scales, when these are not disarranged, the broad flat intervals with irregular, transversely wrinkled punctures. *Legs* with non-contiguous scales, which on the femora are short at the base and much longer at the apex, except on the hind pair on which they are long and dense throughout.

Length 4.7-5.5 mm., *breadth* 2.2-2.6 mm.

S. SHAN STATES: Taunggyi, 5000 ft., 3♂, viii-ix. 1934 (type); Pekkong, 3000 ft., 1♂, x. 1934.

This insect is distinguished from all previously described *Athesapeuta* by the vermiculate sculpture of the prothorax.

PHRISSODERES gen. n.

Head separated from the rostrum by a shallow depression. *Rostrum* strongly bent downwards near the base, comparatively slender, wider beyond the antennae, not deeper than broad at the base, nor narrowed dorso-ventrally at the apex, without carinae; scrobes passing below the rostrum before the middle and uniting towards the base; mandibles dentate, interlocking, with a small angle externally. *Antennae* inserted at one-fourth from the apex of the rostrum in both sexes; scape slender, moderately clavate, with a few sparse setae; funicle only slightly widening distally, joint 1 much longer than 2, 7 distinct from the club. *Prothorax* transverse, shallowly bisinuate at the base, without postocular lobes. *Elytra* sub-triangular, much wider at the shoulders than the prothorax, with ten complete deep striae and obtuse posterior calli. *Legs* slender; femora only slightly clavate, not sulcate or toothed beneath; tibiae not dilated distally, sulcate and without a mucro; tarsi with joint 3 deeply bilobate, 2 longer than broad, the claws long, slender

and divergent. *Sternum* with a very large deep subhexagonal excavation on the prosternum, which is truncate behind, the gular margin sinuate; mesosternum deeply depressed, the intercoxal process short, vertical and much broader than a coxa. *Abdomen* with the pygidium entirely concealed, the two basal ventrites fused throughout, ventrite 2 much longer than 3+4.

Genotype: *Phrissoderes costalis*, sp. n.

A very distinct genus characterised by the very large cavity on the prosternum the wide vertical mesosternal process, and the anteriorly compressed pronotum, which is entirely covered with costulae radiating in all directions from the middle of the base.

Phrissoderes costalis sp. n.

♂♀. Derm uniform shiny black, entirely bare.

Rostrum very similar in the two sexes, rather slender; the subcylindrical basal part in ♂ with two rather strong rows of punctures dorsally, the apical part with stronger confluent punctures, the lateral areas with coarse irregular furrows and costae; rostrum of ♀ with the dorsal punctures on the basal area minute, but those on the apical part as coarse as in ♂. *Antennae* red-brown, with the club fuscous; funicle with joints 3-7 transverse, the club large, as long as joints 2-7. *Prothorax* narrowing from the base to beyond the middle, with the sides almost straight, then curving in rapidly to the apical collar; dorsum much more strongly compressed in front in ♂ than in ♀, with branching costulae radiating in all directions from the middle of the base, and similar coarser sculpture on the pleurae. *Scutellum* with a broad median depression in ♀, smaller and almost flat in ♂. *Elytra* subtruncate at the base, parallel or very shallowly sinuate from the shoulders to one-third, then rapidly narrowing to the apex, where they are separately rounded, the disk with a shallow transverse impression at one-fourth from the base; in ♀ the broad deep striae contain small distant punctures, each puncture having a minute granule on each side of it, in ♂ the striae are much broader and the punctures much larger; the intervals in ♀ are broader than the striae, flat, with a row of microscopic punctures (sometimes obsolescent), in ♂ the intervals are not broader than the striae and strongly costate. *Legs* black, with sparse short appressed setae, the tarsi red; femora with large close punctures. *Underside* with round isolated punctures which become confluent towards the sides of the metasternum and form longitudinal ridges; venter with a deep lateral fovea on the line of junction of ventrites 1 and 2.

Length 2.8-3.4 mm., *breadth* 1.4-1.7 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1 ♂ 5 ♀, v-vi. 1934.

It is very unusual among the weevils for the apex of the rostrum to be more strongly punctured than the base, especially in the female.

Chelonebarus burmanus sp. n.

♂. Derm red-brown; pronotum rather darker, with a broad lateral stripe of dense oblong yellowish scales divided in the middle by a large transverse bare patch, and with a few scales along the median line; elytra with a loose patch of similar scales at the base of intervals 2 and 3, and a few scales near the base of 10 behind the shoulder, and a few elongate narrow scales in the striae (these may normally form continuous rows in the striae, as some seem to have been abraded).

Head mostly concealed within the prothorax, with close shallow punctures. *Rostrum* 1.5 times as long as the pronotum, rather strongly curved, subcylindrical,

only slightly widened at the apex, closely and strongly punctate nearly to the apex, with a complete fine low median carina and a regular row of close subquadrate punctures on each side of it on the basal half, a fine irregular carina externally to these, and the lateral areas with larger irregular subconfluent punctures. *Antennae* inserted at one-third from the apex of the rostrum, red-brown; funicle with joint 1 a little longer than 2+3+4, 2 and 3 equal and slightly longer than broad, 4-7 transverse. *Prothorax* transverse (2:3), widest at the base, rapidly narrowing with a slight curve to the shallowly constricted apex, which is about one-third the width of the deeply bisinuate base; dorsum strongly convex longitudinally, with coarse confluent punctation, the intervals forming sinuous ridges, without any smooth median line. *Scutellum* oval, bare, with a median impression. *Elytra* very broadly ovate, nearly as broad as long (2.8 by 2.5 mm.), much broader at the prominent shoulders than the base of the prothorax, slightly widening behind the shoulders, then rapidly narrowing to the broadly rounded apex; dorsum comparatively flat transversely, highest near the base and sloping uniformly from there to the apex, with a broad transverse depression behind the shoulders and large obtuse conical posterior calli; the striae narrow and deep, containing shallow spaced punctures, except in the basal fourth of striae 1 and 2 where the large close punctures quite obliterate the striae, stria 7 ceasing behind the humeral callus; the broad flat intervals opaque and shagreened, 1-3 with large punctures on the basal third, elsewhere the intervals with a row of minute shiny granules, the humeral calli also with small flat granules. *Legs* red-brown, coarsely punctate, each puncture with a short stout white recumbent seta, the femora with a row of short fine erect setae on the basal half of the lower edge.

Length 3.0-3.9 mm., *breadth* 1.9-2.5 mm.

N.E. BURMA: Kambaiti, 7000 ft., 2♂, v-vi. 1934.

The discovery of this genus in Burma was unexpected, the only other species (*C. partimpunctatus* Mshl. 1940) having been described from Kenya. It differs in having a much shorter rostrum, the pronotum simply punctate, elytra with much less prominent posterior calli and uneven punctation, etc.

PSILARTHUS gen. n.

Head with fine sparse punctures, separated from the rostrum by a shallow impression. *Rostrum* varying in thickness and curvature, not compressed at the base and not narrowed dorso-ventrally at the apex, without any sulci or carinae; scrobes passing completely below the rostrum near the base, not or very shortly extending beyond the antennae; mandibles dentate and interlocking, not projecting when closed. *Antennae* inserted beyond the middle of the rostrum in both sexes; scape slender, abruptly clavate; funicle not or but slightly widening distally, joint 1 longer than 2, 7 distinct from the club. *Prothorax* with a collar-like constriction at the apex, only shallowly bisinuate at the base. *Elytra* black, shiny, with prominent shoulders and ten deep narrow striae containing catenulate punctures, with posterior calli. *Legs* very slender; femora moderately clavate, not sulcate or toothed beneath; tibiae narrow, subcylindrical, straight, not widening distally, without any sulci, impunctate or with only obsolescent punctures; front or anterior pairs of tibiae sometimes mucronate in ♂, the hind corbels open; tarsi with joint 3 deeply bilobate, the claws divergent from the base. *Sternum* without any prosternal sulcus, the front margin of the prosternum truncate or sinuate, its hind margin without any median process; mesosternum

depressed, the side-pieces fused. *Abdomen* with the pygidium shortly exposed, ventrite 2 as long as or longer than 3+4, more or less fused with 1 in the middle.

Genotype : *Psilarthrus dentipes* sp. n.

Distinguished from the known Oriental genera of Baridini by the slender, non-sulcate tibiae, a very unusual character in the tribe.

***Psilarthrus dentipes* sp. n.**

♂♀. Derm shiny black, the antennae and tarsi, and the apex of the rostrum in ♀, reddish.

Head without a frontal fovea. *Rostrum* strongly curved, a little longer than the head and pronotum in ♂ (10 : 9), still longer in ♀ (13 : 9), slightly widened in the apical part ; dorsum with only a few sparse punctures near the base, those at the sides much coarser and more or less confluent, the punctures smaller and sparser in ♀. *Antennae* red to red-brown, the club fuscous ; funicle with joint 1 as long as 2+3, 5-7 transverse. *Prothorax* nearly as long as broad, widest at the base, narrowing very slightly from the base to the middle and then curving in to the apical collar, the gular margin truncate ; dorsum with small strong punctures of varying density, some on the disk usually separated by more than their diameters, and with a smooth median line ; the lateral areas with sparse narrow whitish scales. *Elytra* narrowly ovate, very shallowly sinuate laterally behind the shoulders and thence narrowing to the apex ; dorsum without discal impressions but with the suture distinctly raised behind the middle, the subapical calli well developed, and a slight elevation at the joint apex of intervals 3 and 8 ; the intervals broad, flat, shiny and impunctate, with widely spaced long triangular whitish scales on 3, 5 and 7, which are apparently rather easily abraded. *Legs* with the front coxae very narrowly separated, the space being no wider than the narrowest part of the antennal scape ; femora with fine sparse punctures containing a minute white seta, but more coarsely punctate at the apex ; tibiae not widened at the apex, without a mucro in either sex, the front pair in ♂ with a large sharp triangular tooth at a little beyond the middle of the lower edge.

Length 3.3-4.0 mm., breadth 1.2-1.5 mm.

N.E. BURMA : Kambaiti, 7000 ft., 16♂ 13♀, v-vi. 1934 (*Dr. R. Malaise*-type).
ASSAM : Manipur, 1♂ (*Doherty*).

***Psilarthrus costicollis* sp. n.**

♂♀. Derm shiny black, the antennae and tarsi red.

Head with sparse minute punctures and no frontal fovea. *Rostrum* about as long as the head and pronotum in both sexes, moderately stout, slightly less so in ♀, parallel-sided from base to antennae (inserted at two-sevenths from apex in ♂, three-tenths in ♀), beyond which it is somewhat wider, the apical part being parallel-sided in ♂ and gradually widening distally in ♀ ; dorsum with very fine sparse punctures, the sides coarsely punctate, being more confluent in ♂. *Antennae* with joint 1 of the funicle slightly shorter than 2+3, 5-7 transverse. *Prothorax* nearly as long as broad, very gradually narrowing from the base to two-thirds or almost parallel-sided, the apical constriction rather abrupt, the basal angles acute and very slightly projecting ; dorsum moderately convex longitudinally, closely set with large strong punctures which are much wider than the intervals between them, and with a low smooth median costa, which is usually complete but sometimes abbreviated, and very sparse whitish setae. *Elytra*

ovate, the sides rather deeply sinuate behind the shoulders; dorsum without impressions, the subapical calli low and obtuse, the intervals broad, flat and impunctate, with very sparse elongate white scales on 3, 5 and 7. *Legs* with small separated punctures on the femora, but more coarsely punctate towards the apex; tibiae not widened at the apex, without a mucro or tooth in either sex.

Length 3.0–3.5 mm., *breadth* 1.4–1.5 mm.

ASSAM: Manipur, 1 ♂ 1 ♀ (*Doherty*-type). N.E. BURMA: Kambaiti, 7000 ft., 2 ♂ 2 ♀, v–vi. 1934 (*Dr. R. Malaise*).

Type in the British Museum; cotypes in the Stockholm Museum.

***Psilarthrus mucronatus* sp. n.**

♂♀. Entirely black and shiny, except for the red tarsal claws and tibial unci; upper surface entirely bare.

Head with fine sparse punctures and a shallow median fovea. *Rostrum* a little longer than the head and pronotum (13:10) in both sexes, somewhat widened beyond the antennae (at one quarter from the apex in ♂, a little further back in ♀), the apical part being parallel-sided in ♂ and gradually widening distally in ♀, with small subconfluent punctures dorsally and rugosely punctate laterally in ♂, the punctures smaller in ♀. *Antennae* with joint 1 of the funicle as long as 2+3, 6 and 7 transverse. *Prothorax* very nearly as long as broad, gently rounded laterally, widest behind the middle, the basal angles not projecting, the apical constriction gradual and not abrupt; dorsum moderately convex longitudinally, closely punctate, without any smooth median line or costa, the intervals narrower than the punctures, which are partly subconfluent on the disk and much more strongly so laterally, so as to form curved ridges. *Elytra* ovate, distinctly sinuate laterally behind the shoulders; dorsum with a shallow transverse impression on each side at one-fourth from the base and another behind the middle, the subapical calli distinct, the intervals broad and flat, devoid of scales and with a rather irregular row of very fine shallow punctures. *Legs* with the space between the front coxae broader than the antennal club; femora with the punctures rather stronger and closer near the base, fine and sparse distally; front tibiae somewhat widened at the apex, with a strong mucro in both sexes, the unci and mucro being widely separated in ♂ and closer in ♀.

Length 4.0–4.5 mm., *breadth* 1.5–1.6 mm.

BURMA: Ruby Mines, 1 ♂ 2 ♀ (*Doherty*-type); Kambaiti, 7000 ft., 1 ♂ 2 ♀, v. 1934 (*Dr. R. Malaise*).

Type in the British Museum; cotypes in the Stockholm Museum.

***Psilarthrus coracinus* sp. n.**

♂♀. Derm entirely black, except for the red claws and tibial unci.

Head with fine separated punctures and a small frontal fovea. *Rostrum* of ♂ half as long again as the head and pronotum, comparatively slender, bent at the base and less curved distally than in the other species, somewhat widened and parallel-sided beyond the antennae (inserted at one-third from the apex), the dorsum more strongly and closely punctate than in the other species, more coarsely punctate laterally; rostrum of ♀ unusually long and slender, being nearly twice as long as the head and pronotum, scarcely widened beyond the antennae (inserted at only a little beyond the middle), the punctures much finer and sparser. *Antennae* comparatively long and slender, with joint 1 of the funicle as long as 2+3 (♂) or 2+3+4 (♀), only 7 slightly transverse. *Prothorax* nearly as long as broad, parallel-sided from the base to the middle, then narrowing

with a curve to the shallow apical constriction ; dorsum almost flat longitudinally, rather unevenly punctate, the intervals on some parts of disk being as wide as or wider than the punctures, but without any smooth median line and entirely without scales, the punctures on the pleurae much denser and coarser. *Elytra* rather broadly ovate, almost parallel to the middle, with only a shallow sinuation behind the shoulders and rather broadly rounded at the apex ; dorsum with a shallow impression on intervals 3-5 at one-fourth from the base, the subapical calli obsolescent, the broad intervals feebly convex, the minute punctures forming small transverse wrinkles near the base but evanescent behind, entirely devoid of scaling. *Legs* with the space between the front coxae as broad as the antennal club ; femora with rather large shallow punctures ; front tibiae somewhat widened at the apex, with a distinct mucro in ♂ and a minute one in ♀, both widely separated from the uncus.

Length 3.5-4.5 mm., *breadth* 1.5-1.6 mm.

N.E. BURMA : Kambaiti, 7000 ft., 2♂ 1♀, v-vi. 1934.

***Psilarthrus squamifer* sp. n.**

♂♀. Derm shiny black, the tarsi red-brown to piceous, the tarsal claws, tibial unci, and the base of the antennal scape, red.

Head with small separated punctures, without any frontal fovea. *Rostrum* similar in the two sexes, as long as the prothorax only, comparatively short and stout, moderately curved, somewhat widened beyond the antennae which are much nearer to the apex than usual, the apical part being about as long as the antennal club ; dorsum with fine separated punctures, those on the sides coarse and confluent. *Antennae* comparatively short, with joint 1 of the funicle slightly longer than 2+3, 3-7 transverse. *Prothorax* nearly as long as broad, widest at the very slightly projecting basal angles, very gradually narrowing to the middle, with the sides straight in ♂ and feebly curved in ♀, then curving in to the rather abrupt apical constriction ; dorsum slightly convex longitudinally, with strong close even punctures, which are much broader than the intervals, without any smooth median line ; with sparse narrow whitish scales, especially towards the sides. *Elytra* rather broadly ovate, feebly rounded laterally, the post-humeral sinuation very shallow ; dorsum without discal impressions, the subapical calli distinct, the broad intervals flat and impunctate, with a row of sparse long whitish scales on 3, 5, 7 and 9. *Legs* with rather large shallow punctures on the femora ; front tibiae of ♂ not widened at the apex with a minute tooth on the lower edge at one-third from the apex which is surrounded by a few comparatively long erect setae, and at the apex a very small mucro which is united at the base with the uncus ; front tibiae of ♀ without the tooth or mucro.

Length 2.6 mm., *breadth* 1.2 mm.

N.E. BURMA : Kambaiti, 7000 ft., 1♂ 1♀, v. 1934.

KEY TO THE SPECIES OF *Psilarthrus*.

- 1 (2). Gular margin of prosternum truncate ; space between the front coxae not wider than the narrowest part of the antennal scape ; front tibiae without a mucro in both sexes, those of ♂ with a large triangular tooth a little beyond the middle, tarsi red ; elytra with sparse isolated large whitish scales . . . *dentipes* sp. n.
- 2 (1). Gular margin of prosternum sinuate ; space between the front coxae wider than the scape ; front tibiae of ♂ without any large triangular tooth on the lower edge.

- 3 (4). Prothorax with a low median costa ; scape of antennae and tarsi red ; front tibiae without a mucro ; elytra with sparse narrow whitish scales *costicollis* sp. n.
- 4 (3). Prothorax without any median costa ; antennae and tarsi black or mainly black.
- 5 (6). Prothorax with the punctures confluent laterally, forming curved ridges ; front tibiae with a strong mucro in both sexes ; elytra without scales *mucronatus* sp. n.
- 6 (5). Prothorax with the punctures not confluent and without lateral ridges ; front tibiae of ♀ at most with a minute rudimentary mucro.
- 7 (8). Rostrum dissimilar in the sexes, the distance of the antennae from the apex greater than the length of the antennal club ; antennal scape entirely black ; elytra without scales ; front tibiae of ♂ without any tooth on the lower edge and the mucro widely separated from the uncus, that of ♀ with a minute mucro
coracinus sp. n.
- 8 (7). Rostrum similar in the sexes, shorter and stouter, the distance of the antennae from the apex about equal to the antennal club ; scape red at the base ; elytra with sparse large whitish scales ; front tibiae of ♂ with a minute tooth at one-third from the apex, the small mucro united with the base of the uncus, ♀ without any mucro *squamifer* sp. n.

DOLICHAULAX gen. n.

The species upon which this genus is based agrees entirely with *Psilarthrus*, gen. n., except in regard to the structure of the scrobes on the rostrum, which do not pass beneath the rostrum basally but are fully visible laterally right up to the eyes, and moreover they extend deeply beyond the antennae almost to the apex. This condition of the scrobes is quite exceptional, and I have been unable to find a similar case in any other Old World Baridinae.

Genotype : *Dolichaulax curvirostris* sp. n.

Dolichaulax curvirostris sp. n.

♀. Derm black beneath, the head and pronotum black with the apical margin of the latter red-brown, the elytra chestnut-brown, the legs reddish with the femora and tibiae sometimes piceous ; prothorax and elytra with sparse whitish scales.

Head with fine separated punctures, without any frontal fovea. *Rostrum* of ♀ long and very strongly curved, 1.6 times as long as the head and pronotum, comparatively slender, cylindrical and only slightly widened close to the apex, the antennae being inserted at a little beyond the middle ; dorsum shiny and impunctate, the lateral areas with small close shallow punctures at the base and a single line of punctures from there to the antennae. *Antennae* red-brown with the club fuscous ; scape long, slender and abruptly clavate ; funicle not widened distally, joint 1 as long as 2+3, 3 and 4 longer than broad, 5-7 as long as or slightly longer than broad. *Prothorax* nearly as long as broad, parallel-sided from the base to the middle, then narrowing with a curve to the shallow apical constriction ; dorsum almost flat longitudinally, closely and strongly punctate, without any smooth median line, and with separated oblong whitish scales

laterally and a few on the disk. *Elytra* oblong-ovate, parallel from the prominent shoulders to the middle and obtusely rounded at the apex; dorsum without discal impressions, the fine deep striae with very shallow small punctures, the broad flat intervals impunctate, 3, 5, 7 and 9 with large separated triangular whitish scales (often partly abraded), the alternate intervals with small narrow scales, the subapical calli well-developed and obtuse. *Legs* slender; femora with fine sparse punctures, each containing a very short fine recumbent pale seta; tibiae impunctate, not widened at the apex, without any mucro.

Length 3.0 mm., breadth 1.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., 3♀, v-vi. 1934.

CALYPTOPYGUS gen. n.

Head not separated from the rostrum by an impression. *Rostrum* slender, cylindrical, not compressed at the base, nor narrowed dorso-ventrally at the apex, without carinae; scrobes passing below the rostrum near the base; mandibles dentate and interlocking. *Antennae* inserted at a little beyond the middle of the rostrum in both sexes; scape slender, abruptly clavate; funicle with joint 1 longer than 2, 7 distinct from the club. *Prothorax* as long as broad, shallowly bisinuate at the base, truncate at the apex, without any postocular lobes, the dorsum laterally compressed in front. *Elytra* only a little wider than the prothorax with very sloping shoulders and ten deep complete striae, the posterior calli, obsolescent. *Legs* slender; femora moderately clavate, not sulcate or toothed beneath; tibiae not dilated distally, with fine shallow sulci dorsally, and without a mucro; tarsi with joint 3 deeply bilobate, the claws separated. *Sternum* without any prosternal sulcus, the gular margin truncate, and the hind margin not produced in the middle; the mesosternum only slightly lower than the metasternum. *Abdomen* with the pygidium entirely concealed in both sexes; ventrite 2 longer than 3 and 4 and fused in the middle with 1.

Genotype: *Calyptopygus ellipticus* sp. n.

Distinguished from *Baris* by the outline of the slender rostrum being completely continuous with that of the head and by the entirely concealed pygidium. These characters also distinguish it from the two preceding new genera, which it somewhat resembles, though the facies is different owing to its broader prothorax and narrow elytral shoulders.

Calyptopygus ellipticus sp. n.

♂♀. *Derm* entirely black, shiny; the upperside bare, except for sparse minute narrow whitish scales at the sides of the pronotum; underside with a small whitish scale in each puncture.

Head with fine sparse punctures. *Rostrum* of ♂ as long as the pronotum, moderately curved and almost parallel-sided throughout, the antennae being inserted at three-eighths from the apex; dorsum shiny, with an irregular line of punctures on each side from the base nearly to the apex, the lateral areas with coarser confluent punctures and a short sulcus above the scrobe; rostrum of ♀ of the same length but very slightly more slender and with the apex red, all the punctures much reduced and the antennae slightly farther from the apex. *Antennae* black; funicle only slightly widened distally, joint 1 as long as 2+3, 4-7 transverse. *Elytra* only a little wider at the shoulders than the base of the prothorax (10.5 : 8), parallel to beyond the middle, broadly rounded at the apex; dorsum rather flat, without discal impressions, the broad intervals with a row of distinct small separated punctures. *Legs* rather slender, entirely black (except

the red claws), with sparse small punctures, each containing a short recumbent white seta; front femora with a fringe of erect palpi setae on the lower edge, which are rather longer in ♂; front tibiae of ♂ with a small triangular tooth on the lower edge a little beyond the middle.

Length 3.2–3.5 mm., *breadth* 1.1–1.2 mm.

N.E. BURMA : Kambaiti, 7000 ft., 3 ♂ 5 ♀, iii–vi. 1934.

Subfamily COSSONINAE.

Eutornus lateralis sp. n.

♂♀. Derm of head, prothorax and underside black, rostrum black basally and red-brown in front, elytra red-brown, with the suture, lateral margins and apical declivity usually blackish.

Head very shallowly constricted behind the eyes, with rather strong close punctures and a short shallow frontal stria. *Rostrum* stout, moderately curved, 1.5 times as long as broad, fairly closely punctate and with a short interantennal stria, the punctures being somewhat finer in ♀. *Antennae* inserted at a little behind the middle of the rostrum in both sexes, red, with the funicle darker; scape strongly curved and gradually widening distally. *Prothorax* longer than broad, much longer than the head and rostrum (3 : 2), widest near the base, feebly rounded laterally, and deeply constricted near the apex; dorsum comparatively strongly punctured, with an abbreviated impunctate median line, the punctures being a little smaller than those in the striae on the elytra and much larger than those on the intervals. *Elytra* with closely punctate striae, stria 1 and the basal half of 5 being deeper than the others; the intervals almost flat on the disk, with a single row of very small distant punctures. *Legs* with the front tibiae sinuate on the dorsal edge.

Length 3.5–4.7 mm., *breadth* 0.9–1.1 mm.

N.E. BURMA : Kambaiti, 7000 ft., 15 ♂ 21 ♀, iv–vi. 1934.

Of the five other Burmese species the most nearly allied are *antennalis* Fst. and *congener* Woll. The former differs in having the prothorax much more finely punctate and the apical constriction shallower, the punctures in the striae on the elytra are about twice as large as those on the pronotum, and in the male the antennal scape is abruptly incrassate. *E. congener* has the prothorax red, with much finer punctures and a shallower constriction, and joint 4 of the tarsi is widened towards the base, which is not the case in *lateralis*.

Cossonus corax sp. n.

Derm shiny black, the tarsi, the stem of the scape and sometimes the funicle, red.

Head with sparse minute punctures on the vertex, the frons with much larger separated punctures and a deep median fovea; eyes gently convex, their curvature not continuous with that of the temples. *Rostrum* with the head as long as or slightly longer than the pronotum, porrect in the basal half and sloping steeply at the apex, gradually widening from the base to the antennae and there abruptly dilated, the apical area being as long as broad; dorsum with numerous small separated punctures which are much finer on the apical area. *Prothorax* a little broader than long, gently rounded laterally, widest behind the middle, rather deeply constricted apically, but the constriction not continuous across the disk; dorsum without any median or basal depressions, with rather large punctures, which are smaller and dense laterally, becoming larger, irregular and

sparser in the middle of the disk, leaving variable impunctate patches. *Elytra* much wider at the shoulders than the prothorax, flat as far as interval 3, the striae with strong close punctures which become much smaller on the declivity, where the striae are much deeper; intervals 1 to 4 or 5 flat, broader than the striae, the lateral ones much narrower, all with an irregular row of minute punctures that do not become larger behind. *Legs* with small sparse punctures on the femora; front tibiae not angulate beneath.

Length 5.0-7.0 mm., breadth 1.0-2.2 mm.

N.E. BURMA: Kambaiti, 7000 ft., four specimens, v-vi. 1934.

Allied to *C. carinensis* Fst., which differs in its much shorter rostrum, flatter eyes, and much more densely punctate pronotum, which normally has a shallow median depression.

Cossonus stricticeps sp. n.

Derm shiny black, the tarsi, the stem of the scape and the base of the funicle red.

Head constricted immediately behind the eyes, the vertex impunctate, the frons with strong punctures and a large elongate fovea. *Rostrum* rather long, together with the head longer than the pronotum (7:6), correct in the basal half and strongly curved downwards at the antennae, comparatively narrow near the base, widening to the antennae and there abruptly dilated, the subquadrate apical part being slightly broader than long; dorsum with rather strong punctures, which are sparser on the basal half and denser in front. *Prothorax* as long as or very slightly longer than broad, almost parallel-sided from the base to the middle then curving in to the rather shallow apical constriction, which is not continuous across the disk; dorsum without the usual longitudinal median impression, but with a transverse depression in the middle of the base, the middle of the disk with large irregular remote punctures which become much denser laterally. *Elytra* much wider at the shoulders than the prothorax, flat as far as interval 3, the striae containing very large round punctures which becomes very much smaller behind, the striae being much deeper there; the intervals much narrower than the striae, except 2 (and sometimes 3) behind the middle, and bearing an irregular row of minute punctures, which become much coarser on the declivity. *Legs* with the punctures on the femora fine and sparse but denser towards the apex and dorsally; front tibiae not angulate beneath.

Length 6.5 mm., breadth 2.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., two specimens, v. 1934.

Distinguished from the other Burmese species by the constriction behind the eyes, the parallel-sided prothorax, and the strongly punctate elytra.

Oxydema sp.—Taunggyi, 1♂, viii-ix.

? *Eremotes* 2 spp.—Kambaiti, 2 ex., v-vi.

Tomicoproctus sp.—Kambaiti, 1 ex., vi.

Genus?—Kambaiti, 2 ex., iv-v.

Xenomimetes opacicauda sp. n.

Derm piceous brown, bare, the prothorax usually darker; antennae and tarsi red.

Head with small sparse punctures on the vertex, those on the frons larger and much denser. *Rostrum* as long as broad, parallel-sided, with small shallow punctures and a shallow median sulcus. *Prothorax* a little longer than broad, widest not far from the base, almost parallel-sided in the apical half, the sides

with a small sinuation in the middle and gently rounded posteriorly, the apical constriction well-marked; dorsum with dense elongate punctures and an abbreviated smooth median line, the punctures longitudinally confluent, especially on the sides and pleurae. *Elytra* cylindrical, parallel from the shoulders to the very deep subapical constriction below the subrectangular posterior calli on interval 9, the apices being, as usual, subexplanate, broadly divergent and with the margins feebly denticulate; dorsum rather shiny, but the apical declivity quite opaque, with the intervals broader, flatter, finely rugulose and with short recumbent setae; the striae containing deep close oblong punctures, the intervals about as broad as the striae with a single row of small punctures, except on the first three intervals, of which 1 is transversely wrinkled and depressed at the base, and 2 and 3 are confusedly punctate on the basal half, uniting at the base to form a rugulose callus.

Length 3.3–4.0 mm., *breadth* 0.8–1.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., five specimens, v–vi, 1934.

In the closely allied *X. himalayensis* Stebb. and *sikkimensis* Mshl. (both originally described in *Eremotes*) the punctures on the pronotum are not elongate, the elytra are not more opaque on the declivity than on the disk and the posterior calli are not so angularly prominent.

Subfamily STROMBOSKERINAE.

Xerodermus sp.—Kambaiti, 1♀, iii.

Dryophthoroides sp.—Kambaiti, 1♂, iii.

Subfamily CALANDRINAE.

Cyrtotrachclius buqueti Guérin.—S. Shan States, Pekkong, 3000 ft., 1♂, x.

Cercidocerus carinensis Faust.—S. Shan States, Taunggyi, 1♂, ix–x; Pekkong,

1♂ 1♀, x.

Cercidocerus doherthyi Günther.—Taunggyi, 2♂, ix–x.

Otidognathus quadrimaculatus Buq.—Kambaiti, 1♂ 1♀, v.

Otidognathus sp.—Kambaiti, 1♂, v.

Otidognathus amoenulus sp. n.

♂♀. Derm black; elytra with a variable irregular reddish-yellow transverse band near the base from stria 1 to the margin, then continuing to the base and inwards to stria 6, so as to half-encircle the black humeral callus; behind this a similar broad band running obliquely from about the middle of the lateral margin to behind the middle of stria 1; underside entirely black or with the mesepimera and the anterior part of the prosternum red.

Head strongly and closely punctate; frons almost parallel-sided, flat, with or without a deep median fovea. *Rostrum* a little shorter than the pronotum, that of ♂ with distinct irregular punctures without any granules, its upper surface forming a continuous line with the frons; that of ♀ less dilated at the base, with minute obsolescent punctures and with a fine median carina on the apical half, the dorsal outline forming a wide angle with the frons. *Antennae* black; funicle with joint 2 longer than broad, 6 as long as broad; club with the pubescent part only narrowly projecting, the glabrous part as long as broad in ♂, much longer in ♀. *Prothorax* widest at its strongly arcuate base and narrowing with a curve to the apical collar; dorsum with rather strong uneven punctation, which is denser in the middle of the anterior half, a deep impunctate transverse sulcus close to the base and on the posterior half of the disk a broad deep oblique

punctate depression on each side, these almost meeting on the middle line at one-fifth from the base; the lateral areas of the apical collar almost impunctate. *Scutellum* unusually large, nearly forming an equilateral triangle, with a few shallow punctures at the base. *Elytra* widest at the oblique shoulders and rapidly narrowing behind; all the striae impressed, 1-5 with the punctures very small and shallow, those in 6-9 much stronger; the intervals with an irregular row of minute punctures. *Legs*, with minute sparse punctures, red, with the knees, apex of tibiae and the tarsi black, or the tibiae and femora may be half black. *Pygidium* closely punctate, with a low median carina.

Length 5.0 mm., *breadth* 2.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., 1♂ 1♀, v-vi. 1934.

Closely allied to the Assamese *O. satelles* Gthr., which differs as follows: the rostrum of the ♂ bears two rows of granules; the pubescent part of the antennal club is nearly or quite as long as the glabrous part; the pronotum is more finely and sparsely punctate; the scutellum is much smaller and narrower; the elytra are much more narrowed behind and the shoulders more prominent.

Adapanetus malaisei sp. n.

♂. Derm bare, rather opaque, very variable in colour; head and rostrum black; prothorax black beneath, fulvous above, with the basal and apical margins and a variable median stripe black, the latter normally narrow in front and dilated behind, but varying in width, and rarely the whole dorsum black; elytra normally fulvous, with the suture and lateral margins black, a transverse black spot near the base between striae 2 and 5 (often much reduced or entirely absent), an oblong subapical spot between striae 3 or 4 and 6, and sometimes a transverse black band at the middle; rarely the elytra may be black with six fulvous spots; underside rarely entirely black, usually with a stripe at the sides of the metasternum, another on the metepisterna, and the basal margin of the ventrites, reddish.

Head with comparatively strong irregular punctures and a deep frontal fovea. *Rostrum* shorter than the pronotum (7:10), the dilated basal part parallel-sided, punctate like the head, and without any angular projection on the lower edge near the base; the narrow anterior part moderately curved, opaque and minutely punctate. *Antennae* black, shiny; scape only slightly longer than the funicle; club of ♂ hatchet-shaped, with its basal two-thirds chitinous and shiny, the spongy terminal part with its apical margin broadly truncate. *Prothorax* a little longer than broad, widest near the base, the basal angles rounded, the sides straight in the middle or very shallowly sinuate, roundly narrowing in front to the deep apical constriction which is continued across the disk; dorsum with irregular strong punctures which are densest near the apex and in the middle of the base, and in front of the middle an indefinite broad transverse area which is impunctate or very sparsely punctate. *Scutellum* elongate, triangular, impunctate and very shallowly impressed in the middle. *Elytra* somewhat wider at the rounded shoulders than the prothorax, widest at the shoulders, very slightly narrowing behind, and separately rounded at the apex; the narrow deep striae with fairly strong punctures, striae 7 and 8 continued to the base, 8 very shallowly; the convex intervals with a row of distinct separated punctures. *Legs* fulvous, with the apex and base of the femora and tibiae black, the tibiae rarely all black, the tarsi black; structurally as in the genotype.

Length 8.0-9.0 mm., *breadth* 2.7-3.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., 9♂, v-vi. 1934.

The only other known species, *A. sericoclava* Günther 1936, differs in having the head, rostrum and pronotum much more finely punctate; the rostrum is separated from the head by a narrow transverse depression and its basal part is strongly dilated from the base to the antennae; the antennal club of the male is silky throughout and its apical margin is broadly rounded; the elytra are jointly rounded at the apex, the intervals being flat and minutely punctate.

Adapanetus sericoclava Günther.—Kambaiti, 3♂ 1♀, iv-vi.

***Aplotes histrio* sp. n.**

♂♀. Derm red; the head dorsally, the apex of the rostrum and the area round the scrobe, blackish; prothorax with the following black markings: an incomplete median stripe, an elongate spot in the basal angles, a variable stripe on the pleurae and another one passing over the coxa; black markings on the elytra: a little before the middle a transverse spot between striae 2 and 5 or 6, a small one on interval 9 (rarely 8 and 9), and an oblique band above the declivity between striae 3 and 9, and just in front of this a small spot on interval 3, which is often absent and rarely (in ♀) extending inwards to the suture; underside with very variable black markings, often absent.

Head coarsely punctate, with a shallow punctate sulcus immediately behind the eyes; frons one-third as wide as the base of the rostrum. *Rostrum* rather strongly curved, slender, the dilated basal part irregularly punctate and with a shallow median stria; the slender anterior part impunctate in ♀ except near the base, shorter and slightly stouter in ♂ with very shallow punctures on the sides. *Antennae* black; funicle with joint 1 longer than 2, 3 and 4 as long as broad, 5 and 6 transverse; club with the pubescent part occupying fully half the length. *Prothorax* of ♂ almost parallel-sided, only slightly widening towards the base, with an abruptly constricted apical collar, that of ♀ distinctly widening basally; dorsum coarsely reticulately punctate, without any median sulcus but with a large shallow discal depression on the basal half and an abbreviated median carina. *Scutellum* plane, without any median stria. *Elytra* only slightly wider at the shoulders than the prothorax in ♂, distinctly broader in ♀, subparallel from there to the middle, with a broad shallow transverse impression close to the base extending from the scutellum to the shoulder; the striae with strong separated punctures on the basal half which diminish behind, interval 1 with a dense row of small punctures, the others with large shallow irregular punctures on the basal third or half which become small and sparse or even obsolescent behind. *Legs* red, with the knees and tarsi black; femora with rather large separated punctures usually filled with tomentum; tarsi with joint 4 normal. *Pygidium* of ♂ coarsely punctate, without a median carina, obtusely rounded at the apex; that of ♀ truncate at the apex, with a tuft of setae on each angle.

Length 6.5–8.5 mm., *breadth* 2.5–3.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., 11♂ 11♀, iv-vi, 1934.

Nearly allied to the Japanese *A. roelofsi* Chev., which, however, has the head, apex of the rostrum and the tarsi red, whereas the basal margin of the prothorax and the humeral callus of the elytra are black; the head has no sulcus behind the eyes; the pubescent part of the antennal club is much shorter than the glabrous part; the pronotum bears a broad median sulcus, the punctures are smaller and hardly reticulate, and the apical constriction is much less abrupt; the pygidium of the male with the apical margin broadly sinuate and with a tuft of setae in each angle.

Aplotes pollex sp. n.

♂♀. Colour similar to that of *A. histrio* sp. n., except that the head and rostrum are entirely red, and there is a small black spot on the shoulders of the elytra.

Head coarsely punctate, with a sulcus behind the eyes; front half as wide as the base of the rostrum. *Rostrum* as in *A. histrio* except that the apex is not black, and that of the ♂ is distinctly punctate above and laterally on the basal two-thirds. *Antennae* red, only the club black; funicle with the two basal joints subequal, the rest more or less transverse; club with the pubescent part occupying a little less than half the length. *Prothorax* differing from that of *histrio* in being more bell-shaped, similar in the two sexes, the dorsum rather less coarsely punctate, with a broad median sulcus that is dilated behind. *Scutellum* with a distinct median stria. *Elytra* similar in the two sexes, as wide at the shoulders as in *histrio* ♀ but narrowing more rapidly behind, the basal depression shallower and interrupted by interval 3; the punctures in the striae and on the intervals much smaller. *Legs* red, the knees not black, the tarsi red to red-brown; the fourth tarsal joint produced into a sharp angle on the underside behind each claw. *Pygidium* of ♂ with the apex broadly truncate and with sparse erect pale setae, that of ♀ narrower at the apex and without erect setae.

Length 7.0–10.0 mm., breadth 2.4–3.8 mm.

N.E. BURMA: Kambaiti, 7000 ft., 24♂ 20♀, iv–vi. 1934.

This species closely resembles superficially the female of *A. histrio* sp. n., but it may be distinguished from all the known Burmese species by the unusual structure of the claw-joint of the tarsi.

Aplotes sp.—Kambaiti, 1♂, iv.

Aplotes sp.—Sadon, 4000 ft., 1♀, vi–vii.

Diocalandra caelata sp. n.

♂♀. Derm dull black; the extreme apex of the rostrum and the apical margin of the prothorax reddish; elytra with a fulvous stripe on intervals 6–8 from the base nearly to the middle, where it unites with the anterior margin of a large quadrate fulvous spot on intervals 2–6, and a smaller oblong spot on interval 3–5 extending from near the base to one-third, the basal half of which is usually connected with the lateral stripe.

Head coarsely punctate, the frons as long as broad, with a deep median sulcus and a row of erect setae on each side. *Rostrum* of ♂ with the head as long as the pronotum, the dilated basal part almost parallel-sided and shorter than the head; dorsum with two rows of minute granules and a very fine median carina; rostrum of ♀ longer, the narrow anterior part without granules or carina, the former replaced by punctures. *Antennae* blackish with the scape red; scape strongly curved; funicle with joint 2 longer than 1, the rest as long as or slightly longer than broad; club with the pubescent apical part as long as the shiny basal part. *Prothorax* 1.5 times as long as broad, almost parallel-sided from the base to two-thirds, then narrowing gradually to the deep subapical constriction; dorsum opaque, with dense reticulate punctation and a very shallow large depression in the middle of the basal half, and on each side of this behind the middle a small group of very short erect setae. *Elytra* scarcely wider at the shoulders than the prothorax and narrowing very gradually from there to the apex; the striae containing large quadrate punctures, the alternate intervals

more raised and bearing a rather sparse row of erect clavate white setae. *Legs* comparatively long and slender, black, the basal half and apical margin of the femora red; femora rugosely punctate, front tibiae finely serrate on the lower edge. *Pygidium* coarsely punctate, with sparse erect clavate white setae.

Length 3.5–4.5 mm., breadth 0.8–1.0 mm.

N.E. BURMA: Kambaiti, 7000 ft., 3♂ 4♀, v–vi. 1934.

Most nearly allied to *D. elongata* Roel., which in the *Catalogus Coleopt.* is placed in *Calandra* (= *Sphenophorus*). This Japanese species differs in having the rostrum much shorter, of the same length in the two sexes, that of the male having no granules; the antennae are red and the pubescent part of the club is much shorter than the bare part; the setae on the elytra are much more numerous and closely set; and the legs are shorter and stouter.

Calandra oryzae L.—Myitkyina, 1♂ 1♀, iii; Sadon, 2♂, vi–vii.

Periphemus sp.—Tenasserim, Malvedaung, 100 ft., 1♂ 1♀, xi.

A SYNOPSIS OF THE GENUS *MECEDANUM* ERICHSON (COLEOPTERA, COLYDIIDAE)

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(With five text-figures.)

ONLY five species of *Mecedanum* have been described, three from Madagascar and two from Africa. In this paper four additional species are described, three from Africa and one from the Seychelles Islands. The presence of a species of *Mecedanum* in the Seychelles Islands (Silhouette) was reported long ago by Grouvelle (1918), and the new species here described from those islands is based on the two damaged specimens examined by Grouvelle. A list of the species, including the new additions, is as follows:—

1.	<i>Mecedanum punctatum</i> Grouvelle	Madagascar . . .	1
2.	„ <i>carinifrons</i> Grouvelle	„ . . .	—
3.	„ <i>erichsoni</i> Sharp	„ . . .	2
4.	„ <i>scotti</i> sp. n.	Seychelles Is. . .	2
5.	„ <i>antennatum</i> (Kraatz)	Africa . . .	3
6.	„ <i>filum</i> sp. n.	„ . . .	36
7.	„ <i>tomentosum</i> sp. n.	„ . . .	1
8.	„ <i>centralis</i> sp. n.	„ . . .	2
9.	„ <i>giganteum</i> (Kraatz)	„ . . .	4
			—
	Total number of specimens examined . . .		51

In his catalogue of the family, Hetschko (1930) includes a further species *M. erichsoni* Broun, which he records from New Zealand. The citation following this name refers to the original description of *Lithostygnus minor* Broun (1893). In the *Zoological Record* for 1893, *M. erichsoni* Sharp is listed immediately beneath *Lithostygnus minor* Broun, so that by a mistake in transcribing the names, the compiler of the catalogue was left with a *M. erichsoni* Broun from New Zealand and a *M. erichsoni* Sharp from Madagascar. *M. erichsoni* Sharp was unnecessarily renamed by Hetschko, and the synonymy of the species is now as follows:—

***Mecedanum erichsoni* Sharp.**

1893. *Mecedanum erichsoni* Sharp, *Ent. mon. Mag.* **29**: 257

1929. *Mecedanum sharpi* Hetschko, *Wien. ent. Ztg.* **46**: 84

1930. *Mecedanum sharpi* Hetschko, *Coleopt. Cat.* **107**: 10.

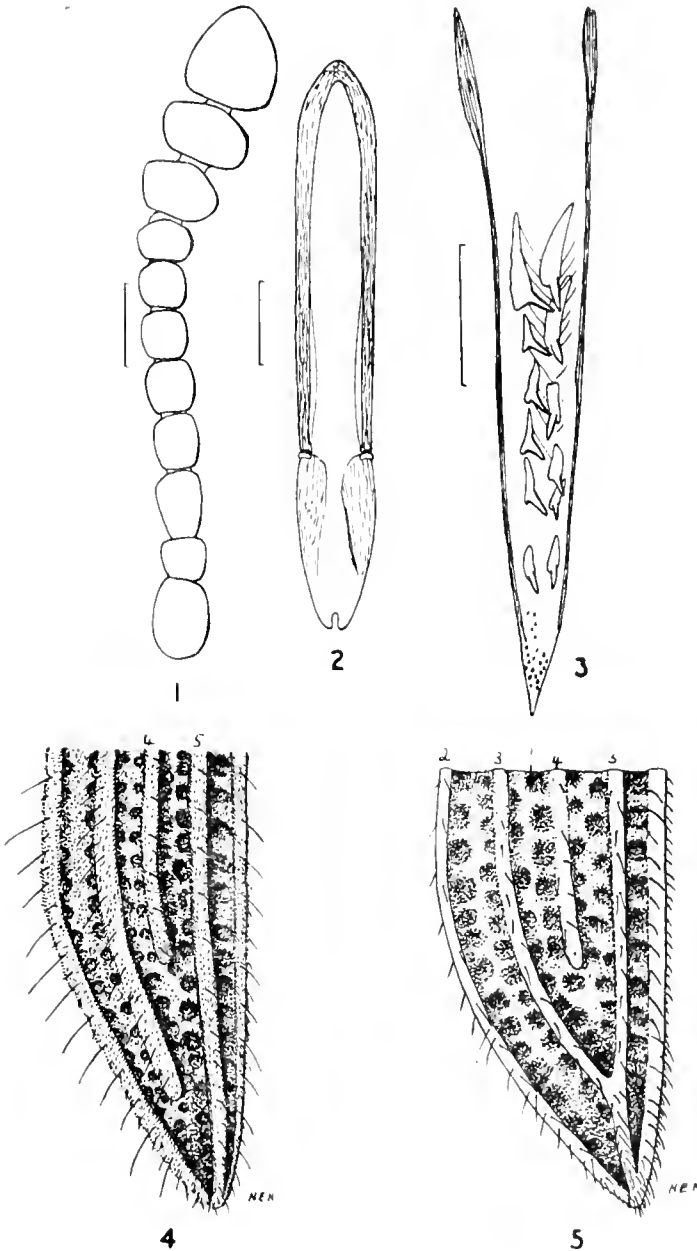
Almost nothing is known of the biology of these curious-looking Colydiidae. Observations made by Mr. G. H. Thompson in the Gold Coast on *M. antennatum* (Kraatz), *M. filum* sp. n., *M. tomentosum* sp. n., and *M. giganteum* (Kraatz) suggest that there is a definite association between the species of *Mecedanum* and various species of Platypodidae (*Platypus*, *Crossotarsus*) and possibly some species of Scolytidae. All of the species mentioned above have been found by Mr. Thompson in the galleries of species of *Platypus* and *Crossotarsus*, but whether they feed on the fungi in the galleries or whether they prey on the makers of the galleries is not clear.

In all species of *Mecedanum* there is an extremely fine plate projecting from the sides of the first five abdominal segments. This semi-membranous plate is finely striated, and it must rub against the striated inner ventral surface of the

elytra when the abdomen and elytra are moved against each other. It is possible that the semi-membranous abdominal plates and the striated inner surface of the elytra are the two components of a stridulating organ.

KEY TO THE SPECIES OF *Mecedanum*.

1. Front of head without median longitudinal carinae or gibbosities 2
- Front of head with one or more median longitudinal carinae or gibbosities 4
2. Elytra with fourth and fifth carinae joined together before apex ; third, fifth, and seventh intervals distinctly carinate on middle of elytra. Clypeus and anterior part of head with punctures as coarse as facets of eyes, often elongate, and above eyes often longitudinally confluent so that surface is partly strigose. Length, 9.0–10.0 mm. Madagascar *Mecedanum punctatum* Grouvelle (1906)
- Elytra with fourth carina ending freely before apex, not joined to fifth ; third, fifth, and seventh intervals only feebly convex on middle of elytra. Clypeus and anterior part of head with punctures round or oval, never elongate and longitudinally confluent 3
3. Antenna with club 5-segmented. Head with a transverse ridge opposite anterior margin of eyes ; middle of head opposite anterior margins of eyes very nearly as high as margins above eyes. Pronotum narrowest at base, not distinctly narrowed before base but with sides more or less evenly converging from apex to base. Abdomen with punctures of fourth sternite much finer than those of third and fifth sternites except for a posterior row of coarse, deep, often confluent punctures. Length, 8.0 mm. W. Africa, Uganda *Mecedanum antennatum* (Kraatz, 1895)
- Antenna (fig. 1) with club distinctly 3-segmented. Head without a transverse ridge opposite anterior margins of eyes and here very much lower than margins above eyes, which are very strongly elevated. Pronotum broadly and deeply sinuate before base so that it is distinctly narrower in front of base than at base. Abdomen entirely coarsely punctate like third sternite or at most with an oval area on each side which is only finely punctate. Length, 4.5–6.9 mm. Belgian Congo, Sierra Leone, Gold Coast *Mecedanum filum* sp. n.
4. Front of head with three longitudinal carinae. Length, 8.0–13.0 mm. Madagascar *Mecedanum carinifrons* Grouvelle (1906)
- Front of head with a single median longitudinal cariniform elevation or with a single very broad longitudinal gibbosity 5
5. Elytra (fig. 4) with third and fourth carinae ending freely before apex, neither joined to the fifth (ninth interval) ; second to fifth carinae nearly as strongly raised on basal half as at apex. Pronotum with sides of median impression narrowly and strongly elevated, cariniform. Head, pronotum, and carinate intervals of elytra densely and finely but conspicuously tomentose. Length, 9.5 mm. Gold Coast *Mecedanum tomentosum* sp. n.



EXPLANATION OF TEXT-FIGURES

FIGS. 1-3 *Mecedanum flum*, sp. n. (1) Antenna. (2) Dorsal view of male genitalia after the median lobe has been pulled out. (3) Ventral view of median lobe. Lines next to figures refer to a length of 0.20 mm.

FIG. 4 *Mecedanum tomentosum*, sp. n. Lateral view of apex of right elytron.

FIG. 5 *Mecedanum centrale*, sp. n. Lateral view of apex of right elytron.

- Elytra (fig. 5) with third or fourth carina joined to fifth (ninth interval); second to fifth carinae noticeably decreasing in height towards base so that on basal half they are usually but little more convex than the even intervals. Pronotum with sides of median impression rounded or elevated but never produced as narrow carinae. Head, pronotum, and carinate intervals of elytra glabrous or sparsely hairy, without trace of tomentum 6
6. Elytra (fig. 5) with fourth carina ending freely before apex, not joined to third or fifth 7
- Elytra with fourth carina joined to fifth before apex 8
7. Head with anterior margin of clypeus moderately deeply, arcuately emarginate; coarsest punctures of clypeus and frons much finer than facets of eyes and seldom separated by less than three diameters; median carina approximately half as broad as head between carina and elevated margins above eyes; top of median carina convex. Eyes separated beneath head by much less than twice their horizontal diameter (30 : 22). Pronotum with narrow channel in bottom of median impression restricted to anterior seventh; hypomera with oval punctures usually separated by less than their diameters. Metasternal sides without apparent hairs between the setiferous punctures. Length, 5.0 mm. Seychelles Islands. *Mecedanum scotti* sp. n.
- Head with anterior margin of clypeus truncate or nearly so; coarsest punctures of clypeus and frons as coarse or coarser than facets of eyes and rarely separated by more than two diameters; median carina two-thirds as broad as head between carina and elevated margins above eyes; top of median carina flat; Eyes separated beneath head by twice (90 : 40) or nearly twice (68 : 40) their horizontal diameters. Pronotum with a nearly complete, narrow, parallel-sided channel in bottom of median longitudinal impression; hypomera with round punctures usually separated by one or more diameters. Metasternal sides very finely and densely pubescent, nearly tomentose. Length, 10.0–12.5 mm. Uganda, Congo.
Mecedanum centralis sp. n.
8. Antenna with club 5-segmented, the seventh segment being scarcely narrower than the eighth and much broader than the sixth. Front of head with median gibbosity very strongly raised and flat-topped. Apex of elytra deeply and broadly, truncately emarginate. Length 8.5–13.5 mm. Togo, Gold Coast, Uganda.
Mecedanum giganteum (Kraatz, 1895)
- Antenna with club 4-segmented, the seventh segment being much narrower than the eighth and scarcely broader than the sixth. Front of head with median gibbosity feebly elevated. Apex of elytra at most feebly, triangularly emarginate. Length, 8.2–9.5 mm. Madagascar
Mecedanum erichsoni Sharp (1893)

***Mecedanum antennatum* (Kraatz).**

1895. *Colydium antennatum* Kraatz, *Dtsch. ent. Z.* 1895 : 158.

This species was described from two specimens taken in Togo. Before me are three specimens, which agree well with the original description, with

data as follows : 1, Uganda : Bunnga, 20. v. 1926 (*G. L. R. Hancock*) and 2, Gold Coast : Mpraeso District, 19-24. ix. 1945, in galleries of Platypodidae in *Albizzia zygia* and *Trichilia heudelotii* (*G. H. Thompson*).

Mecedanum filum sp. n. (Figs. 1-3).

Male : Length, 4.5-6.9 mm. ; breadth, 0.57-0.96 mm. Cuticle moderately shining and black or nearly black with antennae and legs dark rufo-piceous. *Head* without a median longitudinal carina or a transverse ridge ; in some of the larger specimens the middle of the head between the eyes is very feebly convex. Lateral margins narrowly and very strongly elevated to a point opposite posterior margins of eyes, the most strongly elevated part of each margin being opposite anterior margin of eye. Clypeus with anterior margin truncate or nearly so and anterior angles rounded and moderately strongly projecting forwards ; anterior tentorial pit (or channel in this position) oblong-oval or with sides subparallel, and usually nearly twice as broad as largest puncture of head. Surface of frons and clypeus with deep or moderately deep punctures which are half as coarse to as coarse as facets of eyes and are very irregularly distributed ; basal part of head with punctures broadly oval, as coarse as facets of eyes, and usually separated by about one diameter, the surface between the punctures being more strongly shining than that of frons and clypeus. Eyes separated above by slightly more than twice their horizontal diameter (0.60 : 0.26 mm.) and beneath head by about one and a half diameters (0.38 : 0.26 mm.). Antenna (fig. 1) with a distinct 3-segmented club. *Pronotum* at broadest point, which is at about apical fifth, less than half as broad as long (0.90 : 2.02 mm.) and apex broader than base (0.82 : 0.68 mm.). Sides distinctly margined very nearly to base, and base completely, distinctly margined ; sides broadly, moderately deeply sinuate before base so that narrowest part of pronotum is a short distance before base. Median impression broad and deep with a deep narrow channel extending along its bottom from apex to near base ; secondary channel deepened and slightly broadened at middle and near apex ; sides of median impression rounded, neither elevated nor carinate. Surface laterad from rounded and nearly impunctate dorsal margins of the median impression with oval to irregular punctures which are two to three times as coarse as facets of eyes ; in large specimens these punctures are seldom separated by as much as one diameter, but in some small specimens they are usually separated by about one diameter. *Elytra* twice as long as pronotum (4.0 : 2.0 mm.) and very nearly parallel from broadest point behind humeri (0.96 mm.) to near apex. Apex of elytra deeply, very narrowly but often irregularly emarginate ; inner apex of each elytron with a large, ventrally directed tooth, the margin laterad from this tooth being finely toothed or crenate for a short distance. On basal two-fifths the alternate intervals are not more than feebly convex except at extreme base where the second and third (third and fifth intervals) are broadly carinate. Apex with first, second, and third carinae joining fifth, which here forms the dorsal apical margin, the second carina being joined to the fifth more or less opposite the junction of the epipleuron and fifth. Third carina much lower than fifth at the junction of the two, so that in some specimens—which have third less elevated than usual—this carina appears to be separated from fifth by a short distance. Seventh interval (fourth carina of other species) ending some distance before apex, where it is as far from third as from fifth ; at apex only feebly convex, nowhere distinctly carinate. Surface of carinae with sparse, erect, testaceous setae and also with numerous punctures. Strial punctures very deep, flat-bottomed, subquadrate

usually broader than flat intervals, and usually separated longitudinally by one or slightly less than one diameter. *Hypomera* with punctures round to broadly oval, as coarse as facets of eyes to half again as coarse, and usually separated by slightly less than one to slightly more than one diameter; surface between punctures not pubescent (mag. $\times 75$). Metasternum with extreme sides non-tomentose and so closely punctate that surface is rugose. Abdomen with first four sternites punctate something like hypomera; surface between punctures with a very dense, reticulate, alutaceous microsculpture; fourth sternite in many but not all specimens with an oval area of varying size on each side, which is free of coarse punctures but has numerous fine punctures and is more strongly shining than adjacent areas. *Legs* with first segment of front tarsi distinctly shorter than combined length of two following segments (0.11 : 0.16 mm.). Middle and hind tarsi with first segment only slightly shorter than combined length of two following segments (0.16 : 0.19 mm.).

Female: Externally similar to male.

Type: A male in the British Museum (Nat. Hist.). Belgian Congo: 18 miles S.W. of Elizabethville, i. 1928 (*H. S. Evans*).

Paratypes: 14, with same data as type. 7, Sierra Leone: 1, Kent, ii. 1928 (*E. Hargreaves*); 4, Njala, 4. i. 1933, under bark of dead rubber tree (*E. Hargreaves*); 1, Njala, at light, 7. x. 1925 (*E. Hargreaves*); and 1 without further data. 15, Gold Coast (*G. H. Thompson*); 6, from Sunyani District and 9 from Mpraeso District, i-iii, vi, viii, ix, xi. 1945-46, on *Albizzia zygia*, *Bosquiea angolensis*, *Cassia siamea*, *Ficus exasperata*, *Lonchocarpus sericeus*, *Terminalia ivoriensis*, and *Trichilia heudelotii* timber or trees scorched by fire. These specimens were commonly found under loose bark, and two were found in the tunnels of Platypodidae (*Crossotarsus* sp.).

Comparative notes: The distinct three-segmented antennal club (fig. 1) will serve to distinguish it from any other known species of *Mecedanum*.

***Mecedanum tomentosum* sp. n. (Fig. 4).**

Male: Length, 9.4 mm.; breadth, 1.5 mm. Cuticle nearly entirely mat, not shining; black or nearly black, with tarsi dark rufo-piceous and elytra moderately pale brownish red. Cuticle nearly everywhere densely, scarcely visibly (mag. $\times 75$) pubescent, but head, pronotum, and carinate elytral intervals with the hairs longer, denser, greenish yellow, and very distinct; cuticle also with sparse, long, nearly erect setae which are exceptionally long and regularly spaced on the carinate elytral intervals; fourth abdominal sternite moderately shining and without the fine, dense pubescence of other sternites. *Head* with median longitudinal carina extending from a point near anterior margin of clypeus to a point opposite anterior margins of eyes, where it is very nearly as high as elevated margins above antennae; surface of median carina strongly convex. Clypeus with anterior margin very broadly, shallowly, arcuately emarginate, with the antero-lateral angles rounded but prominent. Tomentum of head absent on a narrow anterior belt on clypeus, on top of median carina, and on top of lateral elevated margins; surface of head and clypeus with numerous round or oval punctures which are coarser than facets of eyes. Eyes more finely faceted than in any other species known to me; separated above by three times their horizontal diameters (0.93 : 0.30 mm.) and separated beneath by more than two diameters (0.77 : 0.30 mm.). Antenna with club 5-segmented, but seventh segment only slightly broader than sixth although distinctly so. *Pronotum* at broadest point, which is at about apical fourth, about half as broad as long (1.26 : 2.51 mm.) and base only

slightly narrower than apex (1.01 : 1.20 mm.). Median impression deep and broad with its sides strongly and narrowly carinate like the alternate intervals of the elytra ; lateral marginal line deep and complete nearly to base ; lateral margins thickened and cariniform, so that with sides of median impression the pronotum is quadricarinate ; sides on anterior three-fifths between submedian carinae and lateral margins broadly and longitudinally gibbous. Surface throughout with round or nearly round punctures which are half again to twice as coarse as facets of eyes and are usually separated by a little less than one to about two diameters ; on basal third and in median impression the coarse punctures are sparser and only about as broad as facets of eyes. *Elytra* more than twice as long as pronotum (6.0 : 2.5 mm.), at base much broader than base of pronotum (1.48 : 1.01 mm.), and feebly broadened behind humeri to apical two-thirds, where they become slightly narrower ; from middle feebly and gradually broadened to about apical sixth, where they are broadest. Apex of elytra deeply and truncately emarginate. Alternate intervals strongly but not equally carinate from base to apex ; at base the second carina (third interval) is the most strongly elevated and the third (fifth interval) the second most strongly elevated. First carina (sutural interval) most strongly elevated from basal third to apical two-fifths, where it has a few broad dorsal tubercles which are feebly to strongly elevated. Second carinae feebly diverging from base, strongly diverging for a short distance on apical declivity, and thence nearly parallel to apex where each is joined to the fifth carina. Third and fourth carinae ending freely before apex (fig. 4). Strial punctures very deep, often flat-bottomed, and usually two to three times as coarse as facets of eyes. *Legs* with first segment of front tarsi distinctly (7 : 8.5) and first segment of middle and hind tarsi scarcely (8.5 : 9.0) shorter than combined length of two following segments.

Female : Unknown.

Type : A male in the British Museum (Nat. Hist.). Africa : Gold Coast : Mpraeso District, 5. ix. 1945, in tunnels of *Platyplus* sp. in a mahogany (*Khaya grandifolia*) log (G. H. Thompson).

Comparative notes : The very distinctive appearance of this species is due to the dense olive-green tomentum of the head, pronotum, and carinate intervals of the elytra, no other species of the genus possessing tomentum on its dorsal surface. In no other species are the margins of the median pronotal impression elevated to form narrow carinae, and in no other are the elytral carinae strongly elevated from apex to base. A further interesting feature of *M. tomentosum* is the sparsely punctate and strongly shining fourth abdominal sternite which contrasts strongly with the densely punctate and mat sternites before and behind.

Mecedanum scotti sp. n.

1918. *Mecedanum* sp., Grouvelle, *Trans. ent. Soc. Lond.* 1918 : 28.

Female : Length, 5.0 mm. ; breadth, 0.8 mm. Cuticle strongly shining and moderately dark rufo-piceous ; fine hairs everywhere sparse. *Head* with median longitudinal carina extending from a point opposite anterior tentorial pits to a point opposite middle of eyes, posteriorly slightly more strongly elevated than margins above eyes, dorsal surface strongly convex, and with breadth equal to about half of distance between carina and elevated margins above eyes. Clypeus with anterior margin broadly, moderately deeply, and arcuately emarginate. Surface of frons and clypeus strongly polished and with both sparse microscopic punctures and punctures about one-half to two-thirds as coarse as facets of eyes ;

larger punctures largely confined to the clypeus, where they are rarely separated by as little as one diameter; head behind highest point of median carina with very dense, deep, round to broadly oval punctures which are as coarse as facets of eyes. Eyes separated above by twice their horizontal diameter (0.46 : 0.22 mm.) and beneath head by little more than one diameter (0.30 : 0.22 mm.). Antenna with segments from fourth onwards becoming progressively broader towards apex; seventh segment not sufficiently narrower than eighth to make a distinct 4-segmented club; inner surface of third to sixth segments with numerous long, pale-testaceous hairs. *Pronotum* at broadest point, which is at about apical sixth, slightly more than half as broad as long (0.82 : 1.48 mm.) and much broader than base (0.82 : 0.65 mm.). Sides with a distinct marginal line extending from apex nearly to base, but with margins cut off by marginal line not conspicuous. Median impression broad, moderately shallow, and with latero-dorsal margins distinct but rounded, not carinate; pit slightly behind middle in bottom of median impression deep and distinct; apical fifth or sixth of impression with a deep secondary channel which may be entire or interrupted. Surface with deep, round to broadly oval punctures which are usually half again as coarse as facets of eyes and are seldom separated by more than two-thirds of one diameter, but on declivous part of apex are much finer and distinctly sparser; surface between coarse punctures with a few microscopic punctures, *Elytra* twice as long as pronotum (3.07 : 1.53 mm.). Apex of elytra not or only very feebly emarginate and from a lateral view regularly and distinctly toothed on apical part of epipleuron, as the latter is regularly notched. Alternate intervals feebly convex at base but becoming more strongly convex towards apex, so that on apical declivity first (sutural), third, fifth, and ninth are distinctly carinate and seventh interval (fourth carina of other species) is very feebly carinate. First three carinae joined to fifth which is continued to suture as dorsal apical margin; fourth carina ending freely considerably before apex where its apex is nearly as far from fourth as from fifth carina. Strial punctures deep, subquadrate, as broad or nearly as broad as intervals, and usually separated longitudinally by slightly less than one to one diameter. *Hypomera* with oval punctures very nearly as coarse as those of pronotum and seldom separated by distinctly more than one diameter. *Metasternum* with punctures of extreme sides oval, about as coarse as facets of eyes, and usually separated by half or less than half of one diameter; surface between coarse punctures densely, scarcely visibly alutaceous and also with numerous fine punctures but nevertheless moderately strongly shining, without apparent hairs and not mat as in other species of the genus. *Legs* with first segment of front tarsus about as long as the combined length of the two following segments. Middle and hind tarsi with first segment very slightly longer than combined length of two following segments.

Type: In the British Museum (Nat. Hist.). Seychelles Is.: Silhouette, forest at edge of Mare aux Cochons plateau, ca. 1000 ft., ix. 1908 (H. Scott). The apex of the elytra and all of the abdomen are lost.

Paratype: A female with same data as type. Part of the head and one elytron are missing.

Comparative notes: Its small size and strongly shining, moderately pale rufo-piceous instead of black or nearly black cuticle will serve to distinguish it at first sight from any other *Mccedanum*. In structural details it most nearly resembles *M. centralis* sp. n., but it is not very closely related to the latter, as is evident from the differences between the two listed in the key. The species is named after its collector, Dr. Hugh Scott, F.R.S.

Mecedanum centralis sp. n. (Fig. 5).

Male: Length, 12.5 mm.; breadth, 2.11 mm. Cuticle moderately strongly shining and black or nearly black with legs dark rufo-piceous. *Head* with median longitudinal carina extending from a point opposite anterior part of tentorial pits to slightly beyond anterior margins of eyes, posteriorly nearly as strongly elevated as margins above eyes, two-thirds as broad as head between carina and elevated margin above eye, and with dorsal surface flat. Clypeus with anterior margin truncate or nearly so, with anterior angles rounded and moderately strongly produced forwards; anterior tentorial pits parallel-sided, curved, and about five times as long as broad. Surface of frons and clypeus with moderately deep punctures which are usually round, slightly finer than facets of eyes to half again as coarse, and are irregularly distributed, being separated by less than one to two or even more diameters; head behind median carina with coarse punctures seldom separated by more than one diameter; surface between coarse punctures shining, densely microscopically alutaceous, and with a few very fine punctures. Eyes separated above by three times their horizontal diameter (1.23 : 0.4 mm.) and beneath head by slightly more than two diameters (0.90 : 0.40 mm.). Antenna with a 5-segmented club, the seventh segment being considerably broader than the sixth, which is not noticeably broader than the fifth. *Pronotum* at broadest point, which is at about apical fifth, only slightly more than half as broad as long (1.86 : 3.42 mm.) and apex broader than base (1.56 : 1.42 mm.). Sides deeply margined from apex very nearly to base; base broadly, shallowly, and completely margined. Median impression broad and moderately deep; dorsal sides distinct but rounded and not carinate; bottom of impression with a deep, narrow, parallel-sided channel which extends from apex nearly to base; and median pit round, very deep, and scarcely broader than secondary channel in median impression. Surface of pronotum with round punctures which are half again to twice as coarse as facets of eyes and are usually separated by one-half to two-thirds of their diameters; surface between coarse punctures with only microscopic punctures; surface only microscopically punctate on narrow dorsal part of sides of median impression. *Elytra* more than twice as long as pronotum (8.39 : 3.42 mm.) and base broader than base of pronotum (1.78 : 1.42 mm.). Apex of elytra not or only scarcely noticeably emarginate. First carina (sutural interval) only feebly convex on basal third and elsewhere only moderately strongly carinate; before apical declivity with four or five broad but low gibbosities. Second carina (third interval) strongly carinate at base, from basal fifth to about apical third only moderately convex, and thence strongly carinate to apical margin to which it is joined shortly beyond junction of epipleuron and fifth carina. Third carina joined to fifth before apex (fig. 5). Fourth carina (seventh interval) ending freely some distance before apex. Strial punctures very deep, subquadrate, as broad as even intervals, and usually separated longitudinally by their own diameters. *Hypomera* with deep, round punctures slightly finer than those of pronotum and usually separated by one to two diameters; surface between punctures with dense, scarcely visible (mag. $\times 75$) hairs which make the surface mat. Sides of metasternum similarly sculptured and pubescent and also mat. Abdomen punctate and finely pubescent like hypomera; disk of first three sternites not mat like sides and with the very fine pubescence sparse or absent; each side of fourth sternite with a large triangular area which is strongly shining and free of the very fine pubescence. *Legs* with first segment of front tarsus as long as combined length of two following segments.

Middle and hind tarsi with first segment distinctly longer than combined length of the two following.

Female : Unknown.

Type : A male in the British Museum (Nat. Hist.). Uganda : Entebbe, iii. 1929 (*G. D. Hale Carpenter*).

Paratype : Male, Belgian Congo : 18 miles S.W. of Elizabethville, 1927 (*H. S. Evans*). The paratype is only 10.5 mm. instead of 12.5 mm. long, its elytra are slightly less strongly sculptured and more strongly shining, the top of the median carina of the head is shallowly but distinctly concave, and nearly the whole of the fourth sternite is shining and free of the microscopic pubescence. The genitalia of the type and paratype are identical in all essentials. The proximal teeth of the ejaculatory duct are slightly longer in the type, but these and other slight differences are almost certainly attributable to the differences between the two in absolute size.

Comparative notes : Of the known species, this is nearest to *M. scotti*, from which it may be distinguished as shown in the key.

Mecedanum giganteum (Kraatz).

1895. *Colydium giganteum* Kraatz, *Dtsch. ent. Z.* 1895 : 159.

The types of this species are from Togo. In the collection before me there are four females with data as follows : 1, Uganda : Budongo Forest, ix. 1934 (*T. H. E. Jackson*) ; 1, Uganda : Jinga, iv. 1923 (*V. G. L. van Someren*) ; and 2, Gold Coast : Mpraeso District, 17. viii. 1945 and 13. i. 1946, in dead trees (*Albizia zygia* and *Cassia siamea*) associated with Scolytids and Platypodids (*G. H. Thompson*). These range in length from 8.5 mm. to 13.5 mm. All have the inner apices of the third to seventh, and, to a lesser extent, the eighth antennal segments clothed with very long, golden-testaceous hairs.

NOTES ON ASTEROIDS IN THE BRITISH MUSEUM
(NATURAL HISTORY)—I

The Species of *ASTROPECTEN*.

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(With four plates.)

THE large and valuable collection of Asteroids in the British Museum (Natural History) is being revised. This paper, describing what has seemed worthy of description concerning the collection of *Astropecten*, will, it is hoped, be the first of a series. It is therefore numbered as such.

The following species of *Astropecten* are represented in the Museum collection ; those of which the types are held are marked with an asterisk (*) :

- | | |
|---|--|
| * <i>acanthifera</i> Sladen | <i>kagoshimensis</i> de Loriol |
| <i>andersoni</i> Sladen | <i>mammilatus</i> Koehler |
| <i>antares</i> Döderlein | <i>marginatus</i> Gray |
| <i>antillensis</i> Lütken | * <i>mauritanus</i> Gray |
| <i>aranciacus</i> Linn. | * <i>mesactus</i> Sladen |
| * <i>armatus</i> Gray | <i>michaelseni</i> Koehler |
| <i>articulatus</i> (Say) | <i>mindanensis</i> Döderlein |
| <i>bispinosus</i> Otto | * <i>monacanthus</i> Sladen |
| <i>brasiliensis</i> M. and Tr. | * <i>pectinatus</i> Sladen |
| * <i>brevispinus</i> Sladen | <i>platyacanthus</i> Philippi |
| <i>duplicatus</i> Gray | <i>polyacanthus</i> M. and Tr. |
| * <i>formosus</i> Sladen | <i>preissii</i> M. and Tr. |
| <i>granulatus</i> M. and Tr. | <i>pusillulus</i> Fisher |
| <i>granulatus natalensis</i> n. subsp. | <i>regalis</i> Gray |
| <i>griegi</i> Koehler | <i>sanctae helenae</i> Mortensen |
| <i>hartmeyeri</i> Döderlein | <i>scoparius</i> M. and Tr. |
| <i>hemprichi</i> M. and Tr. | * <i>sphenoplax</i> Bell |
| * <i>hermatophilus</i> Sladen | <i>spinulosus</i> Philippi |
| * <i>imbellis</i> Sladen | <i>triseriatus</i> M. and Tr. |
| <i>indicus</i> Döderlein | * <i>triseriatus fijiensis</i> n. subsp. |
| <i>irregularis</i> (Pennant) | <i>vappa</i> M. and Tr. |
| * <i>irregularis pontoporaicus</i> Sladen | <i>variegatus</i> Mortensen |
| <i>javanicus</i> Lütken | <i>velitaris</i> von Martens |
| <i>johnstoni</i> (Delle Chiaje) | <i>verrilli californicus</i> Fisher |
| | * <i>zebra</i> Sladen |

Something is written below of fifteen of these forty-nine species. Five (*granulatus*, *indicus*, *monacanthus* and *zebra* and *hartmeyeri*) are discussed chiefly because the Museum specimens show that, within each, the range of variation is greater than had previously been described. In one of them (*granulatus*) variation is correlated with locality and a new subspecies is created. In four other species (*brevispinus*, *mesactus*, *pectinatus* and *sphenoplax*) re-examination has shown the presence of many more actinal intermediate plates than was hitherto known ; they extend much farther down the arm than is normal in the genus. The Museum specimens of *triseriatus* have made possible a fuller description of that little-known form ; one of them is described as a new subspecies. *A. michaelseni* Koehler is shown to include *A. dahomensis* Döderlein ; some notes on the Museum specimens are added. Some Museum specimens of *A. antillensis* appear to show that the species has a greater range than was previously known.

Before the war a search was made for Gray's Asteroid types. Of those of his species of *Astropecten* which, according to Döderlein (1917), are still valid as species

or subspecies, the types of only three were found. They are those of *A. brasiliensis armatus*, *A. brasiliensis erinaceus* and *A. mauritianus*. They are redescribed and figured.

Astropecten granulatus Müller and Troschel

(Plate I, figs. 1 and 2.)

Astropecten granulatus Müller and Troschel, 1842, *Syst. Ast.* : 78 ; Sladen, 1889 : 215, pl. 35, figs. 3-4, pl. 39, figs. 4-6 ; Koehler, 1910 : 266 ; Döderlein, 1896 : 305, pl. 18, figs. 30 and 30a ; Döderlein, 1917 : 148, pl. 5, fig. 7 ; pl. 14, figs. 1, 3 and 3a ; pl. 17, figs. 2, 2a and b ; Fisher, 1919 : 73 ; Clark, H. L., 1923 : 250 ; Livingstone, 1932 : 242, pl. 8, figs. 2 and 3 ; Clark, H. L., 1938 : 60, pl. 1, fig. 1 (in colour).

The locality from which the types of this species came is not known, but all subsequent records, with the exception of that of Clark (1923), have been from Australian, E. Indian or Philippine seas. Clark recorded it from off the coast of Natal and from off Cape Agulhas (one "young and dubious specimen"), in South African waters. But in 1938 he changed his opinion, saying : " Comparison of the South African specimens (those he described in 1923) with the material from Broome indicates that it is quite different and further study suggests that it is nearer to *A. notograptus* Sladen than to any species hitherto described. Hence *granulatus* should be deleted from the list of South African sea-stars."

There are in the British Museum (Natural History) fourteen South African specimens which I am satisfied are of the same species as those Clark ascribed to *A. granulatus*. They were presented in 1904 by the Cape of Good Hope Government under the following reference numbers :

Ref. No. 49—1 specimen	Ref. No. 10639—6 specimens
101—1 ,,	10723—2 ,,
? 171—3 specimens	10894—1 specimen

A search of the correspondence between the Marine Biologist at the Cape (Dr. Gilchrist) and Professor Jeffrey Bell concerning the Echinoderms sent to the British Museum from the Cape between 1897 and 1904 shows that each specimen had a reference number and that lists, giving localities against reference numbers, accompanied Dr. Gilchrist's letters. Some of the lists have been found, but not any including one of the reference numbers above. One of them, however, is to be found in Bell's paper on the Asteroidea (1905, p. 244). It is 10639 and the accompanying data read : "Cape Natal W. by N. 4½ miles, large dredge, 47 fms., sand and shells." Professor Bell named these specimens *Astropecten pontoporeus*. It must, unfortunately, remain unknown exactly where the other specimens came from.

There are twelve specimens from Australian waters: the "Challenger" specimen ; the Barrier Reef Expedition specimen figured by Livingstone ; two specimens from Broome received through Dr. H. L. Clark from the Museum of Comparative Zoölogy ; one from 36 fathoms on the north side of Holothuria Bank and four from Roebuck Bay (Admiralty) ; and three specimens from "West Australia" (Australian Museum, Sydney).

A comparison of the two sets of specimens, the Australian augmented by ample description and illustration in published papers, does not convince me that they are of two species :—

	R. r in mm.	Br in mm.	No. of superomarginal plates
<i>South African Specimens</i>			
Reference Number 10639	13 : 4 = 3·2	3	13
171	16 : 5 = 3·1	3·5	16
10639	19 : 6 = 3·1	5	16
101	20 : 6 = 3·3	5	17
10639	22 : 7 = 3·1	6	15
10894	23 : 7 = 3·3	5·75	18
171	26 : 7 = 3·7	5	18
10639	30 : 9 = 3·3	7	17
10639	32 : 10 = 3·2	9	20
49	35 : 8 = 4·4	7	22
10723	35 : 9 = 3·9	8	18
10723	37 : 11 = 3·4	8·5	19
171	39 : 11 = 3·5	8	20
<i>Australian etc. Specimens (including those described in the literature)</i>			
W. Australia (Clark, 1938)	7 : 3 = 2·3	3·5	10
Philippine Is. (Fisher, 1919)	15 : 5 = 3		
Aru Is. (Koehler, 1910)	21 : 9 = 3·5		19
Arafura Sea, "Challenger" [in British Mus. (Nat. Hist.)]	21 : 7 = 3	4	18
Holothuria Bank [in B.M. (N.H.)]	22 : 6 = 3·7		22
Thursday Is. (Döderlein, 1896)	29 : 8 = 3·6		24
Broome, W. Australia [in B.M. (N.H.)]	35 : 10 = 3·5	6·5	29
Barrier Reef (Livingstone, 1932)	38 : 10 = 3·8	5·5	29
West Australia [in B.M. (N.H.)]	44 : 11 = 4		29
West Australia [in B.M. (N.H.)]	46 : 11 = 4·2		27
Western Australia [in B.M. (N.H.)]	49 : 13 = 3·5		27
Roebuck Bay [in B.M. (N.H.)]	77 : 18 = 4·3		40
West Australia (Döderlein, 1917)	79 : 17 = 4·7		42
Roebuck Bay [in B.M. (N.H.)]	83 : 15 = 5·5		41
Broome [in B.M. (N.H.)]	86 : 15 = 5·75	14	39
Roebuck Bay [in B.M. (N.H.)]	88 : 10 = 5		42
Roebuck Bay [in B.M. (N.H.)]	93 : 19 = 4·9		41
West Australia (Clark, 1938)	118 : 22 = 5·4		45

Note.—One of the S. African specimens (Ref. No. 10639) is too distorted to measure.

There are differences, some of which are brought out in the table. The number of superomarginal plates is greater in Australian than South African specimens : of two specimens of R=35 mm. the South African has twenty-two, the Australian twenty-nine ; a South African specimen of R=37 mm. has nineteen marginal plates, while an Australian specimen of R=38 mm. has twenty-nine. The covering of the superomarginal plates of the South African specimens is a little less dense, that of the inferomarginal plates a little more dense, than those of Australian specimens, but they are of the same nature ; and the difference in the inferomarginal plate covering is not greater than that between Aru Islands and Thursday Island specimens shown in Döderlein's figs. 2a and 3 (1917, pl. 17). The second of the two marginal spines of the inferomarginal plates is in most, but not in all, South African specimens bigger in proportion to the first than it is in Australian specimens, being often two-thirds and sometimes three-quarters as long.

The only difference that I see in the general facies is that of the relative proportions of the inferomarginal spines ; that the superomarginal plates of Australian specimens encroach more on the abactinal surface than do those of South African specimens ; and that two of the South African specimens have spines on some of the superomarginal plates. One of them is remarkable in having large spines, more than 2 mm. long, on the first superomarginal plates in some

interradii but not in others. The spines on the more distal plates of both specimens are smaller, about half the length of the plates on which they occur. They are broad based and pointed—*i.e.*, sharply conical.

Clark (1923, p. 251) wrote: "One of the smaller African specimens shows six superomarginal spines," but he does not state where they occurred. Their very irregular occurrence in the two British Museum specimens is shown in the following table :—

Specimen	Rays—showing number of individual superomarginal plates on either side on which spines occurred.									
	1		2		3		4		5	
	a	b	a	b	a	b	a	b	a	b
Ref. No. 49, R=35 mm.	1		1				1	1	1	?1
			9	9	7	7	7	7	8	8
			10	10	8	9	8	8	10	?9
			12	11	9	10		9		?10
					10	11		10		?11
				11			11			
Ref. No. 10723, R=37 mm.	10	11	9		10	6	6		8	
					12	7	7		9	
					13	11				
					14	12				
					15	13				
						14				
									Rays broken off at 10th superomarginal plates	

Many characters are shared in common by the two sets of specimens. The paxillae, with all their variations of age, are essentially the same. A characteristic feature is the raised rim which the outer spinelets form around the shorter central granules and the unequal size of the latter (Döderlein's fig. 2a, pl. 17, 1917, shows this very well.) The rim is least apparent in the very large Australian specimen (R=86 mm.) in which all the spines are of roughly equal length and have flattened polygonal ends; but it tends to be present even there. The number of spines or granules present on the largest paxillae varies from one or two central and seven to ten peripheral in the smallest specimens, to ten to seventeen central and fifteen to seventeen peripheral in those of medium size. In the largest specimen (R=93 mm.) there are twenty-five to thirty in the centre and about twenty-five around the edge. The shape of the larger paxillae where they are crowded tends to be polygonal.

The characteristic spines which occur among the squamules on the ventral surfaces of the inferomarginal plates are present in nearly all the British Museum specimens, Australian and South African alike. They are flattened and blade-like with an irregular outline, but each tapers to a point. Their occurrence is very irregular. In smaller, and sometimes in medium-sized, specimens they are present on the first plate only and lie in a row down its centre. In larger specimens they occur too on neighbouring plates, but have moved to the aboral edge; and in very large specimens they may extend to the end of the ray (Döderlein, 1917, pl. 14, fig. 1).

The order of the adambulacral spines is the same in both sets of specimens, but the aboral spine of the second row is much less enlarged in South African than in Australian specimens; it is only slightly bigger than the adoral.

More South African specimens are required before it can be said whether the form occurring there is best called a separate species. In the meantime it seems

wise to regard it as a new sub-species—subsp. *natalensis*, distinguished by its smaller number of superomarginal plates, which may carry spines, and by other differences, detailed above (in the covering of the marginal plates, the relative proportions of the two spines of the inferomarginal plates, etc.), which are of degree and not of kind; and, even so, are not constant.

The Australian specimen of $R=46$ mm. which has the unexpectedly large minor radius of 13 mm. has unusual numbers of actinal intermediate plates. In two interradii there are five; in the other three there are six, seven and nine respectively. The nine are arranged as a chevron of seven enclosing a pair in its angle.

Astropecten indicus Döderlein.

Astropecten indicus Döderlein, 1888, *Zool. Jb. Abt. 1*: 828, pl. 31, figs. 2a-d; Koehler, 1910, 27, pl. 4, figs. 8-15; Döderlein, 1917: 146, pl. 14, figs. 4-4a.
Astropecten koehleri Loriol, 1899, *Mém. Soc. Phys. Genève*: 19, pl. 1, fig. 5; Döderlein, 1917: 122, pl. 11, figs. 1-1a.
Astropecten pleiacanthus Bedford, 1900, *Proc. Zool. Soc. Lond.*: 292, pl. 24, figs. 9a-c.

There are in the collection ten specimens which appear to me to show that Koehler (1910) was right in uniting *A. koehleri* with *A. indicus*, a conclusion with which Döderlein (1917) did not agree. He thought *koehleri* to be sharply marked off from *indicus* by (a) the possession of well-developed spines on the inner margins of the more proximal superomarginals, and (b) the presence of well-developed rows of spines along the distal edges of the inferomarginals. How he can have held the first, (a), after Koehler's careful description of a series I do not know. The second, (b), I find a more puzzling point.

The ten specimens are as follows:—

No.	R : r in mm.	No. of superomarginals	Locality	Source	Remarks
1	9 : 3 = 3	15	Ceylon	Herdman collection	Does not have characters of adult, but presumed because of its occurrence with one to belong to this species.
2	24 : 8 = 3	17	India—probably near Madras	Day collection	
3	24 : 8·5 = 2·8	19			
4	35 : 8 = 4·4	25	N. coast Socotra	H.M.S. "Weston"	Paratype of <i>A. pleiacanthus</i> , Bedford
5	28 : 8 = 3·5	23	Ceylon	Dr. Ondaatje	
6	32 : 9 = 3·6	24	Singapore	F. D. Bedford	
7	30 : 10·5 = 3·4	24	Matrah, Iraq	V. H. W. Dowson	
8	37 : 11 = 3·4	24	Ceylon	Herdman collection	
9	41 : 12 = 3·4	23	India—probably near Madras	Day collection	
10	42 : 13 = 3·2	20	Karrachee	J. Murray	

They show, in one direction, an even wider variation in the spination of the superomarginals than did Koehler's series. No. 1, which is very juvenile, has no trace of spines. Nos. 2 and 3 each has a small spine on practically every superomarginal; they are inner spines on the first three plates and pass to the outer edge on the fourth to sixth plate. No. 4 is similar except that on most arms the inner

spine is confined to the first two plates, and the outer series begins on the second plate, which therefore has two spines. No. 5 is a dry specimen which has lost many spines. It seems to have been similar to Nos. 2 and 3. One of its arms is regenerated beyond the fourth superomarginal. The spines borne on the regenerated plates are relatively much bigger than those of the adult arm.

No. 6, the paratype of Bedford's *A. pleiacanthus*, is described below.

No. 7 has large inner spines on the first three to four plates, inner and outer spines on each of the mid-arm plates, single outer spines on the last six or seven plates. No. 8 is rather different, for the spines are very small. There is one to each plate except that on some arms there are one to four unarmed plates between the first three, which have inner spines, and the outer plates, which have spines on the external edge. Some plates at the extremity of the arm are also unarmed.

Nos. 9 and 10 show spination greater than any Koehler described. No. 9 has large single spines on the first three superomarginals. In mid-arm each plate has up to six unequal spines or enlarged granules. They form an irregular row near the distal edge with odd spines or granules standing proximal to it. Four or five plates at the tip of the arm usually have but one, outer, spine. One arm is regenerated beyond the third superomarginal. The regenerated portion bears one spine on each of the twelve plates. No. 10 is similar but even more spiny, for most of the first superomarginals bear two strong spines. For the largest specimen it has a curiously low number of marginal plates (20).

The other characters of these specimens (except for the juvenile No. 1) are those of *indicus* as described by Döderlein (1917).

No. 6 is different and it was long before I decided to treat it as of the same species. (It is the smaller of the two specimens upon which Bedford based his description of *A. pleiacanthus* and it is the one photographed by him.) It has spines on all the superomarginals and they are bigger than those of any of the specimens described above. Two spines occur, very irregularly on different arms, on some of the plates between the third and the eighth; the inner spine of the pair is much smaller than the outer. In this there is no difference in kind from the series described above; but there is such a difference in the armature of the inferomarginals. The first six to nine possess strong spines arising among the scale-like spinelets of the ventral surface. There are three to four on the first, two on the second, and, usually, one thereafter. They lie in the mid-line on the first plate, near the distal edge of the others.

Koehler described these spines as constituting one of the characters of *A. indicus* and shows them in figs. 11 and 12 of his pl. 4. In the other specimens of the Museum series (with the exception of No. 1) there are enlarged spinelets in corresponding positions on the first, second and sometimes on the third to fifth plates; but they are so different in size from those of No. 6 that they are not immediately apparent as its spines are. To regard No. 6 as a separate species because it has these spines would be to suppose that intermediate stages between it and the others of the series do not occur. On the other hand, I cannot assert that they do.

No. 6, however, has another difference. The other specimens of the series (again excepting No. 1) have a rudimentary spine standing proximal to and above the large inferomarginal spine. It is variable in size; in some of the larger specimens it is double. It is not present at all in No. 6.

***Astropecten monacanthus* Sladen.**

Astropecten monacanthus Sladen, 1883, *J. Linn. Soc. (Zool.)*, **17**, 203, 1889, 210, pl. 33, figs. 7 and 8; pl. 37, figs. 10-12; Koehler, 1910, 37, pl. 3, figs. 9-11, pl. 5, fig. 11; Döderlein, 1917, 150, pl. 14, figs. 5-5b; pl. 17, fig. 9; Fisher, 1919, 74; Macan, 1938, 336; H. L. Clark, 1938, 63.

There are in the British Museum twenty-three specimens, including the type, of this species. They come from Arabia, the Maldives, India, the Andamans, Burma, the East Indies and Philippines, and (one large specimen) from Pin Tang in China. Included in this number are seven juvenile specimens ($R=9-15$ mm.) the adambulacral spines of which do not have the characteristic shape of those of the adult. They are regarded as *monacanthus* because they were taken with adults and because most of them have the distinctive disk markings of the species (see below). There are, on the other hand, two juvenile specimens ($R=11$ and 15 mm.) in which the outer adambulacral spines are widened and flattened as in the adult. The largest specimen previously recorded was of $R=53$ mm. (Macan). There are specimens of $R=62$ and 91 mm. in the Museum.

If nothing else were said of this series, this should be recorded: that ten specimens of it have spines or enlarged granules on the superomarginals. Koehler described their occurrence and figured them. But two more recent descriptions of the species have seemed to deny their presence: Döderlein's diagnosis says superomarginals "without spines," although on another page (p. 146) he notes that there may be spines; and Fisher writes of "unarmed granulate superomarginals."

The spines may be very small—no more than enlarged granules; but they may, on the other hand, be anything up to half the length of the plate from which they arise. Their presence is not, so far as this series shows, correlated with size. The largest specimen ($R=91$ mm.) possesses them on some plates near the end of the arms, but they are very small. A specimen of $R=52$ mm. has none. The largest are on a specimen of $R=37$ mm. They occur on four specimens of $R=9-14$ mm., on three of them on the first and second superomarginals only. It may be significant that all the specimens on which they occur come from Indian seas.

Their occurrence is very irregular. They may be only near the end of the arm; or from the fourth or fifth plate to the end; or only on mid-arm plates; or irregularly anywhere; or (in the juvenile specimens referred to above) on the first and second plates only. They are sometimes double.

Fourteen of the specimens, including five of the juveniles, bear characteristic markings on the dorsal side. (All are in spirit.) A dark line lies parallel and near to the margin of the proximal part of each arm on each side, those of contiguous arms being joined around the arm angle to form a chevron. In some of the larger specimens there is also a dusky ring around the centre of the disk from which a band runs down the centre of each arm. The largest specimen has this pattern alone. There may also be dark bands across the arms two-thirds of the way down.

Twelve of the specimens, including some that are fairly large (up to $R=62$ mm.), possess an epiproctal cone.

There is nothing to add to Fisher's account of the adambulacral armature except that in the Pin Tang specimen the adoral spine of the outer series is more broadly spatulate than in any figure, or in any specimen that I have seen.

The largest paxillae of the biggest specimen have up to forty central and thirty peripheral granules. The number of superomarginals of this specimen,

being forty-seven, appears very high. Four specimens of between $R=42$ and 45 mm. have twenty-four to thirty superomarginals; a specimen of $R=62$ mm. has thirty-six.

***Astropecten zebra* Sladen and *Astropecten hartmeyeri* Müller and Troschel.**

- Astropecten zebra* Sladen, 1883, *J. Linn. Soc. (Zool)*, **17** : 261; 1889 : 212, pl. 36, figs. 3 and 4; pl. 39, figs. 7 and 9; Döderlein, 1896 : 306, pl. 18, figs. 31 and 31a; Lorient, 1899 : 9; Bell, 1904 : 149; Kochler, 1910 : 44; Brown, 1910 : 29; Döderlein, 1917 : 155, pl. 14, figs. 8 and 8a; Clark, H. L., 1921 : 27; Livingstone, 1932 : 242; Clark, H. L., 1938 : 63.
- Astropecten coppingeri* Bell, 1884, "Alert" Report : 132.
- Astropecten zebra* var. *rosea* Sladen, 1883, *J. Linn. Soc. (Zool.)*, **17** : 263; 1889 : 214.
- Astropecten zebra* var. *sibogae* Döderlein, 1917, *Siboga Exped. Monog.* **46a** : 156, pl. 6, fig. 4; pl. 14, figs. 7 and 7a.
- Astropecten hartmeyeri* Döderlein, 1917, *Siboga Exped. Monog.* **46a** : 156, pl. 5, fig. 8; pl. 14, figs. 6-6c; Clark, H. L., 1938 : 62.
- Astropecten hartmeyeri* subsp. *siamensis* Döderlein, 1926, *K. svenska Vetensk.-Akad. Handl.*, (3) **2** : 5, pl. 1, fig. 2.

H. L. Clark (1938, p. 63), in writing of *A. hartmeyeri*, states "whether *hartmeyeri* is really distinct from *zebra* Sladen seems to me rather doubtful, but the only specimens of *zebra* available for comparison are too young to be of real service. Larger collections from North-eastern Australia are necessary for a final decision."

In the British Museum collection there is a series of twenty-four specimens, a description of which may help to solve the problem. They are as follows:—

I. *From North-eastern Australia.*

- A. Torres Strait, Challenger Station 186. Four specimens, the types of *A. zebra*.
- B. Torres Strait, Challenger Station 187. Three specimens, the types of the var. *rosea*.
- C. Thursday Island, Torres Strait, "Alert" Collection. One specimen, the type of *A. coppingeri*.
- D. Torres Strait, "Alert" Collection. Three specimens, labelled *coppingeri*.
- DI. Prince of Wales Channel, Torres Strait, "Alert" Collection. One specimen, labelled *coppingeri*.
- E. Holothuria Bank, Admiralty Collection. Two specimens.
- F. Holothuria Bank, 34 fms., Admiralty Collection. Three specimens.
- G. North-west side of Holothuria Bank, 39 fms., Admiralty Collection. Two specimens.
- H. South of Cape Kimberley, 4 fms., Great Barrier Reef Expedition. Two specimens.

II. *From Western Australia.*

- J. Magnetic Shoal, off Cossack, Admiralty Collection. Two specimens.
- K. Broome. One specimen of *A. hartmeyeri*, presented by Dr. H. L. Clark.

In the following discussion the specimens will sometimes be referred to as of A, B, C, etc. The variation described is tabulated, so far as is convenient, in the table on p. 495.

Döderlein distinguishes *hartmeyeri* from *zebra* by (1) the fact that its superomarginal plates beyond the first three to six nearly always bear small spines on the outer edges, whereas those of *zebra* do not; and (2) the fact that it has

pedicellariae on the first inferomarginal plates in place of the large marginal spine ; small pedicellariae on the lower distal edges of some of the superomarginal plates ; and pedicellariae among the paxillae of the dorsal surface, usually near the marginal plates ; whereas *zebra* has them on the adambulacral and actinal intermediate plates only.

The occurrence of the superomarginal spines and pedicellariae is described as extraordinarily variable.

Discussion of Series.

Superomarginal spines. In the largest of the type specimens (A) the inner spines of the arm angle extend to the sixth plate, becoming progressively smaller. They reach the third plate in the types of the var. *rosea* (B). In one of the largest specimens (R=23 mm.) of C and D they extend to the third plate on some rays ; in the smallest (R=11 mm.) there are very small spines on the first plates only. In none of these specimens are there spines on the outer edges of the superomarginal plates. It is otherwise with most of the specimens of D1, E, F, G and H. In D1, by far the largest specimen in the series (R=107 mm.), there are outer spines on the fourteenth and fifteenth plates on one side of one arm, none on the other side nor on any other arm. In both specimens of E there are spines on all the superomarginal plates except one or two at the ends of the arms ; they move from the inner to the outer edge on the third and fourth plate. In the three specimens of F they extend to respectively, in order of size, the twelfth, seventeenth and sixteenth plates. There are, here and there, gaps in their occurrence : in the smallest specimen they are wanting from the third and fourth plates on most arms. In one of the specimens of G there are inner spines on the first and second, and none on any other plates ; in the second specimen there are small outer spines from the fourth or fifth to the seventh, eighth or ninth plates. H are the specimens listed by Livingstone (1932). One has only large spines on the inner edges of the first and second plates ; the other has, in addition, small outer spines occurring irregularly as far out as the eleventh plate ; some plates, including the first, have two spines.

In the larger specimen of J (R=46 mm.) small outer spines extend to the eighteenth superomarginal plate on some rays. They are not always continuous. The change from inner to outer edge takes place on the fourth to seventh plate. In the smaller specimen (R=12 mm.) the only spines present are very small ones on the inner edges of the first plates in some interradial spaces. In the large specimen (*A. hartmeyeri*, K) only one or two of the plates of some of the margins are armed with very small outer spines. Examples on different margins are : the ninth and tenth plates, the twelfth and fourteenth plates, the twelfth plate.

Pedicellariae. In the three larger type specimens of *zebra* (A) the first superomarginal plate bears in place of the large marginal spine a small pedicellaria composed of three to six spines ; and in one of them there are eight small pedicellariae on the dorsal surface among the paxillae near the marginal plates. These, undescribed by Sladen, are among the distinguishing features of *hartmeyeri*. In the smallest specimen (R=11 mm., Sladen's "young phase") the marginal spine of the first inferomarginal plate is present and there is no pedicellaria. The types of *rosea* (B) resemble those of *zebra* in the occurrence of pedicellariae except that none possesses any in the paxillar field, and the largest has none on the adambulacral plates. In C and D the large spine of the first inferomarginal plate is missing ; it is replaced by a pedicellaria in the larger specimens, but not in the smaller. There

are no pedicellariae among the paxillae. The smallest ($R=11$ mm.) has pedicellariae only on the actinal intermediate plates. In the large specimen D1 there are pedicellariae on the actinal intermediate, adambulacral and first inferomarginal plates; they are also present in small numbers in the paxillar areas near the marginal plates and on the lower distal corners of some superomarginal plates.

In the group of specimens (E, F and G) from the *Holothuria* Bank the first inferomarginal plate carries a spine and not a pedicellaria. Otherwise they vary. The specimens of F have no pedicellariae at all, not even on the actinal intermediate plates. Those of G have the spines of the actinal intermediate plates grouped in a pedicellaria-like way and there are what appear to be incipient pedicellariae on one or two adambulacral plates of one specimen. The specimens of E, which are not very much bigger than those of G and are smaller than some of those of F, are rich in pedicellariae. They are present on the actinal intermediate, and are numerous on the adambulacral, plates. They are also found on the paxillar area: in the smaller there are about ten, all near the marginal plates; in the larger there are over forty grouped for the most part near the marginal plates at the arm angles. The Barrier Reef Expedition specimens (H) have neither large marginal spines nor pedicellariae on the first inferomarginal plates and no pedicellariae in the paxillar area. Both have them on the actinal intermediate plates, but in the bigger only are they present on a very few adambulacral plates.

Turning to the specimens from Western Australia: the large specimen from Cossack (J) has pedicellariae on actinal intermediate and adambulacral plates, in place of spines on the margins of the first inferomarginal plates, and on the dorsal surface (about fifty in number) mostly near the marginal plates; and in addition there are small, low pedicellariae on the lowermost and distal-most corners of some superomarginal plates, more especially those in the proximal part of the arm. The smaller specimen ($R=12$ mm.) has pedicellariae on the actinal intermediate plates and in the arm angles.

The Broome specimen has pedicellariae on the actinal intermediate, adambulacral and first inferomarginal plates as well as many small ones on the dorsal surface near the marginal plates. It has none on the superomarginal plates.

Other Characters. The general facies and the remaining characters of all the specimens are the same. Three sets show a peculiar colour: those Sladen named var. *rosea* are pink; three specimens (F) from the *Holothuria* Bank are a rich straw yellow; the Barrier Reef Expedition specimens are very dark grey. Yet these, as well as the remainder which are the usual museum colour, show the dark pattern characteristic of *zebra*. Döderlein created a variety of *zebra*, var. *sibogae*, on one specimen ($R=18.5$ mm.) with the aboral spines of the inferomarginal plates missing. I find them to be wanting in all but the first two or three proximal plates of specimens below $R=20$ mm. It is worth noting that Döderlein describes his specimen of var. *sibogae* as having a pedicellaria in place of a spine on the outer edge of the first inferomarginal plate; that De Loriol saw no pedicellariae in his specimens from Sumatra; that Rudmose Brown mentions none in examples from the Mergui Archipelago; that Koehler found none on the adambulacral plates of specimens from Madras, Burma and the Andamans. Döderlein does not describe pedicellariae in his single specimen of the subspecies of *hartmeyeri*, *siamensis* from the Gulf of Siam. There are no specimens from these regions in the British Museum collection.

There are three small specimens with no more precise locality than "Australia" which have not been described. Bell referred to them (1884, p. 133). $R=10.5, 17$

and 20 mm. None of them has outer spines on the superomarginal plates. The smallest has an inner spine on the first plate only, the second on the first and second, and the largest on the first, second and third. The smallest has no pedicellariae ; but the first inferomarginals are without marginal spines so that it may be supposed that pedicellariae would have developed there later. That with R=17 mm. has pedicellariae on the actinal intermediate plates and they are incipient on the adambulacral plates. There are pedicellariae on the actinal intermediate, adambulacral and first inferomarginal plates as well as on the paxillar area of the largest specimen.

Conclusions. Though it cannot be said with certainty that *hartmeyeri* and *zebra* are one, it has been shown that the characters used to separate them do not hold good, and are, apart from that, extremely variable. This account is prepared as a contribution to the final solution of the problem.

TABLE OF VARIATIONS

Specimens	R r in mm.	No. of superomarginal plates	Spines on outer edges of superomarginal plates	Occurrence of PEDICELLARIAE				
				Ventrolateral plates	Adambulacral plates	First inferomarginal plates	Paxillar area	Superomarginal plates
A (part)	11 : 4	12	None	×	—	—	—	—
D (part)	11 : 4	13	None	×	—	—	—	—
J (part)	12 : 4	13	None	×	—	×	—	—
G {	15 : 5	15	None	×	×	Spines	—	—
	15 : 5	15	From 4th or 5th to 7th, 8th or 9th plates	×	—		Spines	—
F (part)	19 : 5	16	Extend to 12th plate	—	—	Spines	—	—
D (part)	20 : 5	21	None	×	×	—	—	—
	21 : 6.5	17	On nearly all plates	×	×	Spines	×	—
E {	22 : 7	18	On nearly all plates	×	×	Spines	×	—
	22 : 7	20	None	×	×	×	×	—
A (part)	22 : 7	20	None	×	×	×	×	—
D (part)	23 : 6	25	None	×	×	×	—	—
F (part)	25 : 7	19	Extend to 17th plate	—	—	Spines	—	—
B (part)	25 : 6	23	None	×	×	×	—	—
B (part)	26 : 7	22	None	×	×	×	—	—
F (part)	26 : 7	20	Extend to 16th plate	—	—	Spines	—	—
A (part)	28 : 7.5	22	None	×	×	×	—	—
H (part)	29 : 7.5	25	None	×	—	—	×	—
C	28 : 7.5	22	None	×	×	×	—	—
A (part)	30.5 : 7.5	24	None	×	×	×	—	—
B (part)	31 : 8.5	24	None	×	—	×	—	—
H (part)	32 : 9	23	Extend to 11th plate	×	×	—	—	—
J (part)	46 : 10.5	31	Extend to 18th plate	×	×	×	×	×
K	64 : 11	38	Few on 9th to 14th plates	×	×	×	×	—
DI	107 : 14	55	On 14th and 15th plates on one side of one arm	×	×	×	×	×

× denotes " present."

Astropecten brevispinus Sladen

(Plate I, figs. 3 and 4.)

Astropecten brevispinus Sladen, 1883, *J. Linn. Soc. (Zool.)*, **17** : 249; 1889 : 198, pl. 33, figs. 1 and 2 pl. 37, figs. 1-3; Goto, 1914 : 221; Döderlein, 1917 : 60.

Sladen's description of *A. brevispinus* is excellent and complete except that he described only the spinelets of the actinal intermediate plates and not the plates themselves. They are of exceptional interest.

In the adult specimen (R=32 mm.) there are four chevrons in each inter-radius. In the first there are nineteen plates on either side reaching to the twelfth inferomarginal, which is about three-quarters of the way down the arm. In the second and third chevrons there are on either side seven and four plates reaching, respectively, the fourth and second inferomarginal. The fourth chevron is of six plates, three on either side; they are in contact with the first inferomarginal. The larger actinal intermediate plates in the interradian area are strongly arched in the middle.

In the "young phase" (R=16.5 mm.) there are three chevrons having respectively six, three and single plates on either side. The first row reaches the third inferomarginal; the second and third are in contact with the first inferomarginal.

The possession of these plates, running far down the arm in the adult, might cause the species to fall nearer *Persephonaster* than *Astropecten* in Fisher's key (1911, p. 39). But Goto (1914, p. 221) could not be certain of their presence, and did not explicitly surmise it, when he placed the species in *Persephonaster*.¹ He did so because of the close relations he saw between it and his *Persephonaster triacanthus*. He placed the latter in *Persephonaster* despite its "very strong external resemblance to *Astropecten*" because, above all, it possessed an anus. "The only single character of decisive value that distinguishes the genus (*Persephonaster*) from *Astropecten* is the presence of the anus," he wrote (p. 221). On the other hand, Fisher (1911, p. 38) says of the anus that "No more unstable character can be conjured up to separate *Astropecten* and its near relatives from *Plutonaster*, *Dytaster*, or *Dipsacaster* . . . there is good evidence that the character is variable within a genus (*Astropecten*, etc., etc.)." I cannot see an anus in *Astropecten brevispinus*.

There is no doubt that Sladen's *Astropecten brevispinus* and Goto's *Persephonaster triacanthus* are very closely related. Their general facies is undoubtedly more *Astropecten* than *Persephonaster* and so are the nature of the adambulacral and mouth-plate armature, and of the paxillae. It therefore seems better to call them so.

Astropecten mesactus Sladen

(Plate I, figs. 5 and 6.)

Astropecten mesactus Sladen, 1883, *J. Linn. Soc. (Zool.)*, **18** : 267; 1889 : 219, pl. 34, figs. 5 and 6; pl. 38, figs. 7-9; Döderlein, 1917 : 59.
non Studer, 1884, *Abh. preuss. Akad. Wiss.* : 46.

Sladen described this as a "very abnormal *Astropecten*" which he admitted "not without hesitation" into the genus. "The character of the abactinal paxillae (the pedicel being represented only by a broad tubercular eminence of the plate) and the great development of the actinal interradian areas are altogether unlike any *Astropecten* with which I am acquainted" (1889, p. 221). Sladen's description

¹ Döderlein (1921, p. 26) gives a list of the species of *Persephonaster* known at that time. He omits the three species described by Goto (1914).

of it is of his usual excellence except that he does not fully describe the actinal intermediate plates. They extend two-thirds of the way down the arms.

There are four clearly marked chevrons. The first has twenty-two plates in each limb, reaching the twelfth inferomarginal. The second, with nine plates (including a single plate at the apex), and the third with four plates on each side, reach respectively the fourth and second inferomarginals. The fourth chevron is of four plates, two in each limb, the outer touching the first inferomarginals.

There appear to be no other references to this species than those given above.

Astropecten pectinatus Sladen

(Plate II, fig. 5.)

Astropecten pectinatus Sladen, 1883, *J. Linn. Soc. (Zool.)*, 17 : 251 ; 1889 : 202, pl. 33, figs. 3 and 4 ; pl. 37, figs. 4-6.

Description. There are ten specimens in the Museum collection. Eight are "Challenger" specimens as follows : Port Jackson, five ; St. 161, off entrance to Port Philip, two ; St. 162, Bass Strait, one. The other two, dried specimens in good condition, were collected by J. B. Wilson, Esq., at Port Philip Heads in or before 1885.

I find Sladen to have been wrong in his description of the actinal intermediate plates, which is as follows : "The actinal intermediate plates, which are small and very few in number, are confined to the immediate interradial area. The spinelets that cover them are small, more or less subspatulate in form, and radiate apart."

One of the smallest specimens (Port Jackson, $R=28$ mm., $r=8$ mm., with eighteen superomarginals) has two rows of actinal intermediate plates on either side. The first extends far down the arm to the seventh inferomarginal and consists of thirteen plates. The most distal are very small and cannot be seen until the spines of the adjacent inferomarginals and adambulacrals are removed. The second row is of three plates (including the unpaired plate at the apex of the chevron formed by the two rows in one interradius). The actinal intermediate plates carry tufts of spinelets. Those of the inner row are of smaller spines and fewer in number (seven to eight) on the innermost plates than on those farther out in the interradial area. The plates of the second row have a greatly enlarged and flattened central spinelet ; it is as big as those on the aboral edge of the first inferomarginal plates.

In the smaller specimen from Port Philip Heads ($R=35$ mm., $r=10.5$ mm., nineteen superomarginals) there are three rows of actinal intermediate plates on either side. The first is of twenty-three plates and extends to the thirteenth inferomarginal. The second is of four plates. The third "row," if it may be so called, is represented by one minute plate. The plates of the second row and some of those of the first row in the interradial area (not down the arms) have the greatly enlarged spinelet described in the specimen above ; on some plates it is double.

There are similarly three rows of plates in the specimen upon which Sladen based his description ($R=48$ mm., $r=14$ mm., twenty-one superomarginals). But the first is of only sixteen plates, reaching the ninth inferomarginal. The second and third rows are of four and single plates respectively.

The largest specimen in the collection is the second from Port Philip Heads ($R=56$ mm., $r=16$ mm., twenty-one superomarginals). It has four rows of actinal intermediate plates on either side. There are no less than twenty-seven

plates in the inner row, reaching the fourteenth inferomarginal plate. The second row is of eight plates and it too extends into the arm, as far as the fourth inferomarginal. The third and fourth rows are of three and two plates respectively, those of the latter being very small. The plates of the second and third rows of this specimen, and those of the second row of the preceding specimen, have an enlarged blade-like spine like that described for the smaller specimens above.

The figures in the above descriptions are shown in the following table :—

Specimen	No. of rows of actinal intermediate plates	First row		Second row	Third row	Fourth row
		No. of plates	Reaching infero-marginal	No. of plates	No. of plates	No. of plates
R 28	2	13	7	3	—	—
R 35	3	23	13	4	1	—
R 48	3	16	9	4	1	—
R 56	4	27	14	8	3	2

Discussion. *Astropecten pectinatus* has been shown to have a large number of actinal intermediate plates ; and the number of plates and of rows increases with size. It is clear that had Döderlein known this he would have assigned the single specimen from Tasmania upon which he based his species *schayeri* to *pectinatus* ; for (1917, p. 62) he wrote : "Ich würde beide Formen zu einer Art vereinigen, wenn nicht Sladen ausdrücklich angegeben hätte, dass *A. pectinatus* nur sehr wenige Ventrolateralplatten besitzt."

For all that, I do not find it easy to declare *schayeri* a synonym of *pectinatus* ; for Döderlein describes the adambulacral armature of the former as being so different from that of the latter (which is essentially as Sladen described it) ; and Clark (1938, p. 66) emphasises the description. I think, after a careful comparison of my largest specimen of *A. pectinatus* and Döderlein's fig. 1, pl. 7 of *A. schayeri*, of nearly the same size, that Döderlein in describing the spines on the ventral surface of the adambulacral plate as up to seventeen in number may have taken the spines of the adjacent actinal intermediate plate into his count. They would not be equal in size—nor do they appear so in his photograph. This is assuming that there are more plates in the first row than he describes ; which I think is possible, for the distal plates in *A. pectinatus* are small and hard to see unless all neighbouring spines are removed.

I cannot agree with Clark (*loc. cit.*) when he says that "the difference in the large spines of the inferomarginal plates (of *pectinatus* and *schayeri*) is very great." I find them to be quite similar. The inferomarginal armature of *A. syntomus* (H. L. Clark, 1928, p. 372), with its double fringe of spines, is clearly different, but the species must be closely related to *pectinatus*. It is worth adding that its actinal intermediate plates are similarly armed ; as are those of Döderlein's *A. schayeri*.

The occurrence of spines on the superomarginal plates is, on the whole, regular. But on one arm of one specimen (R=32 mm.) the third to seventh plates are unarmed ; in another (R=48 mm.) many plates are unarmed, especially in mid-arm ; in others an odd plate here and there has no spine. In the largest specimen (R=56 mm.) some of the plates in the arm angle have two spines.

***Astropecten sphenoplax* Bell**

(Plate II, figs. 1-3.)

Astropecten sphenoplax Bell, 1892a, *Sci. Proc. R. Dublin Soc.*, 7: 522, pl. 22; 1892b: 68, pl. 9; Koehler, 1909: 42, pl. 17, fig. 8; Mortensen, 1927: 59.

Bell records seven specimens. I find six in the collection, one of which is dry. Bell gave measurements of only three and did not include the largest among them. The following are my measurements of these:—

R	r	No. of superomarginals	Remarks
ca. 72	ca. 15	29	Distorted.
ca. 70	14	30	Distorted.
58	14	30	
56	12	28	
52	12	24	Dry.
ca. 41	9.5	ca. 21	Arm tips missing.

The paxillae have not been described. They are small and crowded near the centre of the disk and at the ends of the arms. On the proximal parts of the arms they are arranged in transverse rows on either side, but are irregularly disposed in the centre. In the distal part of the arm the arrangement is irregular throughout. The larger paxillae bear forty to fifty fine spinelets with no difference between those which are peripheral and those in the centre. In one specimen only (the dry specimen) one central spinelet of a small proportion of the paxillae on the outer part of the disk and in the proximal half of the arm is enlarged to many times the size of its fellows. When shorn of their spinelets the pedicels of the paxillae are seen to be low and rounded, not hour-glass shaped.

The superomarginal plates do not meet near the tips of the arm as Bell states, though they come very near to doing so. Koehler described his two specimens as having a spine, or the scar of a spine, on each superomarginal. It is not so in these specimens: spines are of irregular occurrence and vary from one individual to another. They are most frequently absent from the arm angles and if present there are very small. Where they occur they are largest, up to 2 mm. long, in the region of the fourth to tenth superomarginals and thereafter become smaller. They are most frequently missing on the outer parts of the arms. In the largest specimen they are present only on the fourth and fifth plates of some arms, and are represented by tubercles on a few of the succeeding plates.

Apart from their larger spines the marginals are densely covered with very fine spinelets which stand out at right angles to the plates and are not flattened or scale-like.

The actinal intermediate plates are more numerous and extend farther into the arms than previous descriptions have shown. Those of three specimens have been examined. In the smallest (R=ca. 41 mm.) there are three rows, the first of ten plates extending to the fifth inferomarginal; the second, third and fourth of five, three and single plates respectively. The dry specimen (R=52 mm.) has twelve plates in the first row reaching the seventh inferomarginal; the second row has five plates, and the third has four plates on one side, five on the other. Five plates irregularly arranged in the angle of the chevron formed by the third rows represent the fourth rows.

It is curious that in the largest specimen ($R = ca. 72$ mm.) there are only three rows. The first is of fifteen plates reaching the seventh inferomarginal, the second of five, the third of two plates.

Expressed in another way, the actinal intermediate plates reach, in the three specimens examined, between a third and half-way down the arms.

***Astropecten triseriatus* Müller and Troschel**

Astropecten triseriatus Müller and Troschel, 1843, *Arch. Naturgesch.*, **9** (1) : 118; Döderlein, 1917 : 125, pl. 5, figs. 2-3; pl. 11, figs. 5, 6-6a; Clark, H. L., 1938 : 66.

Astropecten arenarius Perrier, 1876, *Arch. Zool. exp. gén.*, **5** : 286.

Astropecten triseriatus myobrachiatus Fisher, 1925, *Bull. Bishop Mus., Honolulu*, **27** : 69, pl. 5, fig. B.

The only specimens of this species previously described are as follows :—

From south Western Australia: the type (Müller and Troschel and Döderlein); part of one arm (H. L. Clark).

From north Western Australia: one specimen (Döderlein).

From an unknown locality: one specimen (Perrier).

From the Hawaiian Islands: one specimen of the subspecies *myobrachiatus* (Fisher).

It is therefore worth while to give some details of the two specimens in the British Museum collection, as well as a full account of a third which is described as a new subspecies. The measurements of all the known specimens, including those of the new subspecies, are brought together in the table (p. 501).

Specimen from Bass Strait, $R=54$ mm., $r=12$ mm., thirty-one superomarginals. Only one arm is of normal length; each of the others was broken and is in part regenerated. None of the paxillae have enlarged central spinelets. There is, as a rule, only one spine on the first four superomarginal plates; it is slightly longer than one plate, being 2 mm. long. The succeeding plates have two, three or—towards the end of the arm—one spine. Where there are two or three the outermost is the larger, being as long as one plate. The marginal spine of the inferomarginal plates is as long as three plates. There are two inside it as described by Döderlein, but the first of them is more than half as long as the marginal spine. Only the more proximal of the inferomarginal plates have one or two larger spines along the aboral edge. There is only one actinal intermediate plate on either side. The madreporite is 3 mm. long; a few small scattered spines arise from its surface.

Specimen from an unknown locality, $R=84$ mm., $r=17$ mm., thirty-seven superomarginals. In some arm angles the first pair of superomarginals carry only one spine each; in others there is a second and smaller outer spine. The remaining plates carry three, sometimes four, spines, of which the lowermost is the longest; it is nearly as long as two plates in the middle part of the arm, but shorter towards the end. The three large spines of the inferomarginal plates have some of the spinelets at their bases enlarged to spines. The row of aboral spines, three, two or one in number, extends to about the eighteenth plate. There are two actinal intermediate plates on each side. The madreporite is 4 mm. long with a few small scattered spines.

MEASUREMENTS

Specimen	R : r in mm	No. of supero- marginal plates
Subsp. <i>myobrachius</i>	41 : 12 = 3.4	20
Bass Strait (British Museum) ...	54 : 12 = 4.5	31
Type	65 : 17 = 3.8	30
Subsp. <i>fijiensis</i> (British Museum) ...	66 : 17 = 3.9	25
Perrier	82 : 18 = 4.6	35
Unknown locality (British Museum)	84 : 17 = 5	37
Döderlein	95 : 23 = 4.2	35

***Astropecten triseriatus fijiensis* subsp. nov.**

(Plate II, fig. 4.)

This new subspecies is based on a single dry specimen in good condition from the Fiji Islands which came to the Museum in 1862 or earlier. There are no details of depth, etc.

R=66 mm., r= 17 mm. R=3.9 r. Number of superomarginal plates, twenty-five.

This subspecies differs from *A. triseriatus* in the smaller number of superomarginal plates, the great development of the first pair, and the unarmed condition of the second pair, of superomarginal plates.

The larger paxillae have one to six central spinelets which are often of very unequal size, and nine to twelve peripheral spinelets. Many of those on the disk and near the base of the arms have one spinelet, usually but not always the central one, strongly enlarged, or one or two less markedly enlarged. There are about fourteen paxillae across the base of the arm.

The most striking feature of the superomarginal plates is the great size of the first pair: they rise strongly above the level of the remainder, swelling out as they do so, so that their dorsal width is many times their width at the base. And each carries a larger spine, 5 mm. long, than any other plate. With one exception the second superomarginal plates are narrow and unarmed. The third and fourth, or the third, fourth and fifth, plates each carries one large spine about 4 mm. long. The remaining plates have smaller spines. There are usually three, but sometimes two or four. They are irregular in size and may be so in arrangement—*i.e.*, they are not always in a straight line. The largest is about as long as one plate. The spinelets at the base of the spine are enlarged.

The inferomarginal plates are covered with long spinelets with narrow bases which gradually widen to rounded flattened ends. They are small in the furrows between the plates, greatly enlarged around the bases of the spines described below. Each plate carries on the outer margin one strong pointed spine about as long as two plates. A similar but somewhat smaller and more flattened spine stands inside and slightly aboral to it; it is the first of an aboral row of three or four. The remaining two or three are much shorter and are flattened, pointed and blade-like. In the proximal part of the arm there is frequently a second spine standing on the adoral side of the outermost spine of the aboral row: it is about half as long as its neighbour.

The adambulacral armature in the proximal part of the arm consists of three long and equal furrow spines followed by three similar pairs of spines, one behind the other, each a little smaller than the last; the aboral spine of the first pair is as long as the furrow spines, the adoral is slightly smaller. Farther out on the arm there are only two pairs of spines behind the furrow series.

The combined mouth plates bear a pair of large spines at the inner angle ; each is followed by five smaller spines along the furrow margin. The strongly raised central portion is lenticular in shape and carries nine or ten spines on either side, the space between them being free of spines, except on one plate where one occurs.

There are two actinal intermediate plates on either side, each with a group of nine to twelve long spines similar to those on the inferomarginal plates.

The madreporite is 3 mm. long and bears a group of low spines.

Astropecten michaelsoni Koehler.

Astropecten michaelsoni Koehler, 1914, *Beitr. Meeresfauna Westafri.*, 2 : 144, pl. 4, figs. 3-6, 8-11 ; pl. 5, figs. 1, 2, 13, 16-17.
Astropecten dahomensis Döderlein, 1917, *Siboga Exped. Monog.* 46a : 77, pl. 16, figs. 3-3d ; text-fig. Q.

There can be no doubt that Koehler's and Döderlein's species are the same. I can find no reference to either of them since the original descriptions. There are twelve specimens in the Museum collection, eleven of which were collected in recent years on the Gold Coast by Dr. F. R. Irvine and Miss V. J. Foote of Achimoto College, Accra. The twelfth came in 1890 and is from Gambia and so extends the previously known range, which was from 7 deg. S. to 9 deg. N.

There is little to add to Koehler's excellent description based on nearly fifty specimens. Two of the specimens, the one from Gambia and the other from the Gold Coast, are bigger than the remainder, having each $R=63$ mm. In neither are the central granules on the paxillae enlarged as in all the other, smaller, specimens. But they differ in the arming of the superomarginal plates. In the Gambia specimens there are no spines. On the ninth and succeeding plates an enlarged granule, circular in outline, occupies the position normal for the external spine. It rises hardly at all above the level of its smaller fellows until it reaches the end of the arm. The Gold Coast specimen of the same size has strong spines; on many plates, including some in the arm angle, there are three.

A specimen of $R=56$ mm. shows nine to ten actinal intermediate plates, reaching to the sixth inferomarginal, on either side.

A note attached to a large specimen from Labadi describes it as having been salmon red in life, and the species as being common along the coast. Some, if not all, of the specimens come from rock pools. A batch of five taken at Elmina are, in spirit, a very dark brown with tube-feet deep purple.

Astropecten antillensis Lütken.

Astropecten antillensis Lütken, 1859, *Vidensk. Medd. naturh. Foven. Kbh.* 1 : 47 ; Döderlein, 1917 : 105, pl. 2, figs. 9-10 ; pl. 9, figs. 7 and 8 ; Clark, 1933 : 16 ; Boone, 1933 : 75, pls. 31-32.

Sladen in the Challenger Report (p. 198) records *A. brasiliensis* from "Off Bahia. Depth 7 to 20 fms." The jar so labelled in the Museum collection contained nine specimens, of which four were *brasiliensis*, but the remaining five are undoubtedly *A. antillensis* Lütken. Another jar contains two specimens of *antillensis* labelled "from ? Bahia" which were presented in 1903 by the Earl of Crawford. The species does not previously appear to have been recorded from anywhere but the West Indies.

Another specimen ($R=35$ mm.), which came to the Museum in 1848 from "S. America," is a typical *A. antillensis* except that there is a band of paxillae, encircling the area of small paxillae on the centre of the disk, in which each has a single central spinelet which is considerably enlarged.

Astropecten brasiliensis armatus Gray

(Plate III, figs. 1 and 2.)

Astropecten armatus Gray, 1840, *Ann. Mag. Nat. Hist.*, **6**: 181; Fisher, 1911, 59, pl. 5, figs. 1 and 2; pl. 7, figs. 3 and 6; pl. 50, fig. 4; pl. 51, fig. 3.

Astropecten brasiliensis armatus Döderlein, 1917, *Siboga Exped. Monog.* **46a**: 84; with earlier references and synonymy: 170.

Description of Type Specimen. $R=65$ mm., $r=14$ mm., $R:r=4.6$. The larger paxillae have seven to nine central and twelve to fifteen peripheral spinelets. The central spinelets are globose and unequal in size, the larger being slightly bigger than those of the periphery, which are equal. None of the central spinelets are fused together.

There are twenty-three superomarginal plates which are large and high, particularly in the arm angle. The first bears a spine over 4 mm. long on its inner edge. With some exceptions the second and third plates each bear a much smaller spine on or near the inner edge. A series of strong outer spines begins on the second or third plate and extends to, or to within one or two plates of, the end of the ray. On a number of the second and third plates there are therefore two spines; the outer is stronger than the inner. Double spines occur irregularly and infrequently farther out on the ray. The general surface is covered with upstanding spinelets which are largest, as big as those of the paxillae, on the abactinal surface; they become smaller near the lower margin and fine and capillary towards the fasciolar grooves.

The inferomarginals project appreciably beyond the superomarginals. They are thickly covered with short flattened spinelets with truncated ends. They are finer and very numerous on the adambulacral margin and slender and capillary on the edges of the fasciolar grooves. There are two large spines on the outer margin, the larger above and slightly adoral to the smaller. The larger may be as long as three plates, the smaller slightly over half as long. These spines are not, or are only slightly, flattened. Smaller spines arise around their bases and a row of two or three spines, about as long as one plate, arises from the aboral margin of the plate. There is no corresponding adoral row, but there is frequently a single spine near the adoral edge and the adambulacral plates.

There are three furrow spines, of which the middle is the strongest and longest. Their ends are faintly scooped in that each has a short longitudinal groove on the under side. In the second row there is one enormous blade-like spine nearly 3 mm. long and, adorally to it, a spine less than half its length which is slender. The end of the large spine is, in the proximal part of the ray, enlarged as shown in Fisher's pl. 7, fig. 3, but not so strongly as in his pl. 51, fig. 3. It is very faintly scooped at the end. In the "third row" there are three to five slender spines about equal to the adoral member of the second row. They may be in a group or a row.

The preservation of the mouth-plates does not permit of an accurate description of the armature; what can be seen of it appears to agree with Fisher's description.

There are four actinal intermediate plates on either side. They carry groups of slender spinelets, but do not have the larger spines described in some specimens by Fisher.

The madreporite is about 4 mm. in diameter and is separated by one row of paxillae from the superomarginals. Very small spines arise from the ridges of its striations.

Discussion. Gray describes under *armatus* a variety *pulcher*. The locality he gives may, both in the 1840 paper and in his Synopsis (1866), be read as applying only to the variety, and Döderlein (1917, pp. 169 and 170) has so read it. On the other hand, since it is his custom elsewhere throughout the 1840 paper and the Synopsis to give localities or to indicate where they are not known that it is so, the locality of Puerto Portrero may be read as applying both to *armatus* and its variety. It appears to me that Fisher (1911, p. 60) has done this. I also do so; and I think I am right because of evidence afforded by the specimen described above. It is accompanied by a very old label reading "Puerto Portrero, C.A., sandy bottom, 9 fms."; it has inferomarginals which are produced beyond the superomarginals; it has a second label in the writing of E. A. Smith (who was in charge of the collection from 1867 to 1878) which reads "*Astropecten armatus* Gray (type)" and the initials "E. A. S." Because the variety *pulcher* had "the under series of marginal tubercles not produced," and because Smith stood much nearer to the event than I stand, I believe this to be the type of *armatus*; and, because it has a label saying so, that it came from Puerto Portrero. No trace of the variety *pulcher* has been found.

A further discussion of this subspecies appears below after the description of *A. brasiliensis erinaceus*.

***Astropecten brasiliensis erinaceus* Gray**

(Plate IV, figs. 1 and 2.)

Astropecten erinaceus Gray, 1840, *Ann. Mag. Nat. Hist.* 6: 182; Boone, 1928: 3, pl. 2.

Astropecten brasiliensis erinaceus Döderlein, 1917, *Siboga Exped. Monog.* 46a: 84; with earlier references and synonymy: 169, pl. 8, figs. 4-4a.

Description of Type Specimen. R=65 mm., r=14 mm., R:r=4.6

The paxillae are similar to those of *armatus*.

The superomarginal plates number twenty-three. They are similar to those of *armatus* except that the inner row of spines, present in *armatus* on the first to third plates only, extends as far down the ray as to the thirteenth or fifteenth plate. It is often absent from the fifth plate, which carries a large spine of the outer row. The latter starts on the fourth plate and continues to the end, or to near the end, of the ray. Most plates therefore have two spines; the outer is conspicuously stronger than the inner. The single spines on the first plates are the strongest of all, being nearly 4 mm. long. On a few plates the single inner spine is replaced by two.

The general covering and armature of the inferomarginals is similar to that of *armatus*. The outermost of the spines along the aboral edge is enlarged so as to appear, with the two marginal spines with which it stands in line, as one of a series of three.

The arrangement and proportions of the adambulacral spines are the same as in *armatus* except that the big spine of the second row is not so big. In the proximal part of the ray where it is 2.5 mm. long its end is only very faintly, if at all, expanded. In the distal part of the ray it is not expanded at all; the free end is narrower than the base. The ends of this large spine and of the furrow spines are strongly grooved on the under, the outer, side.

There are only two, exceptionally three, actinal intermediate plates on either side. They are armed with groups of slender spinelets like those on the adambulacral edges of the adjacent inferomarginals. On some of them one of the spines is larger than the remainder and compressed.

The mouth-plates and madreporite are as in *armatus*.

Discussion. Earlier writers had written of *erinaceus* as identical with *armatus* (see Fisher, 1911, p. 60), but Döderlein nevertheless regarded them as distinct and treated each as a subspecies of *brasiliensis*. Two recent authors have not followed Döderlein though neither has given reasons for not doing so: Boone (1928, p. 3) writes of *erinaceus* as a separate species, and Clark (1940, p. 322) of *armatus* as a species in Fisher's sense (including *erinaceus*).

There are not in the British Museum collection any other specimens of *armatus* or *erinaceus* than the specimens described above; so that my only possible contribution to the problem of whether or not they are distinct is that of describing those specimens. If they are distinct, these are the types.

Döderlein describes the differences between *armatus* and *erinaceus* as being in the number and arrangement of the superomarginal spines, and in the nature of the enlarged adambulacral spine. Superomarginal spines may be so very variable in so many species that I think they may be discounted in this discussion. The differences which Döderlein describes between the large adambulacral spine are shown, for what they may be worth, by the types described above.

Döderlein's picture of the under surface of the inferomarginals of *erinaceus* (pl. 8, fig. 4a) shows no isolated spine near the adoral and adambulacral edge. Such a spine occurs in the types of both *erinaceus* and *armatus*. It is not present in Fisher's picture of the inferomarginals of *armatus* (1911, pl. 7, fig. 3).

Astropecten mauritianus Gray

(Plate IV, figs. 3 and 4.)

Astropecten mauritianus Gray, 1840, *Ann. Mag. Nat. Hist.* **6**: 182; 1806, 3; Perrier, 1876: 346 and 359; Döderlein, 1917: 127; non Koehler, 1910: 32; ? non Brown, 1910: 29.

Astropecten mauritianus var. *mascarena* Döderlein, 1917, *Siboga Exped. Monog.* **46a**: 143, pl. 6, fig. 3; pl. 13, figs. 2-2b.

Astropecten hemprichii, Loriol, 1885, *Mém. Soc. Phys. Genève*, **29** (4): 74, pl. 21, figs. 7 and 8.

Astropecten sp. Loriol, 1885, *Mém. Soc. Phys. Genève*, **29** (4): 77, pl. 22, fig. 1.

Description of Type Specimen. R=57 mm., r=18.5 mm., R:r=3:1. Locality: Mauritius.

The specimen is very brittle. Two of the rays are broken off and parts of the paxillar fields of those which remain have fallen in.

Most of the larger paxillae have eight or nine central, and fifteen or sixteen peripheral, spinelets, with the central slightly larger than the peripheral. The central spinelets may be more numerous, up to sixteen, and no bigger than the peripheral. The paxillae are very small in the centre of the disk and at the ends of the rays. In the proximal part of the ray those in the centre are larger than those, which are regularly arranged, on the sides.

There are twenty-one superomarginal plates. They encroach strongly on the abactinal surface particularly in the proximal part of the ray, where they have a more rounded contour than in the distal part. They are covered with low rounded granules which are of the same diameter as, but lower than, the largest of the paxillar spinelets. On each plate there are about six irregular rows of granules, those near the margin smaller than those in the centre. The fasciolar grooves are fringed by fine capillary spinelets. Each plate, except for the first two or three, bears a small conical spine on the outer edge. On the proximal plates it is small, less than half as long as a plate; it is larger, but never as long as a plate, in the distal part of the ray.

The inferomarginals do not project as far as the superomarginals in the arm-angles, but do so slightly beyond them in the distal part of the ray. They are covered, though not thickly, with narrow flattened spinelets with rounded ends. Large flattened spines arise from among them. The most conspicuous form a row of three or four along the aboral edge; there is a less conspicuous row of shorter spines along the adoral edge, and one or two arise from the middle of the plate. On the outer margin there is one long spine nearly as long as three plates. Its base is rounded, but it is compressed towards the end which is sharply pointed. Three flattened spines stand in a row parallel to the axis of the ray below the marginal spine. The aboral is the longest, being half as long as the marginal spine. The spinelets of the fasciolar groove are capillary.

There are three furrow spines of which the middle is the longest. It is not much stouter than the other two and is only slightly compressed. There are two, or exceptionally three, spines in the second row. The aboral is nearly as long as the furrow spine; it is longer and stouter than the adoral. A row or a group of three to five much smaller spines comprise the third row.

The mouthplates are prominent. Parallel to the suture there is on either side a row of about ten roughly equal spines, ending in a very large spine at the inner end. The free margin on either side appears to have about seven spines which grow in size from the outer to the inner end. The innermost stands beside the largest of the first series and is only slightly smaller than it.

There are three actinal intermediate plates on either side. They are armed with groups of spines somewhat similar in size to those of the third row of the adambulacral plates.

The madreporite is small. A number of low irregular mound-like granules are borne on its surface.

Description of Second Specimen. There is a second and larger specimen in the Museum collection: $R=82$ mm., $r=22$ mm., $R:r=3.7$; twenty-seven superomarginal plates. It is labelled "Isle of France" (Mauritius). There are no other data with it, but it is probably old for it is broken and brittle. It differs from the type in a number of small ways.

The central spinelets of the paxillae are globose and markedly larger than the peripheral. They are often arranged in a circle around one which is central. The larger paxillae tend to be polygonal. This heightens the contrast between the irregularly arranged paxillae down the centre of the rays and the smaller ones which are regularly disposed on either side of them.

On one of the arms the superomarginal spines begin on the fourth plate, on the other four on the fifth. In each of the five arm-angles one of the first superomarginal plates, but not the other, has a single enlarged granule like an incipient spine.

On the inferomarginals there is a higher proportion of spines to spinelets than in the type; there are ten to twelve to each plate apart from the three below the large marginal spine.

On the adambulacral plates one of the spines in the groups which comprise the third row is often enlarged. Similarly on the actinal intermediate plates one or two spines are considerably bigger than the others. The madreporite is almost completely hidden.

Discussion. Perrier records that he studied Gray's types of this species at the British Museum. He describes them as having strong conical spines on the

inner margins of the first and neighbouring superomarginal plates. It was an error, difficult to understand and unfortunate in its effects, for it has been copied by Lorient, Koehler, Brown and Döderlein. The latter would not have created his variety *mascarena* were it not for this error: there is no doubt that the specimens described under that name are *mauritianus*.

Brown states that he named his specimen from the Mergui Archipelago after careful comparison with the specimens in the British Museum. It cannot have been with the only two specimens of *mauritianus* or he could not have failed to detect Perrier's mistake. It must remain doubtful what species he was describing until his specimens can be re-examined.

Astropecten mauritianus is known only from Mauritius.

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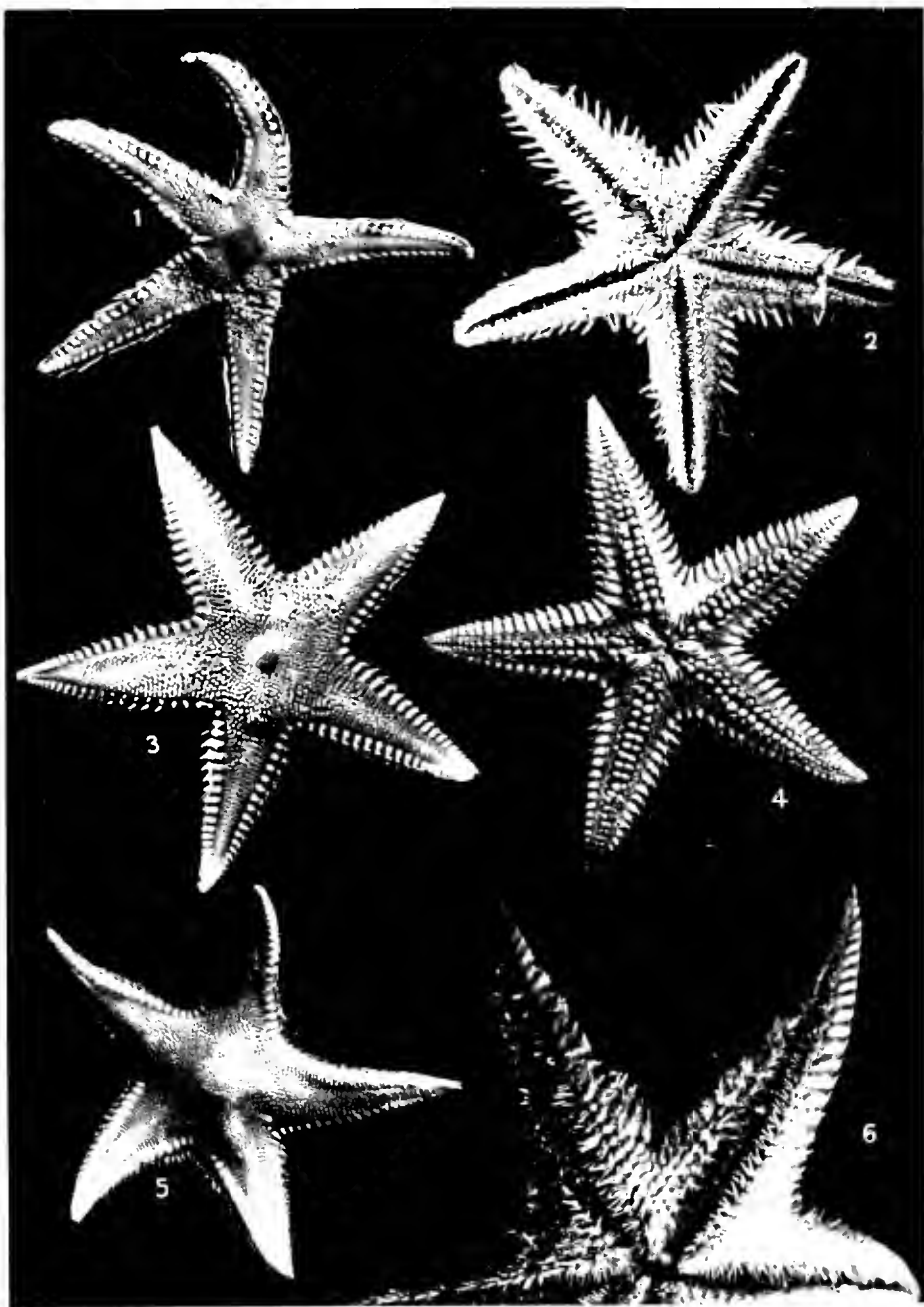


PLATE I

FIG. 1. *Leptasterias (Leptasterias) polyzona*, holotype, aboral surface, 1.5 cm. long. FIG. 2. *Leptasterias (Leptasterias) polyzona*, holotype, aboral surface, 1.5 cm. long. FIG. 3. *Leptasterias (Leptasterias) polyzona*, holotype, aboral surface, 1.5 cm. long. FIG. 4. *Leptasterias (Leptasterias) polyzona*, holotype, aboral surface, 1.5 cm. long. FIG. 5. *Leptasterias (Leptasterias) polyzona*, holotype, aboral surface, 1.5 cm. long. FIG. 6. *Leptasterias (Leptasterias) polyzona*, holotype, aboral surface, 1.5 cm. long.

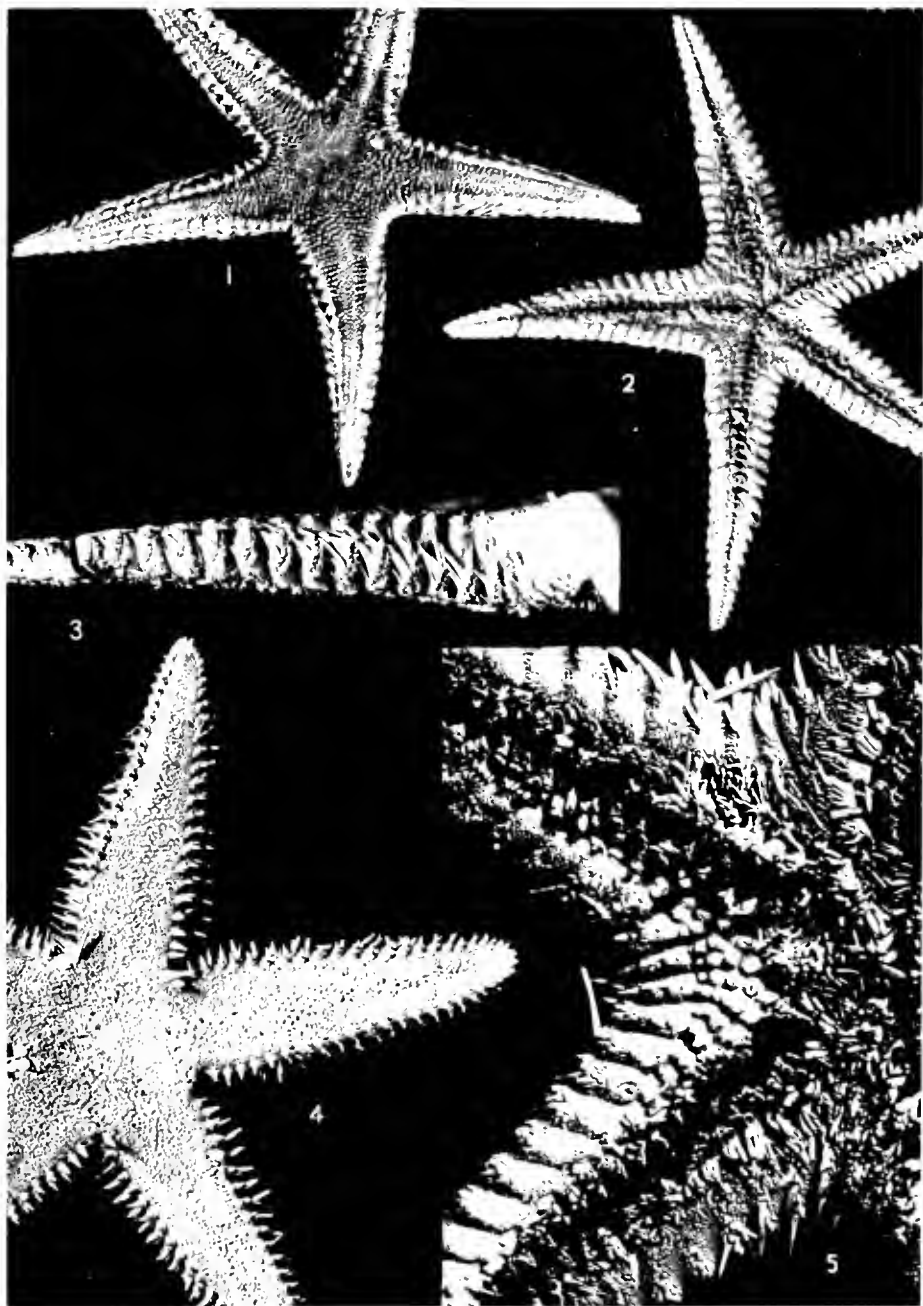


PLATE II

FIG. 1. *Thopsetia* sp. (1901) - dry specimen, dorsal surface, natural size. FIG. 2. *Thopsetia* sp. (1901) - dry specimen, actual surface, natural size. FIG. 3. *Thopsetia* sp. (1901) - side view of arm, enlarged. FIG. 4. *Thopsetia* sp. (1901) - enlarged portion of arm. FIG. 5. *Thopsetia* sp. (1901) - enlarged portion of arm. Plates, enlarged.

PLATE II
 FIG. 1. *Thopsetia* sp. (1901) - dry specimen, dorsal surface, natural size.
 FIG. 2. *Thopsetia* sp. (1901) - dry specimen, actual surface, natural size.
 FIG. 3. *Thopsetia* sp. (1901) - side view of arm, enlarged.
 FIG. 4. *Thopsetia* sp. (1901) - enlarged portion of arm.
 FIG. 5. *Thopsetia* sp. (1901) - enlarged portion of arm. Plates, enlarged.



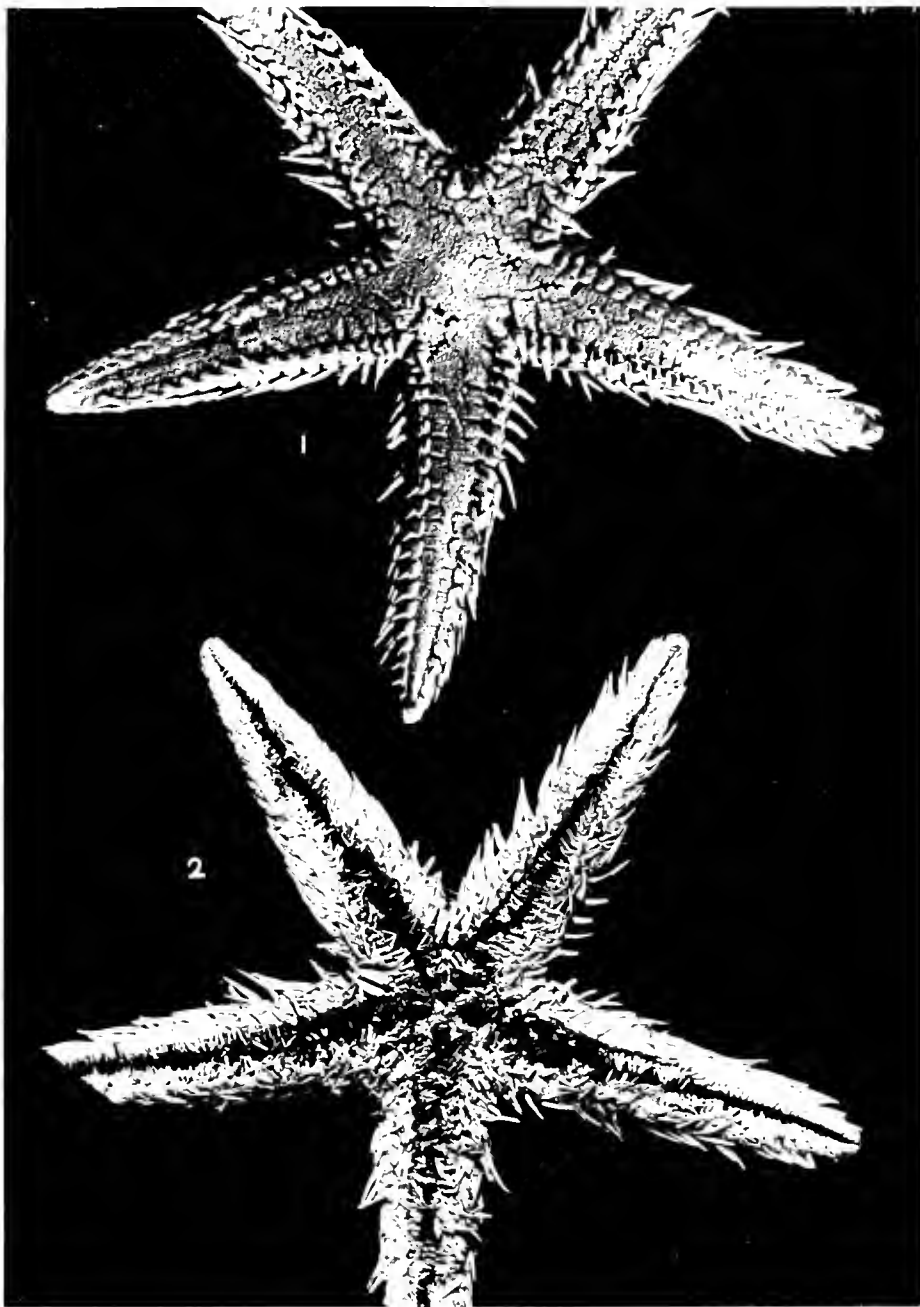


PLATE III

FIG. 1. *Panopaea reticulata* (L.) (1) dorsal surface, natural size. (2) ventral surface, natural size.

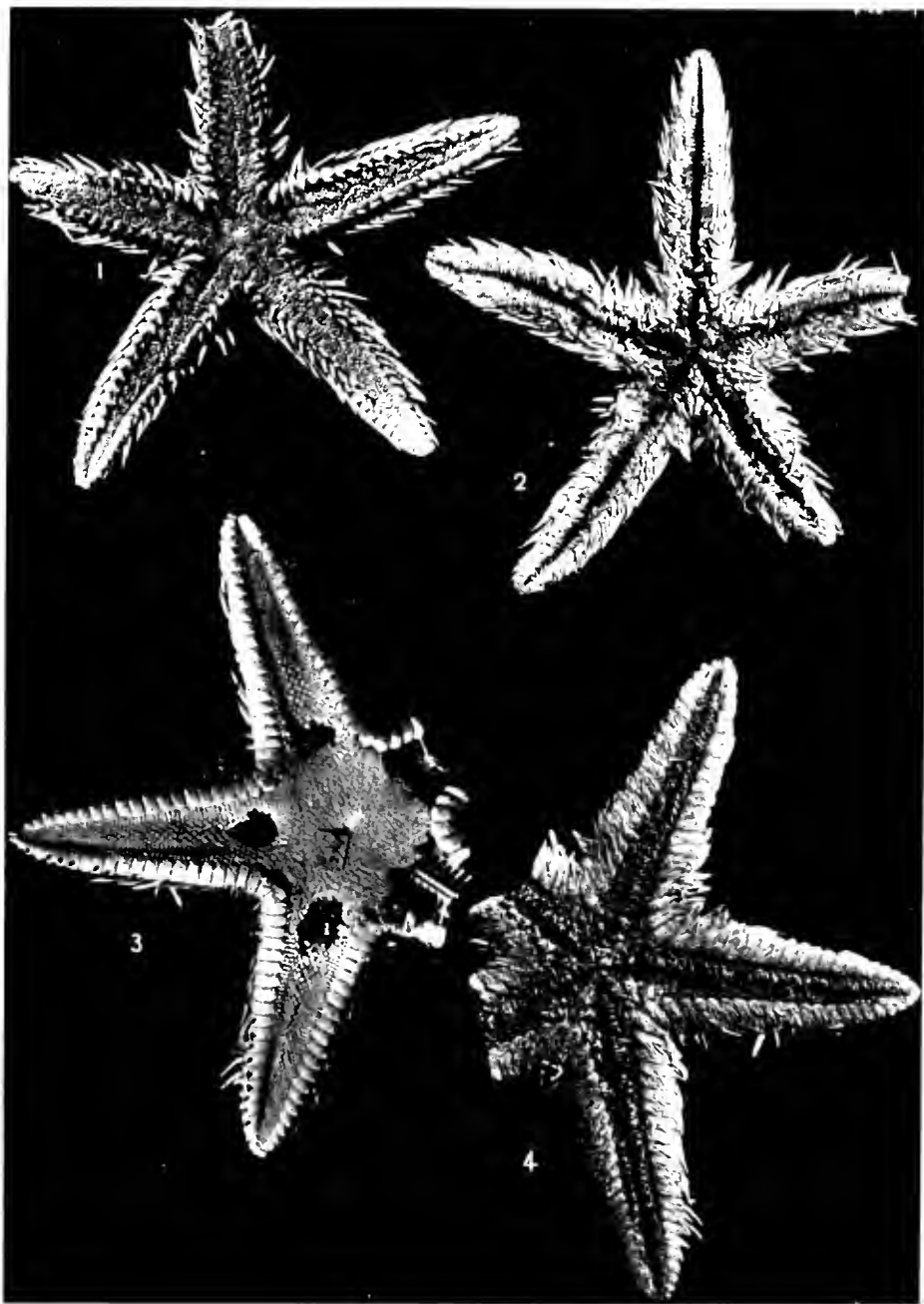


PLATE IV

FIG. 1. *Echinaster* sp. Type, anterior view, reduced. FIG. 2. *Echinaster* sp. Type, anterior view, reduced. FIG. 3. *Echinaster* sp. Type, anterior view, reduced. FIG. 4. *Echinaster* sp. Type, anterior view, reduced.



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